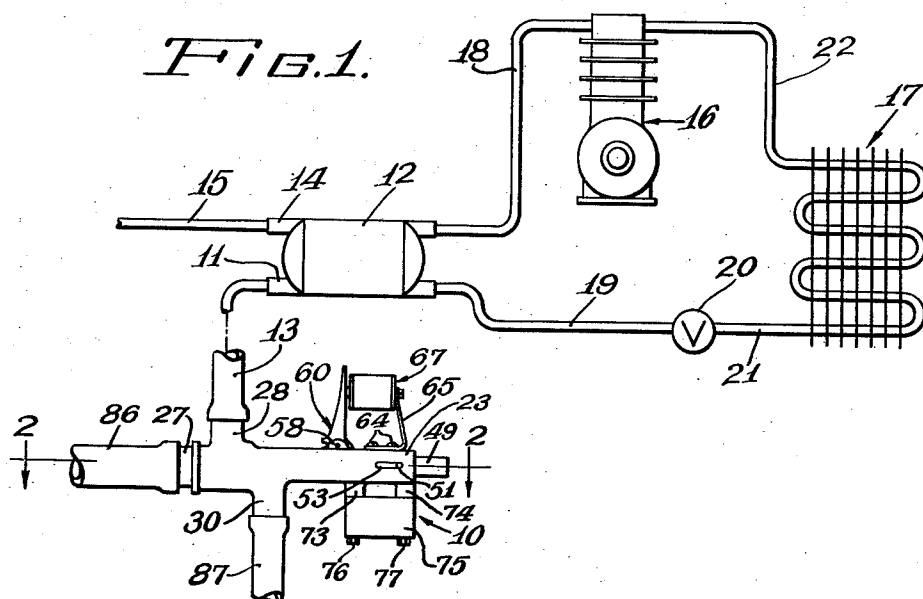
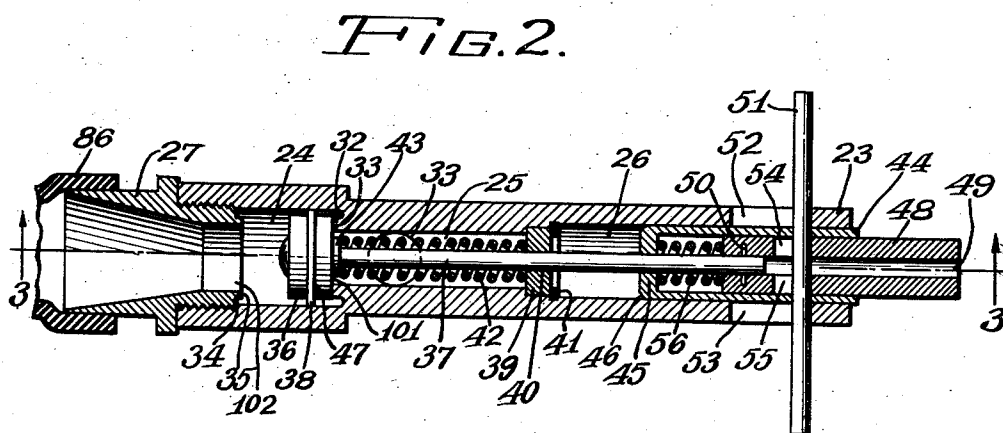


