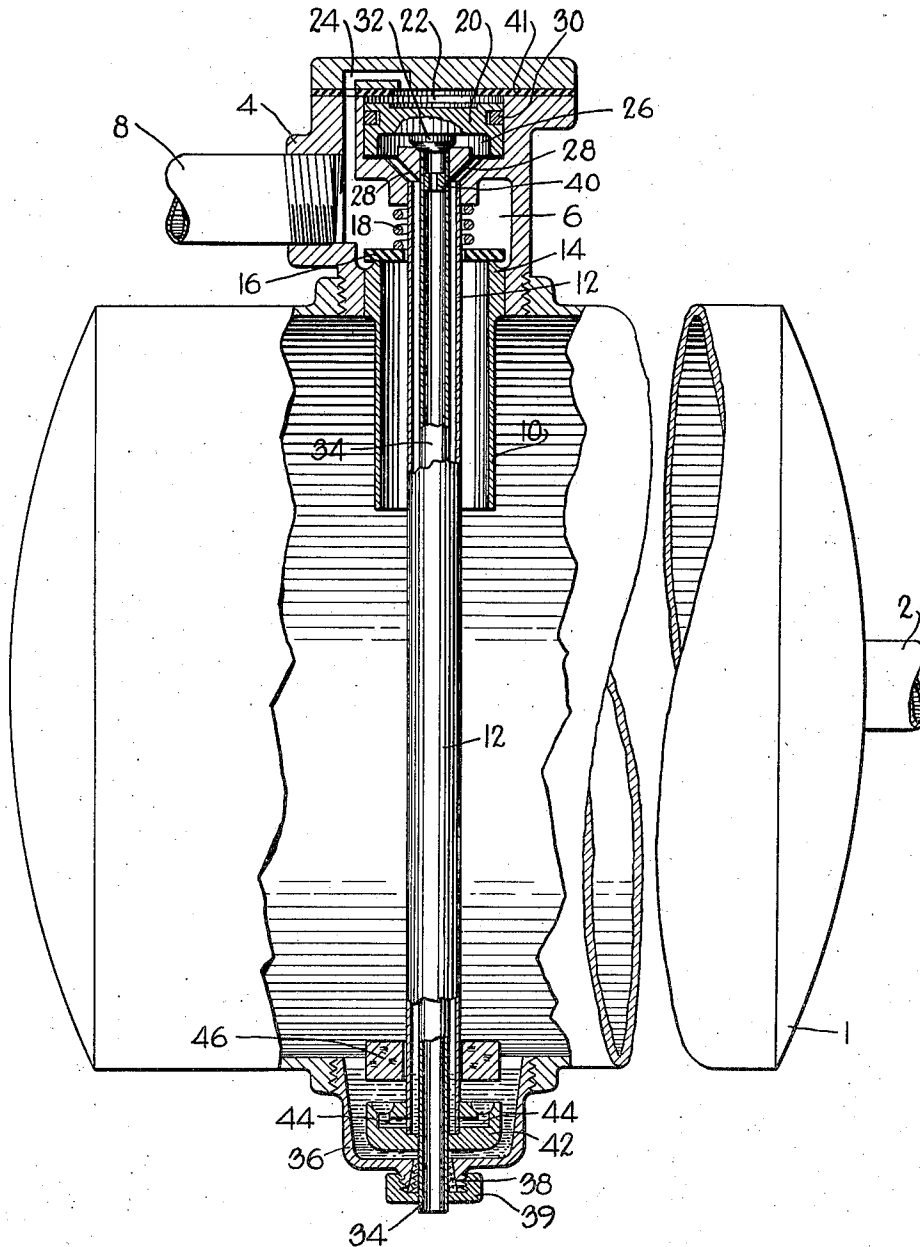


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AUTOMATIC DRAIN VALVE
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AUTOMATIC DRAIN VALVE

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This invention relates to an automatic drain valve device for use on the reservoir or receiver of a fluid pressure system and which operates to drain liquid which may accumulate in this reservoir.

In the operation of fluid pressure systems, such as a fluid pressure brake equipment, air from the atmosphere is compressed and is stored in a reservoir or receiver from which fluid is withdrawn during operation of the equipment. As a result of the supply of fluid under pressure to and the release of fluid under pressure from the reservoir water may be deposited in the reservoir, and unless it is drained off, it accumulates in the reservoir and reduces the volume of the reservoir, while it may freeze and cause injury to the reservoir.

