Sept. 7, 1954 R. A. WITTMANN 2,688,446

HEAT RESPONSIVE VALVE

Original Filed Jan. 17, 1947 2 Sheets-Sheet 1

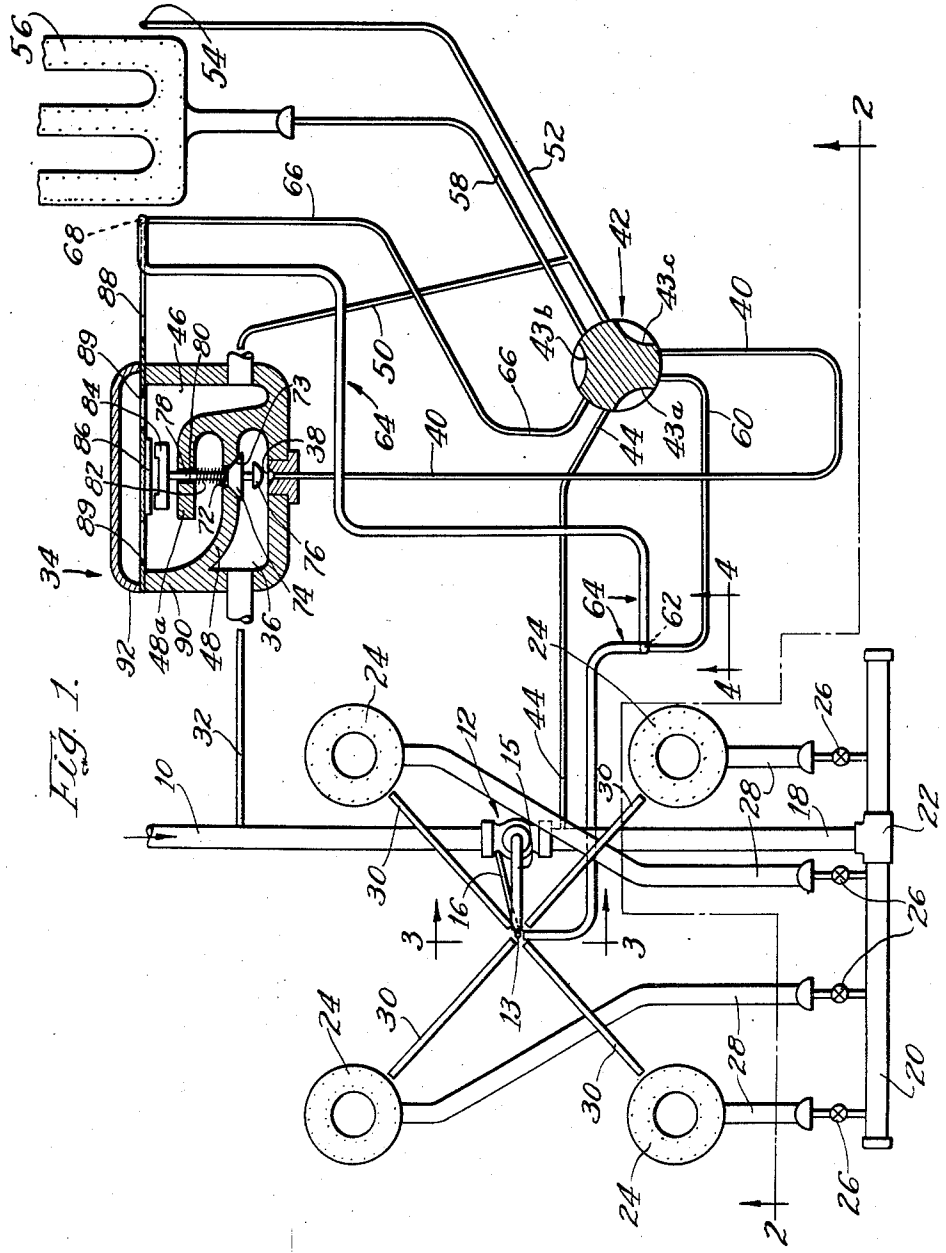

Fig. 1.