W. F. BORGERD
AUTOMATIC DRAIN VALVE

Filed Dec. 29, 1950

3 Sheets-Sheet 1



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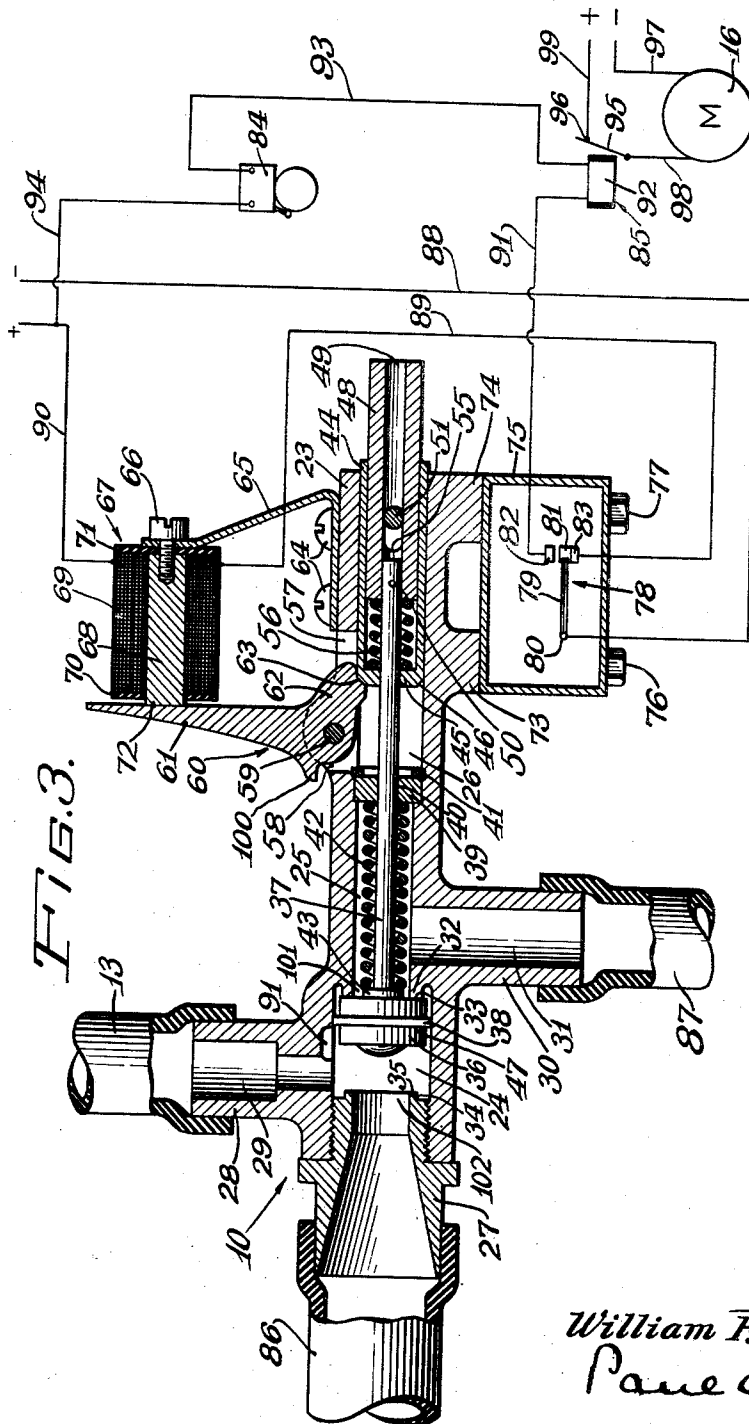
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AUTOMATIC DRAIN VALVE