It is an object of this invention to provide valve means which operates automatically to drain liquid which accumulates in the reservoir of a fluid pressure system.

A further object of the invention is to provide valve means responsive to the release of fluid from a reservoir for draining off liquid present in the reservoir.

Another object of the invention is to provide valve means which operates to drain off substantially all of the liquid in the reservoir each time the valve means is operated.

A further object of the invention is to provide a valve device of the type described, and having means responsive to the level of the liquid in the reservoir for cutting off the flow of fluid from the reservoir through the valve device when the level of the liquid therein has been reduced to a predetermined level.

Another object of the invention is to provide a valve device of the type described and which has its operating elements positioned above the level of the liquid in the reservoir so that the valve device will not be injured if the liquid in the reservoir freezes.

A further object of the invention is to provide an improved automatic drain valve device.

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

Referring to the drawing, the automatic drain valve device provided by my invention is shown in connection with a reservoir 1, which is supplied with fluid under pressure through a pipe

2 by a compressor, not shown. The reservoir 1 may be of any suitable construction, and may be part of a fluid pressure system, such as a fluid pressure brake equipment.

The reservoir 1 has an opening therein adjacent the uppermost portion thereof, and a body 4 is secured in this opening. The body 4 has a control chamber 6 formed therein to which is connected a service pipe 8 through which fluid is withdrawn from the reservoir 1.

A tubular sleeve 10 is secured in the body 4 and communicates with the control chamber 6 and with the upper portion of the reservoir 1, while the body 4 has secured thereto a tube 12 of smaller diameter than the sleeve 10. The tube 12 extends through the sleeve 10 and communicates with the lower portion of the reservoir 1, as will hereinafter more fully appear. The sleeve 10 has a seat rib 14 formed thereon within the chamber 6, while a valve disc 16 is loosely mounted on the tube 12 and is yieldingly held in engagement with the seat rib 14 by a spring 18.

The body 4 has a bore therein in which is mounted a movable abutment in the form of a piston 20 having at one side thereof a chamber 22, which is constantly connected by way of a passage 24 with the control chamber 6, while the piston 20 has at the other side thereof an operating chamber 26, which is connected through passages 28 to the passage within the tube 12.

The piston 20 has a groove in the periphery thereof in which is mounted a packing ring 30, which is yieldingly pressed against the wall of the bore in which the piston 20 is mounted by the inherent resiliency of the material of which it is constructed so as to develop considerable frictional resistance to movement of the piston 20 in the bore in the body 4.

The piston 20 has formed integral therewith a valve 32, which is adapted to seat upon a seat formed on the body 4 surrounding a passage in which is secured a tube 34 of smaller diameter than the tube 12, and mounted within the tube 12.

The tube 34 is of such length as to extend through an opening in the wall of a cup 36, which is secured in an opening in the reservoir 1 diametrically opposite the opening in which the body 4 is mounted. The cup 36 is substantially at the lowest portion of the reservoir 1 so that liquid which accumulates in the reservoir 1 will flow to this cup by gravity.

The opening in the wall of the cup 36 through which the tube 34 extends is sealed by means

of packing 38, which is held in place by a packing nut 39.

A choke plug 40 is secured in the tube 34 adjacent the upper end thereof to limit the rate of flow of fluid through the tube 34.

The tube 12, which is carried by the body 4, is of such length as to extend into the cup 36 secured at the lower portion of the reservoir 1, and has secured on the lower end thereof a substantially circular member 42 having passages 44 therein, which communicate with the passage through the tube 12, and with ports on the upper face of the member 42. The upper face of the member 42 is substantially flat and is adapted to be engaged by a float 46, which may be formed of any suitable material, such as cork. The float 46 is loosely mounted on the tube 12, and on a decrease in the level of the liquid in the cup 36, the float is moved by gravity into engagement with the upper face of the member 42 so as to substantially cut off the flow of fluid from the reservoir 1 to the passages 44 in the member 42.

The member 42 has an opening therein through which extends the tube 34. The tube 34 tightly fits in this opening so as to prevent the flow of fluid from the reservoir 1 to the passage in the tube 12 through the opening in the member 42 through which the tube 34 extends.

