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2,716,418

THERMOSTATIC DRAIN VALVE

Filed Dec. 29, 1950

2 Sheets-Sheet 1

FIG. 1.

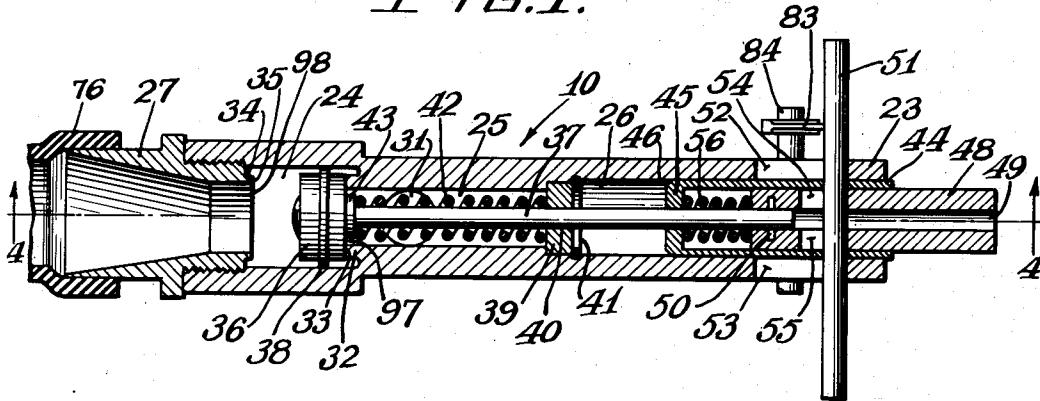


FIG. 2.

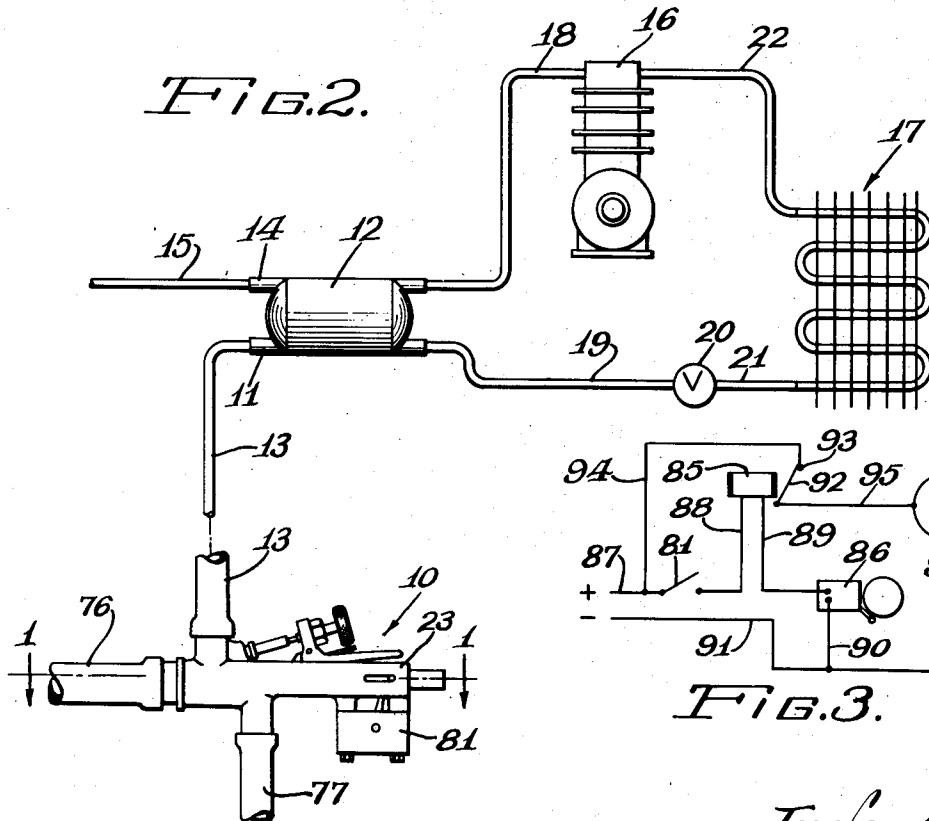


FIG. 3.