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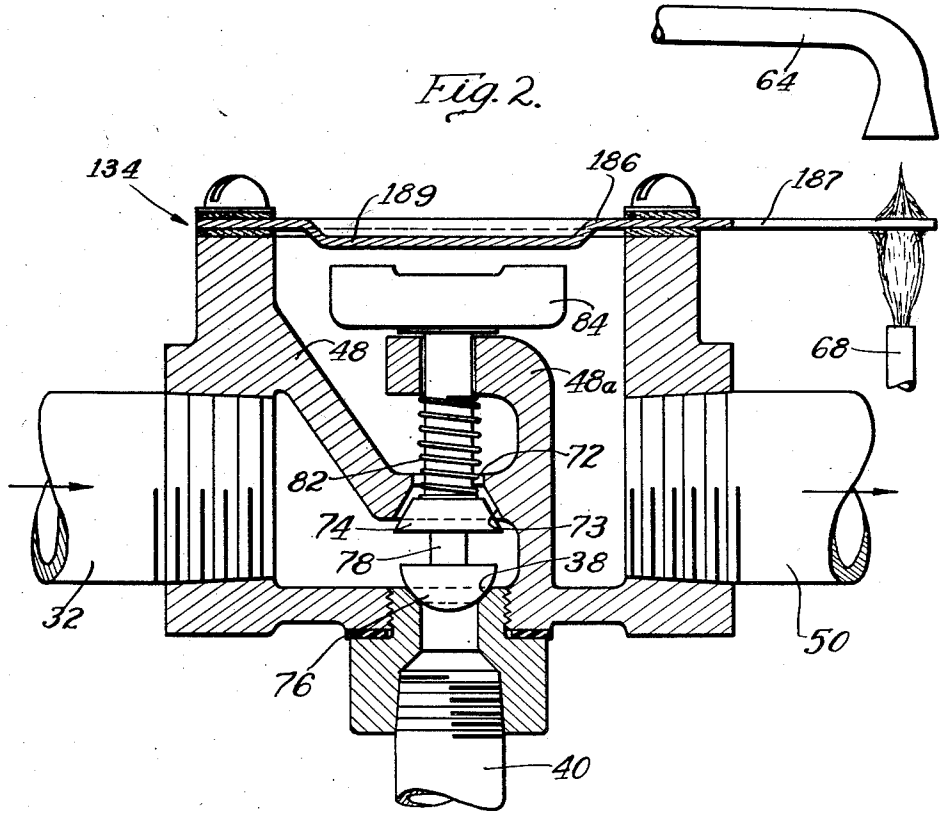
Fig. 2.



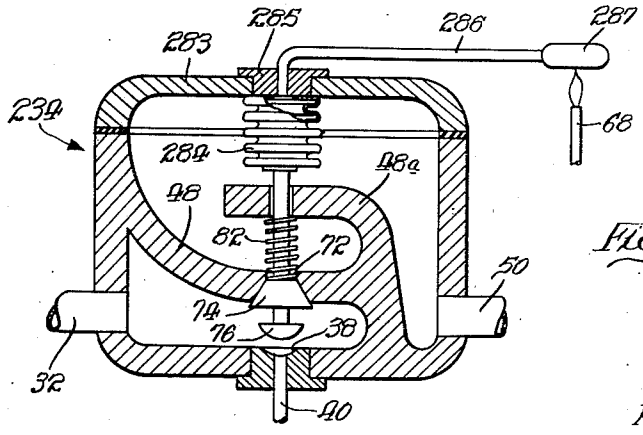




FIG. 3.

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# UNITED STATES PATENT OFFICE

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## HEAT RESPONSIVE VALVE

Robert A. Wittmann, Chicago, Ill.

Original application January 17, 1947, Serial No. 722,584. Divided and this application March 22, 1950, Serial No. 151,193

2 Claims. (Cl. 236—88)

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My invention relates, generally, to valve structures and, more particularly, to heat responsive valves.