In operation, on the initial supply of fluid under pressure to the reservoir 1, fluid will flow therefrom through the passage in the tubular sleeve 10 and past the valve disc 16 to the control chamber 6, and therefrom by way of the passage 24 to the chamber 22 to increase the pressure of the fluid in these chambers to the pressure of the fluid in the reservoir 1.

On the initial supply of fluid under pressure to the reservoir 1 substantially no liquid will be present in the cup 36, and the float 46 will be in engagement with the upper face of the member 42 so as to prevent the flow of fluid from the reservoir to the passages 44.

Fluid supplied to the chamber 22 will leak past the piston 20 and the piston packing ring 30 and increase the pressure of the fluid in the operating chamber 26 substantially to the pressure of the fluid in the reservoir 1.

As the area within the seat engaged by the valve 32 is not subject to the fluid under pressure in the operating chamber 26, the effective area of the face of the piston 20 subject to the fluid under pressure in the operating chamber 26 is somewhat less than the area of the face of the piston 20 subject to the pressure of the fluid in the chamber 22 at the opposite face of the piston, so that even if the pressure of the fluid in the chamber 26 is increased to the pressure of the fluid in the reservoir 1, the piston 20 will be held in a position in which the valve 32 carried thereby engages its seat to cut off the release of fluid from the chamber 26 to the atmosphere through the tube 34.

In addition, the piston 20 will be held in the position in which the valve 32 engages its seat by the piston packing ring 30, which opposes movement of the piston 20 in the bore in which it is mounted.

On the withdrawal of fluid under pressure from the reservoir through the service pipe 8 there is a rapid reduction in the pressure of the fluid in the control chamber 6, and a corresponding reduction in the pressure of the fluid in the chamber 22 at the face of the piston 20. On this reduction in the pressure of the fluid in the con-

trol chamber 6, the valve disc 16 is moved upwardly against the opposing force of the spring 18 by the higher pressure of the fluid in the reservoir 1 so as to permit fluid under pressure to flow from the reservoir 1 to the control chamber 6 and therefrom to the service pipe 8. There will, however, be a small difference between the pressure of the fluid in the control chamber 6 and the pressure of the fluid in the reservoir 1 due to the operation of the valve disc 16.

If at this time the level of the liquid in the cup 36 is not high enough to lift the float 46 away from the face of the member 42, the operating chamber 26 at the face of the piston 20 will not be open to the reservoir through the tube 12. However, fluid is present in the operating chamber 26 at the pressure of the fluid in the reservoir at this time, as explained above, and on the reduction in the pressure of the fluid in the chamber 22 at the opposite face of the piston 20, the piston 20 will be moved upwardly into engagement with a gasket 41, by the fluid under pressure in the chamber 26 so as to unseat the valve 32 and release fluid from the operating chamber 26 through the pipe 34 to the atmosphere.

Since with the float 46 cutting off the flow of fluid under pressure to the chamber 26, the only fluid in this chamber is that which is supplied by leakage past the piston 20, and as this chamber is of relatively small volume, when the piston 20 is moved upwardly to unseat the valve 32, the pressure of the fluid in the chamber 26 will be quickly reduced below that of the fluid in the chamber 22 so that the piston 20 will be moved downwardly to seat the valve 32 and cut off the release of fluid from the chamber 26.

When the release of fluid under pressure from the reservoir 1 through the service pipe 8 is cut off, fluid from the reservoir 1 continues to flow through the passage in the tubular sleeve 10 and past the valve disc 16, which is loosely mounted on the tube 12, to the control chamber 6 and therefrom through the passage 24 to the chamber 22 at the face of the piston 20 to increase the pressure of the fluid in these chambers substantially to the pressure of the fluid in the reservoir 1.

On this increase in the pressure of the fluid in the chamber 22, fluid leaks therefrom past the piston 20 and the packing ring 30 to the chamber 26 to increase the pressure of the fluid in the chamber 26 to the pressure of the fluid in the reservoir 1.

Water condensing out of the fluid supplied to the reservoir will flow by gravity to the cup 36 which is mounted at the lowest portion of the reservoir 1, and on a predetermined increase in the level of the liquid in the cup 36, the float 46 will be lifted away from the face of the member 42 so as to open communication from the reservoir 1 to the passages 44 leading to the tube 12, so that liquid may flow from the cup 36 to the passages 44 leading to the tube 12. Liquid will not flow upwardly in the passage in the tube 12 at this time, however, as its flow is prevented by the fluid under pressure trapped in the tube 12 and in the chamber 26.