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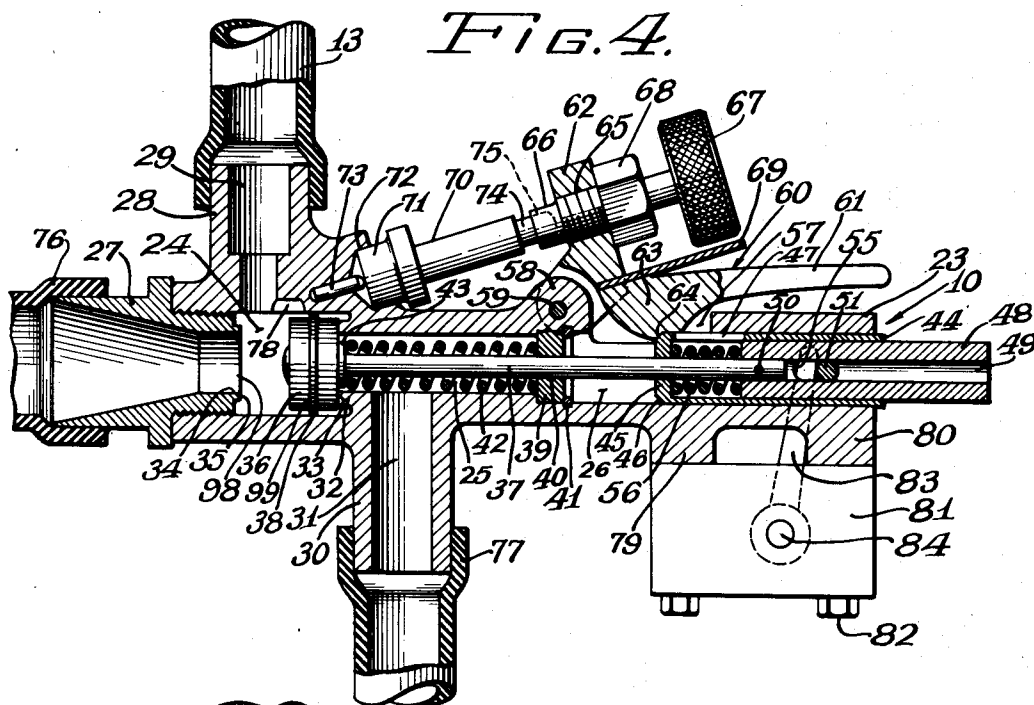
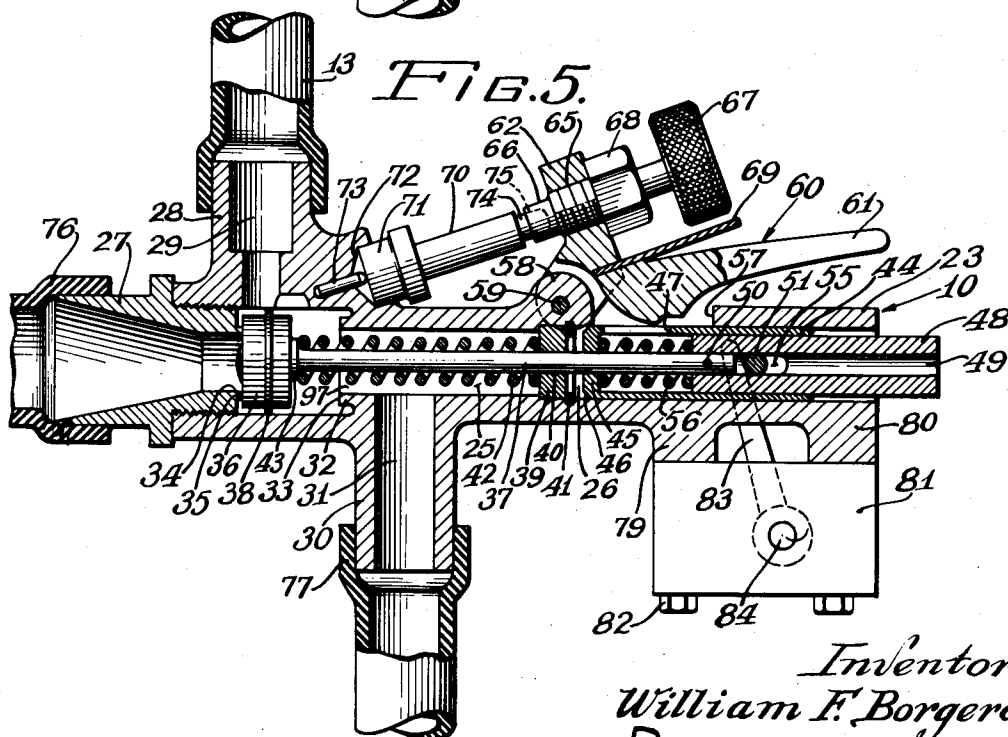
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2 Sheets-Sheet 2



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THERMOSTATIC DRAIN VALVE

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4 Claims. (Cl. 137—61)

This invention relates generally to a thermostatic 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 weekend 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 thermostatic means for operating the valve in response to ambient temperatures.

A further object of the invention is to provide a thermostatic 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 a thermostatic 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 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:

Fig. 1 is a horizontal sectional view of the drain valve taken on line 1—1 of Fig. 2.