2,688,460

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3 Sheets-Sheet 2



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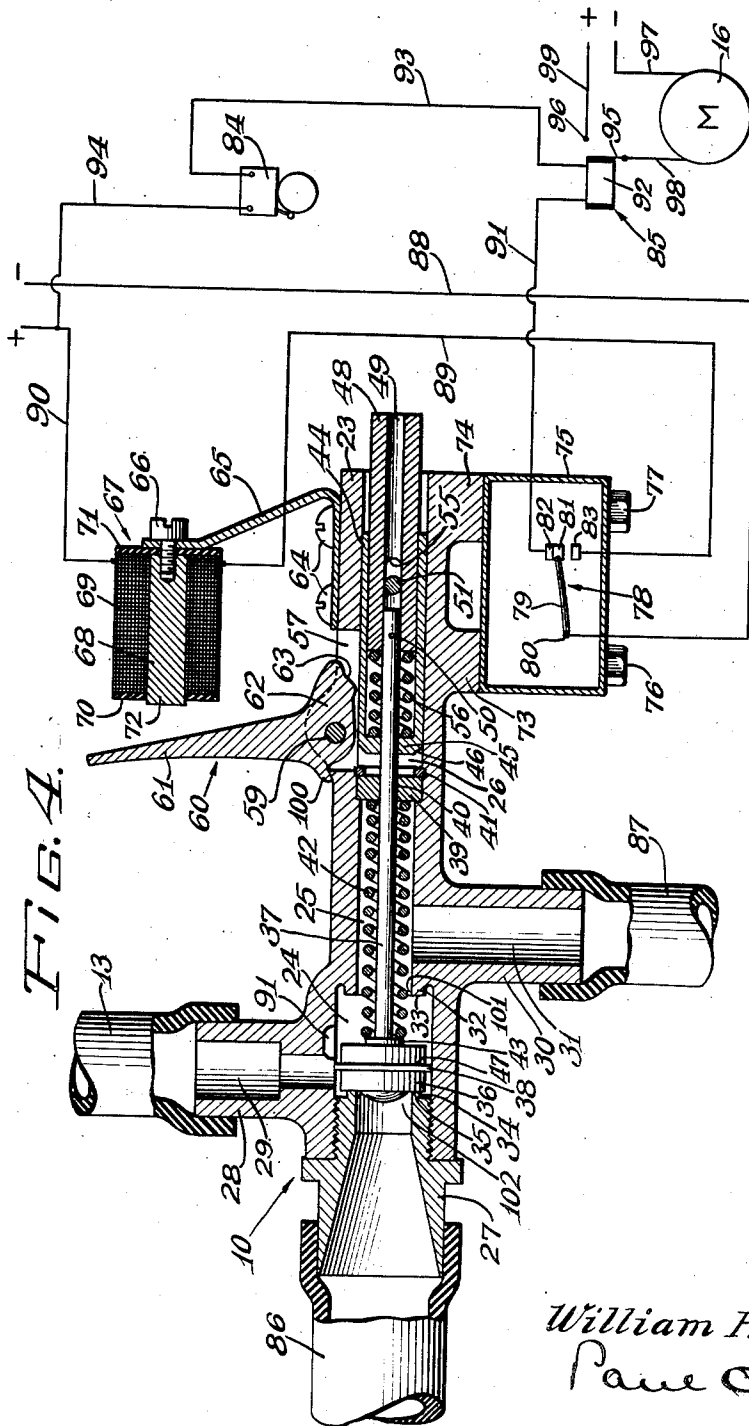
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3 Sheets-Sheet 3



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AUTOMATIC DRAIN VALVE

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4 Claims. (Cl. 251-68)

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This invention relates generally to a thermo-static drain valve and more particularly to a valve which will automatically drain the liquid from a cooling system when the system is subjected to freezing conditions.

The present invention provides a valve which is particularly adaptable for draining water from a water cooled condenser of an air conditioning system. During sudden periods of unusually cold weather, tremendous damage is often done to water cooled condensers since the air conditioning systems are ordinarily placed in enclosed rooms which are heated only by heat leakage from adjacent heated rooms. The temperature of the condenser will be lowered below the freezing point of water during such cold weather, which results in the freezing of the water in the condenser. As the water freezes, it expands and bursts the condenser. Accidents of this kind are quite common in business buildings, especially if the cold weather occurs on a week-end when attendants are absent from the building. When the condenser has burst, water runs all through the refrigeration system and the job of cleaning the system costs nearly as much as a new condensing unit because of the repeated purging with refrigerant that is necessary and the multitude of chemical dryers that must be used. By providing automatic means for draining the condenser, serious damage to the air conditioning system will be prevented.

One object of the present invention is to provide a drain valve which automatically cuts off the supply of cooling water to a water cooled condenser and completely drains water from the condenser when the temperature of the condenser approaches the freezing point of water.

Another object of the invention is to provide a drain valve with electrical means for operating the valve in response to ambient temperatures.

A further object of the invention is to provide an automatic drain valve which may be manually reset and which may be easily checked to determine if it is in proper operating condition.

Another object of the invention is to provide an automatic drain valve with signal means for warning an operator when the valve has moved to drain position.

Another object of the invention is to provide a cooling system with a drain valve which will positively and rapidly operate to drain the system when the system is subjected to freezing temperatures.

With the above and the other objects in view the invention consists in certain novel details of construction and combinations of parts hereinafter fully described and claimed, it being understood that various modifications may be resorted to within the scope of the appended claims without departing from the spirit or sacrificing any of the advantages of the invention.

In the accompanying drawings forming part of this specification:

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Fig. 1 is a diagrammatic view of a refrigeration system with an enlarged side elevational view of the drain valve.

Fig. 2 is an enlarged horizontal sectional view of the drain valve taken on line 2-2 of Fig. 2.

Fig. 3 is a vertical sectional view of the valve taken on line 3-3 of Fig. 2.

Fig. 4 is a vertical sectional view of the valve with the movable parts in drainage position.