On a subsequent withdrawal of fluid from the reservoir 1 through the service pipe 8, there is a reduction in the pressure of the fluid in the control chamber 6, and a similar reduction in the pressure of the fluid in the chamber 22 at the upper face of the piston 20. On this reduction in the pressure of the fluid in the control chamber 6, fluid under pressure from the reservoir 1

flows thereto through the passage in the tubular sleeve 10 and past the valve disc 16, which is forced upwardly against the spring 18. The valve disc 16, however, offers resistance to the flow of fluid from the reservoir 1 to the control chamber 6 so that a small difference is maintained between the pressure of the fluid in the chamber 6, and in the reservoir 1 as long as fluid is released through the service pipe 8 at a substantial rate.

On a reduction in the pressure of the fluid in the chamber 22 at the face of the piston 20 to a predetermined value below the pressure of the fluid in the operating chamber 26 at the opposite face of the piston 20, which chamber is at substantially the pressure of the fluid in the reservoir 1 at this time, the piston 20 is moved upwardly into engagement with the gasket 41 by the fluid under pressure in the operating chamber 26, which exerts enough force on the piston 20 to overcome the opposing force of the fluid under pressure in the chamber 22 and to also overcome the resistance to movement of the piston 20 offered by the packing ring 30.

On upward movement of the piston 20, the valve 32 carried thereby is moved away from its seat so as to open communication between the operating chamber 26 and the pipe 34.

On movement of the valve 32 away from its seat, fluid in the chamber 26 may flow therefrom at a restricted rate through the choke 40 and through the pipe 34 to the atmosphere. On the release of fluid from the operating chamber 26, the higher pressure of the fluid in the reservoir 1 forces liquid from the cup 36 through the passages 44 and the tube 12 to the chamber 26, and past the open valve 32 and through the choke 40 to the pipe 34 through which it is drained to the atmosphere.

The choke 40 restricts the flow of liquid from the chamber 26 through the pipe 34 to a rate substantially less rapid than liquid under pressure is supplied to the chamber 26 from the reservoir 1 as long as the float 46 is held out of engagement with the upper face of the member 42. As a result, the pressure of the liquid in the operating chamber 26 will be maintained substantially at the pressure of the fluid in the reservoir 1, and the piston 20 will be held in engagement with the gasket 41.

When the withdrawal of fluid under pressure from the reservoir 1 through the service pipe 8 is cut off, the pressure of the fluid in the control chamber 6 will build up substantially to the pressure of the fluid in the reservoir 1 by the flow of fluid to the control chamber 6 past the valve disc 16, which loosely fits the tube 12. On this increase in the pressure of the fluid in the chamber 6, there will be a similar increase in the pressure of the fluid in the chamber 22 at the face of the piston 20.

If the withdrawal of fluid from the reservoir 1 through the service pipe 8 is cut off before the level of the liquid in the cup 36 is reduced so as to permit the float 46 to be moved into engagement with the face of the member 42, liquid will continue to flow from the reservoir 1 to the passage in the tube 12, and to the operating chamber 26, so that the piston 20 is held in engagement with the gasket 41 by the piston packing ring 30, which engages the wall of the bore in which the piston is mounted, and which develops considerable frictional resistance to movement, and by the liquid under pressure in the operating chamber 26 at the opposite face of the piston,

which, as pointed out above, is substantially at the pressure of the fluid in the reservoir because of the choke 40.

As the piston 20 is held in its upper position, liquid will continue to flow from the reservoir 1 to the tube 12, and thence through the passages 28 to the operating chamber 26, from which it flows past the open valve 32 and through the choke 40 in the tube 34 leading to the atmosphere.

After a time interval the level of the liquid in the cup 36 will have been lowered by the flow of liquid therefrom to the tube 12, and thence to the atmosphere, sufficiently to permit the float 46 to move into engagement with the upper face of the member 42 to cut off the flow of liquid from the reservoir 1 through the passages 44 leading to the tube 12, thereby cutting off the supply of fluid to the operating chamber 26.

When the flow of liquid from the reservoir 1 to the operating chamber 26 is cut off by movement of the float 44 into engagement with the upper face of the member 42, liquid continues to flow from the operating chamber past the open valve 32, and through the choke 40 in the tube 34 leading to the atmosphere, until the pressure of the fluid in the operating chamber 26 has been reduced to a predetermined value below the pressure of the fluid in the chamber 22, which is at substantially the pressure of the fluid in the reservoir 1.