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Fig. 2 is a diagrammatic view of a refrigeration system with an enlarged side elevational view of the drain valve.

Fig. 3 is a diagram of the electric circuit for the refrigeration system.

Fig. 4 is a vertical sectional view of the valve taken on line 4—4 of Fig. 1.

Fig. 5 is a vertical sectional view of the valve showing 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 therethrough. 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. 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 33 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 33 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 38 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 a snap ring 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°. The upper forward portion of piston 44 is provided with a slot 47. 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,

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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. An upstanding projection 58 is formed as part of valve body 23 along the forward edge of opening 57. Pivotaly secured to projection 58 by pivot pin 59 is a trigger member 60 having a substantially horizontally extending handle 61 and an upstanding leg 62. A bottom portion 63 of handle 61 extends into opening 57 and is provided with a notch 64 which fits over the beveled edge 46 of piston 44. An internally threaded opening 65 is provided in leg 62 in which an externally threaded adjusting screw 66 is secured. One end of adjusting screw 66 is provided with a knob 67 which may be used to set the screw and a nut 68 is provided for holding the screw securely in place after it is properly set. An indicator pin 69 is secured below knob 67 which aids the operator in adjusting the knob to a proper position.

A thermostatic element 70 is provided for forcing trigger member 62 about pivot pin 59. The thermostatic element is provided with a cup portion 71 which is secured in recess 72 formed in valve body 23 and abuts against an anvil pin 73 which is secured in valve body 23. A plunger 74 extends from the thermostatic element 70 with the outer end secured in a recess 75 formed in set screw 66. The cup portion 71 is filled with an expansible-contractible substance which moves plunger 74 when the cup portion is subjected to varying temperatures.

A rubber hose 13 connects the outlet nozzle 28 to condenser inlet 11 and rubber hose 76 connects nipple 27 to a suitable water supply. Drain nozzle 30 is connected to a suitable waste pipe by hose 77. 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 drain valve parts will be positioned as shown in Figs. 1 and 4 of the drawing. Trigger member 60 will be forced clockwise by thermostatic element 70 with notch 64 fitting over beveled edge 46 of piston 44. 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 seat 35 so that cooling water will pass through nipple 27, valve chamber 24, passageway 29, and hose 13 into condenser 12. The thermostatic element 70 and set screw 66 are adjusted so that trigger member 60 will be retained with notch 64 engaging beveled edge 46 of piston 44 as long as the temperature of thermostatic element does not approach the freezing point of water. With the drain valve parts in this position, the condenser 12 will be properly cooled by the cooling water. Spring 56 is strong enough to overcome spring 42 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 the slots 52, 53, 54, and 55.

When the temperature of the air surrounding condenser 12 and the drain valve 10 is lowered, the expansible-contractible substance in the thermostatic element 70 will contract and plunger 74 will move inwardly, which causes the over-all length of the element to be less. The springs 42 and 56 will be acting to force the piston 44 toward the left, which will force the trigger member 60 in a

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counter-clockwise direction as the thermostatic element becomes shorter. When the temperature of the surrounding air has been lowered to approximately 38°, the thermostatic element will have shortened enough to allow trigger member 60 to be rotated so that notch 64 is above beveled edge 46.

This releases piston 44 and the entire valve mechanism moves forward impelled by spring 42 to the position shown in Fig. 5. 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 forward 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 forward until cross pin 51 contacts the front edges of slots 54 and 55 in sleeve 48. Trigger member 60 will be held in the upward position by the thermostatic element 70.

With the valve mechanism moved to the drainage position as shown in Fig. 5, the water supply through nipple 27 will be shut off, and communication between outlet chamber 25 and valve chamber 24 is provided. The water in condenser 12 will drain through hose 13, passageway 29, valve chamber 24, outlet chamber 25, passageway 31, and hose 77 into a suitable waste pipe. A slot 78 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°. If the temperature of the thermostatic element 70 is raised above 38°, it will return to its original length and trigger member 60 will be rotated clockwise with notch 64 protruding into slot 47 of piston 44.