Referring specifically to the drawings, numeral 10 designates generally a drain valve which is connected to the water inlet 11 of a water cooled condenser 12 by hose 13. The water outlet 14 of condenser 12 is connected to a suitable waste pipe by hose 15. The condenser 12 is a member of a refrigeration system comprising motor-compressor unit 16 and evaporator 17. After the refrigerant is compressed by motor-compressor unit 16, it flows through conduit 18 into a series of tubes in condenser 12 where it is cooled by the water flowing into water inlet 11, around the tubes and out the water outlet 14. The refrigerant flows from condenser 12 through conduit 19 into expansion valve 20, then through conduit 21 into evaporator 17. The air to be conditioned is passed over the evaporator and is cooled by the refrigerant passing there-through. From the evaporator 17, the refrigerant returns to the motor-compressor unit 16 through conduit 22 and repeats the cycle.

The drain valve 10 comprises a generally tubular shaped valve body 23 provided with three interconnecting cylindrical shaped chambers 24, 25 and 26 which extend through the central portion of the body. These chambers will hereinafter be referred to as inlet chamber 24, outlet chamber 25 and power chamber 26. One end of inlet chamber 24 is internally threaded into which an externally threaded nipple 27 is threaded. The valve body 23 is provided with an outlet nozzle 28 having a passageway 29 which extends into communication with inlet chamber 24. A drain nozzle 30 is provided on the lower part of valve body 23 having a passageway 31 which extends into outlet chamber 25. An annular shoulder 32 surrounds a valve port 101 and provides a valve seat 33 between valve chamber 24 and outlet chamber 25. Nipple 27 is provided with an annular shoulder 34 which surrounds valve port 102 and forms a second valve seat 35. A valve member or disc 36 is secured to one end of a valve stem 37 and positioned within valve chamber 24. Secured in an annular groove 47 in valve member 36 is a serrated ring 38 which helps to support the end of valve stem 37 and insures concentric seating of valve member 36 against valve seats 33 and 35.

Valve stem 37 extends through outlet chamber 25 into power chamber 26. Between these chambers is a wall member 39 which is secured in valve body 23 by washer 41 and is provided with a central opening 40 through which the valve stem 37 extends in sliding relationship thereto.

A compressible coiled spring 42 encircles valve stem 37 with one end abutting wall member 39 and the other end abutting an annular shoulder 43 formed on valve stem 37. A hollow cylindrical shaped piston 44 is fitted in power chamber 26 in sliding relationship thereto so that it is adapted for reciprocating movement therein. The closed end 45 of the piston is provided with an opening through which the valve stem 37 extends. The forward edge 46 of the piston is beveled to provide a surface inclined approximately 45°. Slidably received within piston 44 is a cylindrical shaped sleeve 48 having an internal bore 49 extending therethrough. The end of valve stem 37 extends into bore 49 and is fixedly secured to the sleeve 48 by pin 50. A horizontally extending cross pin 51 is fixedly secured to piston 44. Slots 52 and 53 are provided in valve body 23 through which the ends of the cross pin 51 extend. Sleeve 48 is provided with slots 54 and 55 through which the pin 51 extends. The slots 54 and 55 are made a length which is approximately twice the diameter of pin 51, whereas the length of slots 52 and 53 is considerably greater. A compressible coiled spring 56 encircles valve stem 37 with one end abutting the closed end 45 of piston 44 and the other end abutting the forward end of sleeve 48.

A portion of valve body 23 is cut away to provide an opening 57 which communicates with the top portion of power chamber 26. A projection 58 is formed as part of valve body 23 along one edge of opening 57. Pivotaly secured to projection 58 by pivot pin 59 is a trigger member 60 having a substantially vertically extending handle 61 and a leg 62 which extends into opening 57. A notch 63 is provided in leg 62 which fits over the beveled edge 46 of piston 44. Secured to valve body 23 by screws 64 is a bracket 65 having an upstanding portion spaced from handle 61. Secured to bracket 65 by screw 66 is a solenoid 67 having a metallic core 68 surrounded by an electrical winding 69. Insulating plates 70 and 71 are positioned at each end of winding 69 with end 72 of core 68 extending through an aperture in plate 70.

Valve body 23 is provided with two bosses 73 and 74 to which housing 75 is secured by bolts 76 and 77. Secured within housing 75 is a thermostat 78 which will be responsive to temperature changes. The thermostat 78 comprises a bimetallic strip 79 having a fixed end 80 secured to the housing 75. Secured to the movable end of strip 79 is an electrical contact 81 which is positioned between two fixed contacts 82 and 83. Contact 83 is connected in an electrical circuit to solenoid 67. Contact 82 is connected in an electrical circuit to an electric alarm bell 84 and an electric relay 85 which will operate as hereinafter described.