When the pressure of the fluid in the operating chamber 26 has been reduced to a predetermined value below the pressure of the fluid in the chamber 22, the piston 20 is moved downwardly by the fluid under pressure in the chamber 22 against the opposing force of the fluid in the chamber 26 and of the resistance to movement of piston packing ring 30 so as to move the valve 32 to the seated position to cut off the further release of liquid from the chamber 26 to the atmosphere.

After downward movement of the piston 20 to move the valve 32 to the seated position, fluid under pressure will leak from the chamber 22 to the operating chamber 26 to increase the pressure of the fluid in this chamber substantially to the pressure of the fluid in the reservoir 1. As a result any liquid remaining in the tube 12 will gradually flow from this tube by gravity to the cup 36, and will not remain in the tube 12 where it might cause injury to portions of the valve device if it should freeze.

From the foregoing it will be seen that when the valve device is operated to drain liquid from the reservoir, it continues to release liquid until the level of the liquid in the reservoir is reduced to a predetermined point, even though the withdrawal of fluid from the reservoir 1 through the service pipe 8 is cut off before the level of the liquid has been reduced to this extent.

This valve device also operates to cut off the release of fluid under pressure from the reservoir 1 through the valve device after the level of the liquid has been reduced to a predetermined point, even though the withdrawal of fluid under pressure to the service pipe 8 continues.

Thus if, while the piston 20 is in its upper position in engagement with the gasket 41, the withdrawal of fluid under pressure through the service pipe 8 continues after liquid has been expelled from the cup 36 to lower the level of this liquid so as to permit the float 46 to be moved into engagement with the upper face of member 42, the float will cut off the further flow of fluid

from the reservoir 1 to the passages 44 in the member 42, and thence to the tube 12 leading to the operating chamber 26.

When the flow of fluid from the reservoir 1 to the operating chamber 26 is cut off, fluid under pressure continues to be released from the operating chamber 26 past the open valve 32, and through the choke 40 in the pipe 34 leading to the atmosphere, until the pressure of the fluid in the chamber 26 has been reduced to a value somewhat less than the pressure of the fluid in the chamber 22 at the opposite face of the piston 20.

When the pressure of the fluid in the chamber 26 has been reduced to a predetermined value below the pressure of the fluid in the chamber 22, the piston 20 is moved downwardly by the fluid under pressure in the chamber 22 against the opposing force of the fluid under pressure in the chamber 26 and of the resistance to movement of the piston packing ring 30, and the valve 32 carried by the piston 20 is moved to the seated position to cut off the release of fluid from the operating chamber 26 through the pipe 34.

On movement of the piston 20 to the seated position, fluid under pressure from the chamber 22 will leak past the piston 20 and the packing ring 30 to the operating chamber 26 to gradually increase the pressure of the fluid in the operating chamber to cause the liquid in the tube 12 to flow therefrom by gravity through the cup 36, as explained in detail above.

When the withdrawal of fluid from the reservoir 1 through the service pipe 8 is cut off, the pressure of the fluid in the control chamber 6 and in the chamber 22 is increased to the pressure of the fluid in the reservoir 1 by flow of fluid from the reservoir to the control chamber 6 past the valve disc 16. On this increase in the pressure of the fluid in the chamber 22 fluid leaks therefrom past the piston 20 and the packing ring 30 to the chamber to increase the pressure of the fluid in this chamber substantially to the pressure of the fluid in the reservoir 1.

On subsequent withdrawals of fluid under pressure from the reservoir 1 through the service pipe 8, this automatic drain valve device operates as described in detail above to drain liquid from the reservoir until the liquid therein has been reduced to a predetermined level.

While one embodiment of the improved automatic drain valve device provided by this 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. An automatic drain valve device for a reservoir comprising a body having a chamber therein, valve means operated on a predetermined reduction in the pressure of the fluid in said chamber below the pressure of the fluid in the reservoir for supplying fluid from the reservoir to said chamber, a release passage communicating with said chamber through which fluid is withdrawn from said chamber and consequently from said reservoir past said valve means, a movable element subject to the opposing pressures of the fluid in said chamber and of the fluid in a chamber adapted to be charged with fluid at reservoir pressure, a valve operated by said element for

controlling a passage through which water accumulating in said reservoir may be drained, and means responsive to the level of the liquid in said reservoir for controlling the flow of fluid from said reservoir to said passage.