Valve body 23 is provided with two bosses 79 and 80 to which an electric switch 81 is secured by bolts 82. A switch arm 83 is secured to rod 84 which is connected to the switch 81. Details of the switch are not shown since it can be one of the many types on the market today. The arm 83 is held in constant contact with cross pin 51 by any suitable means, such as a spring. When the cross pin 51 is moved forward to drain position, the arm 83 is moved and rod 84 is rotated. This action closes the electric switch 81 which completes an electric circuit to a relay 85 and an electric alarm bell 86 from a suitable power source through wire 87, switch 81, wire 88, relay coil 85, wire 89, alarm bell 86, wire 90, and wire 91. The alarm bell 86 will begin to ring which will warn an operator that the condenser 12 is approaching freezing conditions. As the relay 85 is energized, arm 92 will be moved away from contact 93 and the current to motor-compressor unit 16 will be broken. This condition prevails until the 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 64 is in engagement with beveled edge 46. The thermostatic element 70 is warmed sufficiently to hold the trigger member 60 in cocked position. The room must then be warmed so that the valve does not again trip to the drain position. As the cross pin 51 is pulled to the right, arm 83 is rotated and the electric switch 81 is opened which breaks the circuit to the alarm bell 86 and relay 85. As the relay is deenergized, contact arm 92 will move into engagement with contact 93 and the circuit will be completed to motor-compressor unit through wire 94, arm 92, wire 95, motor-compressor 16, wire 96, and wire 91. If considerable time elapses before the operator investigates, the room may have warmed up so that trigger member 60 has been rotated by thermostatic element 70 with lower portion 63 of handle 61 extending into notch 47 of piston 44. It is

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then necessary to lay a small bag of crushed ice on thermostatic element 70 to shorten it before cocking the mechanism to operating position.

From the foregoing description, 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 of the drain hose 77 will also indicate that the water supply is normal. Switch arm 83 may be moved to the left once or twice a season to be sure that the alarm bell 86 works properly. Since the drain valve is accurately responsive to temperature changes, there is no danger that the water in the condenser will be frozen and the refrigeration system may be placed 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 and a drain passageway, a valve port positioned within said valve body between said valve chamber and said drain passageway, a valve stem extending through said valve port, a valve member secured to one end of said valve stem which is adapted to open and close said valve port, a sleeve secured to the opposite end of said valve stem, a piston slidably received in said valve body, said sleeve slidably received within said piston, a trigger member pivotally mounted to said valve body 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 leg formed on said trigger member, retaining means formed in said valve body, said leg and said retaining means relatively positioned to permit mounting of a temperature responsive device therebetween for controlling the pivoting of said trigger member, and means for forcing said valve member to open position when said trigger member disengages said piston.

2. A drain valve for a water system comprising a valve body having a valve chamber and a drain passageway, a valve port positioned within said valve body between said valve chamber and said drain passageway, a valve stem extending through said valve port, a valve member secured to one end of said valve stem, a trigger member pivotally secured to said valve body and pivotable to cocked and uncocked positions, a leg formed on said trigger member, retaining means formed in said valve body, said leg and said retaining means relatively positioned to permit mounting of a temperature responsive expansible and contractible element therebetween for maintaining said trigger member in the cocked position responsive to the expansion of said element and the uncocked position responsive to the contraction of said element, a piston slidably mounted in said valve body when said trigger member is uncocked, said trigger member cooperating with said piston in the cocked position to immobilize said piston, resilient means which cooperates with said valve stem and said piston when said piston is immobilized for forcing said valve member to closed position, said resilient means being made inoperative when said piston is mobilized when said thermostatic element has rotated said trigger member to said uncocked

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position, and spring means for moving said valve member to open position when said resilient means is inoperative.

3. A valve for a water system comprising a valve body having a valve chamber and a drain passageway, a valve port positioned within said valve body between said valve chamber and said drain passageway, a valve stem extending through said valve port, a valve member secured to one end of said valve stem which is adapted to open and close said valve port, a sleeve secured to the opposite end of said valve stem, a piston slidably received in said valve body, said sleeve slidably received within said piston, a trigger member for engaging said piston mounting means pivotally mounting said trigger member to said valve body, 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 leg formed on said trigger member, biasing means formed in said leg, retaining means formed in said valve body, said biasing means and said retaining means relatively positioned and adjustable to permit mounting of a temperature responsive device therebetween for controlling and adjusting the pivoting of said trigger member to engage said piston, means for forcing said valve member to open position when said trigger member disengages said piston, and a cross pin secured to said piston for manually resetting said valve member to closed position.

4. A drain valve for a water system comprising a valve body having a valve chamber and a drain passageway, a valve port positioned within said valve body between said valve chamber and said drain passageway, a valve stem extending through said valve port, a valve member secured to one end of said valve stem, a trigger member pivotally secured to said valve body and pivotable to cocked and uncocked positions, a lever arm rigidly mounted to said trigger member, said lever arm and said retaining means relatively positioned to permit mounting of a temperature responsive expansible and contractible device therebetween for maintaining said trigger member in the cocked position responsive to the expansion of said device and the uncocked position responsive to the contraction of said device, a piston, means operating responsive to said trigger member when cocked for immobilizing said piston and operating responsive to said trigger member when uncocked for mobilizing said piston, resilient means operating responsive to the immobilization of said piston for forcing said valve member to closed position, said resilient means being made inoperative responsive to the mobilization of said piston, spring means for moving said valve member to open position when said resilient means is inoperative, and manual means for forcing said valve member to closed position and recocking said trigger member.

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