The rubber hose 13 connects the outlet nozzle 28 to condenser inlet 11 and rubber hose 86 connects nipple 27 to a suitable water supply. Drain nozzle 30 is connected to a suitable waste pipe by hose 37. The drain valve 10 is positioned adjacent the condenser 12 so that they will both be subjected to the same ambient temperature. When the refrigeration system is operating under normal conditions, the bimetallic strip 79 maintains movable contact 81 in engagement with fixed contact 83 which completes the circuit to solenoid 67 from a suitable power supply through wire 88, strip 79, contact 81, contact 83, wire 89, solenoid winding 69, and wire 90. As the solenoid 67 is energized, a magnetic pull is created which holds the trigger 60 in cocked position with handle 61

contacting end 72 of core 68 and notch 63 engaging the beveled edge 46 of piston 44 as seen in Figs. 2 and 3. Spring 56 is stiffer than spring 42 so that sleeve 48 is forced to the right by spring 56. Since valve stem 37 is secured to the sleeve 48 by pin 50, the valve stem will be moved to the right until valve member 36 is in contact with valve seat 33. This opens valve port 102 so that cooling water will pass through nipple 27, valve chamber 24, passageway 29, and hose 13 into condenser 12. With the drain valve mechanism in this position, the condenser 12 will be properly cooled by the cooling water. Spring 56 is strong enough to overcome spring 33 so that the valve member 36 is securely seated against valve seat 33 which prevents water from running into outlet chamber 25. The cross pin 51 is positioned proximate the rear edges of slots 52, 53, 54, and 55.

When the temperature of the air surrounding condenser 12 and the drain valve 10 is lowered to approximately 38°, the bi-metallic strip 79 will bend and move contact 81 away from fixed contact 83 into engagement with fixed contact 82 which breaks the circuit to solenoid 67. As the solenoid is de-energized the magnetic force will cease and handle 61 of trigger member 60 will be released. Both springs 56 and 42 will be acting to force the piston 44 forward which will force the trigger 60 in a counter-clockwise direction about pin 59 until notch 63 is above beveled edge 46. This releases piston 44 and the entire valve mechanism moves forwardly impelled by spring 42 to the position shown in Fig. 4. Valve member 36 is forced away from valve seat 33 and is moved into engagement with valve seat 35. As the sleeve 48 is carried forwardly by valve stem 37, it carries cross pin 51 and piston 44 with it. When valve member 36 contacts valve seat 35, the spring 56 will abut against fixed sleeve 48 and force piston 44 forwardly until cross pin 51 contacts the front edges of slots 54 and 55 in sleeve 48. The handle 61 is provided with projection 100 which abuts against valve body 23 and acts as a stop for trigger 60.

With the valve mechanism moved to the drainage position as shown in Fig. 4, the water supply through nipple 27 will be shut off, and communication between outlet chamber 25 and valve chamber 24 is provided through valve port 101. The water in condenser 12 will drain through hose 13, passageway 29, valve chamber 24, outlet chamber 25, passageway 31, and hose 37 into a suitable waste pipe. A slot 91 is provided in the upper portion of valve chamber 24 which connects with passageway 29 to insure rapid drainage of water past the valve member 36. Since the drain valve 10 is positioned below the condenser 12, all the water will drain from the condenser which will prevent damage to the condenser as the temperature falls below 32°.

As the bi-metallic strip 79 moves contact 81 into engagement with fixed contact 82 the circuit is completed to alarm bell 84 and relay 85 from a suitable supply source through wire 88, strip 79, contact 81, contact 82, wire 91, relay coil 92, wire 93, alarm bell 84, and wire 94. The resultant current flow will energize the alarm bell 84 and the alarm bell will begin to ring which will warn an operator that the condenser 12 is approaching freezing conditions. As the relay coil 92 is energized, arm 95 will be moved away from contact 96 and the current to motor-compressor unit 16 will be broken. This condition prevails until an operator comes to investigate. If the operator wants to use the air conditioner

in the immediate future, he may recock the valve mechanism by pulling to the right on the extended ends of cross pin 51. As the cross pin is forced to the right, it carries sleeve 48 and piston 44 with it so that trigger member 60 may be rotated until notch 63 is in engagement with beveled edge 46. The bi-metallic strip 79 is then warmed so that contact 81 is moved into engagement with contact 83 which completes the circuit to solenoid 67. The room must then be warmed up so that the valve does not again trip to drain position. As contact 81 is moved away from fixed contact 82 the circuit to alarm bell 84 and relay 85 is broken. As the relay is de-energized, arm 95 will move into engagement with contact 96 and the circuit will be completed to motor-compressor unit 16 through wire 99, contact 96, arm 95, wire 98, motor 16, and wire 97.