2. An automatic drain valve device for a reservoir comprising a body having a chamber therein, valve means operated on a predetermined reduction in the pressure of the fluid in said chamber below the pressure of the fluid in the reservoir for supplying fluid from the reservoir to said chamber, a release passage communicating with said chamber through which fluid is withdrawn from said chamber and consequently from said reservoir past said valve means, a movable element subject to the opposing pressures of the fluid in said chamber and of the fluid in a chamber adapted to be charged with fluid at reservoir pressure, a valve operated by said element for controlling a passage through which water accumulating in said reservoir may be drained, and means operated on a predetermined reduction in the level of the liquid in said reservoir to cut off the flow of fluid from said reservoir to said passage.

3. An automatic drain valve device for a reservoir comprising a body having a chamber therein, valve means operated on a predetermined reduction in the pressure of the fluid in said chamber below the pressure of the fluid in the reservoir for supplying fluid from the reservoir to said chamber, a release passage communicating with said chamber through which fluid is withdrawn from said chamber and consequently from said reservoir past said valve means, a movable element subject to the opposing pressures of the fluid in said chamber and of the fluid in a chamber adapted to be charged with fluid at reservoir pressure, a valve operated by said element for releasing fluid from the lower portion of the reservoir, and means responsive to the level of the liquid in said reservoir for controlling the flow of fluid from said reservoir to said valve.

4. An automatic drain valve device for a reservoir comprising a body having a chamber therein, valve means subject to the opposing pressures of the fluid in said chamber and of the fluid in the reservoir and controlling the flow of fluid from the reservoir to the chamber, means yieldingly opposing movement of said valve means to a position to permit fluid to flow from the reservoir to said chamber, a release passage communicating with said chamber through which fluid is withdrawn from said chamber and consequently from said reservoir past said valve means, a movable element subject to the opposing pressures of the fluid in said chamber and of the fluid in a chamber adapted to be charged with fluid at reservoir pressure for releasing fluid from the lower portion of the reservoir, and means responsive to the level of the liquid in said reservoir for controlling the supply of fluid from said reservoir to the said movable element.

5. In combination, a reservoir adapted to contain fluid under pressure, a body associated with said reservoir and disposed vertically above the lower portions of the said reservoir, said body having a control chamber having a release passage communicating therewith through which fluid may be withdrawn from said chamber, valve means subject to the opposing pressures of the fluid in the reservoir and said control chamber for controlling the flow of fluid from the reservoir to said chamber, yielding means opposing movement of said valve means to permit fluid to flow from the reservoir to said control chamber, the

body having an operating chamber therein, a movable element subject to the opposing pressures of the fluid in said operating chamber and of the fluid in said control chamber for releasing fluid from said operating chamber, and means responsive to the level of the liquid in the reservoir for supplying fluid from the lower portion of the reservoir to said operating chamber.

6. In combination, a reservoir adapted to contain fluid under pressure, a body associated with said reservoir and disposed vertically above the lower portions of the said reservoir, said body having a control chamber having a release passage communicating therewith through which fluid may be withdrawn from said chamber, valve means subject to the opposing pressures of the fluid in the reservoir and said control chamber for controlling the flow of fluid from the reservoir to said chamber, yielding means opposing movement of said valve means to permit fluid to flow from the reservoir to said control chamber, said body having an operating chamber therein, a movable element subject to the opposing pressures of the fluid in said operating chamber and of the fluid in said control chamber for releasing fluid from said operating chamber, means responsive to the level of the liquid in the reservoir for supplying fluid from the lower portion of the reservoir to said operating chamber, and means for retarding movement of said movable element.

7. An automatic drain valve device for a reservoir comprising a body having a control chamber therein having a release passage communicating therewith through which fluid may be withdrawn from said chamber, valve means subject to the opposing pressures of the control chamber and of the reservoir for controlling the supply of fluid from the reservoir to the control chamber, said body having a bore therein, a piston reciprocable in said bore and being subject to the opposing pressures of the fluid in the control chamber and of the fluid in an operating chamber communicating with the lower portion of the reservoir, the piston controlling the release of fluid from said operating chamber and carrying a packing ring having frictional engagement with the walls of the bore in which the piston is mounted to retard movement of the piston in said bore.

8. An automatic drain valve device for a reservoir, a body having a control chamber therein having a release passage communicating therewith through which fluid may be withdrawn from said chamber, valve means subject to the opposing pressures of the control chamber and of the reservoir for controlling the supply of fluid from the reservoir to the control chamber, said body having a bore therein, a piston reciprocable in said bore and being subject to the opposing pressures of the fluid in the control chamber and of the fluid in an operating chamber, the piston controlling the release of fluid from said operating chamber, and carrying a packing ring having frictional engagement with the walls of the bore in which the piston is mounted to retard movement of the piston in said bore, and means responsive to the level of the liquid in said reservoir for controlling the supply of fluid from the reservoir to the operating chamber.

9. An automatic drain valve device for a reservoir, a body having a control chamber therein having a release passage communicating therewith through which fluid may be withdrawn from said chamber, valve means subject to the opposing pressures of the control chamber and of the reservoir for controlling the supply of fluid

from the reservoir to the control chamber, said body having a bore therein, a piston reciprocable in said bore and being subject to the opposing pressures of the fluid in the control chamber and of the fluid in an operating chamber, the piston controlling the release of fluid from said operating chamber, and carrying a packing ring having frictional engagement with the walls of the bore in which the piston is mounted to retard movement of the piston in said bore, and means responsive to the level of the liquid in said reservoir for controlling the supply of liquid from the lowermost portion of the reservoir to said operating chamber.

10. In an automatic drain valve device for a reservoir, a body having a control chamber therein having a release passage communicating therewith for withdrawing fluid from the reservoir, valve means subject to the opposing pressures of the fluid in said control chamber and in the reservoir and controlling the flow of fluid from the reservoir to the control chamber, said body having an operating chamber therein, a movable element subject to the opposing pressures of the fluid in the control chamber and of the fluid in the operating chamber for releasing fluid from said operating chamber at one rate, and means for supplying fluid from the lower portion of the reservoir to said operating chamber at a rate more rapid than said one rate.

11. In an automatic drain valve device for a reservoir, a body having a control chamber therein having a release passage communicating therewith for withdrawing fluid from the reservoir, valve means subject to the opposing pressures of the fluid in said control chamber and in the reservoir and controlling the flow of fluid from the reservoir to the control chamber, said body having an operating chamber therein, a movable element subject to the opposing pressures of the fluid in the control chamber and of the fluid in the operating chamber for releasing fluid from said operating chamber at one rate, and means responsive to the level of the liquid in said reservoir for supplying fluid from the lower portion of the reservoir to said operating chamber at a rate more rapid than said one rate.

12. An automatic drain valve device for a reservoir having a drain passage communicating with the reservoir at or adjacent the bottom thereof and a discharge passage through which fluid under pressure is discharged from the reservoir, the drain valve device comprising means interposed in the communication through which fluid flows from the reservoir to said discharge passage for reducing the pressure of the fluid in the discharge passage relative to the pressure of the fluid in the reservoir on the withdrawal of fluid under pressure from the reservoir through the discharge passage, a movable element having a control chamber at one side open to said discharge passage and an operating chamber at the opposite side open to the drain passage, valve means controlling communication from said operating chamber to an atmosphere outlet and operated by said element upon a reduction in fluid pressure in said control chamber for opening communication from said operating chamber and said drain passage to the atmosphere to permit drainage of water from said reservoir, and means operated on a predetermined reduction in the level of the liquid in the reservoir to cut off communication between the reservoir and said drain passage.

13. An automatic drain valve device for a res-

ervoir having a discharge passage through which fluid is discharged from the reservoir, the drain valve device comprising means interposed in the communication through which fluid flows from
5 the reservoir to the discharge passage for reducing the pressure of the fluid in the discharge passage relative to the pressure of the fluid in the reservoir on the withdrawal of fluid under pressure from the reservoir through the discharge
10 passage, a movable element having a control chamber at one side open to said discharge passage and an operating chamber at the opposite side, means responsive to the level of the liquid in the reservoir for controlling a drain passage through which fluid may be supplied at a predetermined rate from the lower portion of the reservoir to said operating chamber, valve means
controlling communication from said operating 5 chamber to an atmosphere outlet through which fluid may flow at a rate less rapid than said predetermined rate and operated by said element upon a reduction in fluid pressure in said control chamber for opening communication from said
10 operating chamber to the atmosphere outlet to permit drainage of water from the reservoir.

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