From the foregoing it can be seen that a drain valve is provided which will automatically operate to drain water from a water cooled condenser when the condenser is subjected to freezing temperatures. The valve may be easily checked to determine if all parts are free and in good working order by simply bumping the extended end of sleeve 48. The resultant squirt of water out the drain hose 87 will also indicate that the water supply is normal. Since the drain valve is accurately responsive to temperature changes, there is no danger that the water in the condenser will be frozen even if the refrigeration system is located in an unheated room.

It is obvious that minor changes may be made in the form and construction of the invention without departing from the material spirit thereof. It is not, therefore, desired to confine the invention to the exact form herein shown and described, but it is desired to include all such as properly come within the scope claimed.

What is claimed is:

1. A valve for a water system comprising a valve body having a valve chamber, said valve body provided with a drain port which communicates with said valve chamber, a valve stem extending through said drain port, a valve member secured to one end of said valve stem which is adapted to open and close said port, a sleeve secured to the opposite end of said valve stem, a piston slidably received within said valve body, a trigger member for engaging said piston, spring means interposed between said piston and said sleeve which forces said valve member to closed position when said trigger member engages said piston, a lever arm rigidly mounted to said trigger member, said lever arm formed of a magnetically attractable material whereby an electrical magnet is positionable in cooperation with said lever arm to control the operation of said trigger member, and spring means for forcing said valve member to open position when said trigger member is released.

2. A valve for a water system comprising a valve body having a valve chamber and a drain port communicating with said valve chamber, a valve stem, a valve member secured to one end of said valve stem and adapted to open and close said drain port, a sleeve secured to the opposite end of said valve stem, a piston slidably secured within said valve body, a pivotable trigger secured to said valve body and engaging said piston in the cocked position, resilient means interposed between said piston and said sleeve which holds said valve member in closed position when said trigger is engaging said piston in the cocked position, a lever arm rigidly mounted to said trigger,

said lever arm formed of a magnetically attractable material so that an electric magnet is mountable in cooperation with said lever arm to control the cocking and uncocking of said trigger, said resilient means being made inoperative when said trigger is uncocked, and means for moving said valve member to open position when said trigger is uncocked.

3. A valve for a water system comprising a valve body having a valve chamber, said valve body provided with a drain port which communicates with said valve chamber, a valve stem, a valve member secured to one end of said valve stem which is adapted to open and close said port, a sleeve secured to the opposite end of said valve stem, a piston, a trigger member movably secured to said valve body and operable to the cocked position to engage said piston and to the uncocked position to release said piston, resilient means interposed between said piston and said sleeve and operating responsive to the engagement of said piston by said trigger member for holding said valve member in the closed position, said trigger member formed to have a leg projecting therefrom, said leg formed of a magnetically attractable material so that an electro-magnet is mountable in cooperation with said leg to attract and release said leg whereby said trigger member is maintainable in the cocked and uncocked positions, and means for forcing said valve member to open position when said trigger member is released.

4. A valve for a water system comprising a valve body having a valve chamber, said valve body being provided with a drain port which communicates with said valve chamber, a valve stem having a valve member secured to one end thereof, said valve member adapted to open and close said drain port, a piston operable to one position, resilient means in engagement with said valve stem and said piston and operating when said piston is operated to said one position for moving said valve member to close said port, a trigger member movably secured to said valve body, said trigger member movable to one position to operate said piston to said one position whereby said valve member is moved to close said drain port, said trigger member formed to have a lever arm mounted rigidly thereto, said lever arm formed of a magnetically attractable material whereby an electro-magnet is mountable in cooperation with said lever arm to attract said lever arm to cock said trigger member to said one position and to release said lever arm to uncock said trigger member, and means for forcing said valve member to open position when said trigger member is released.

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