While the valve of my invention may be widely used, it is well suited for use in a gas burning system such as that illustrated and described in my copending application, Serial No. 722,584, filed January 17, 1947, of which this application is a division.

It is an object of this invention to provide a valve which is automatically opened or closed in response to differences in temperatures to which the heat responsive means of the valve is subjected. The heat responsive means can be of any desired type, such as bi-metallic strips; bulb and bellows, either liquid or gas filled; thermo-couple energized solenoid; electric solenoid, etc.

In the preferred form of the invention, the means responsive to differences in temperature by which the valve is actuated relies upon the magnetic character of Curie point metals, namely, metals and alloys which normally are ferromagnetic, but which when heated sufficiently, lose their magnetic properties. The transition temperature, or Curie point, as it is called, at which the change in magnetic characteristics occurs on heating is a distinct property of each metal or alloy and varies widely among the various metals and alloys. Each metal or alloy, however, has its own distinct and non-varying Curie point. A valve member moved in response to the attraction between a magnet and a Curie point metal may, therefore, be manipulated by heating the Curie point metal above its Curie point. The invention will be illustrated in connection with this form of heat responsive means, but it will be readily appreciated that other forms may be employed.

It is a further object of my invention to provide means whereby a Curie point metal, or other heat responsive element employed in the heat responsive valve of my invention may be cooled rapidly below its Curie point so that the valve member responsive to such element (for example, responsive to the attractive force between the Curie point metal and any other magnetic member) may be operated quickly. In the accomplishment of this object, I provide, for example, a valve in which the Curie point metal is positioned directly in the flow of gas which passes through the valve when the valve member is opened. A very definite "snap action" of the valve is obtained by using such a Curie point metal and permanent magnet. Such metals retain their temperature responsive characteristics indefinitely.

It is another object of my invention to provide

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a double acting valve mechanism which provides flow through alternate outlets, the actuation of the valve being governed by heat responsive means. Such valve mechanism opens one outlet as it closes the other, and vice versa. The heat responsive means may be any of those mentioned above.

It is a further object of the invention to provide a simplified valve structure employing Curie point metal and a permanent magnet for operating the movable valve element.

Further objects, uses and advantages of the invention will become apparent, or be obvious, from the following description, when taken in connection with the accompanying drawings, in which:

Figure 1 illustrates the valve of my invention employed in conjunction with a gas burning system such as that illustrated and described in my copending application, Serial No. 722,584;

Figure 2 illustrates a modified form of the automatic heat responsive valve of Figure 1; and

Figure 3 illustrates a double acting valve mechanism of my invention with another form of heat responsive means for actuating the movable valve member.

Turning first to Figure 1, the automatic heat responsive valve is indicated generally by the reference numeral **34**. The gas burning system illustrated in Figure 1 does not need to be described extensively here, since a full description thereof may be had in my copending application referred to above, namely, Serial No. 722,584, filed January 17, 1947. Suffice it to say here that the main gas supply pipe **10** communicates by a conduit **32** with the inlet chamber **36** of the valve **34**. The outlet chamber **46** of the valve **34** communicates with, by means of a conduit **50**, a manually controlled valve **42** and a conduit **58** to a gas burner **56**, for which the valve of my invention is adapted to provide a control. In one form of the invention there may also communicate with the inlet chamber **36** of the valve **34** a conduit **40** which is adapted to communicate with a pilot light **62** through the manually controlled valve **42** and conduit **60**. It will be understood, however, that the valve does not need to include the conduit **40** in its operation, but that such inclusion provides a modified structure.

The inlet chamber **36** of valve **34** is separated from the outlet chamber **46** by walls **48** and **48***a*, a passageway **72** being formed in the former wall and having a valve seat **73** at one end, the passageway and seat together sometimes being referred to as a port. The passageway **72** may be

closed by a movable valve member 74. Where the conduit 40 is employed, it may be closed by a movable valve member 76. Both members 74 and 76 may be fixedly secured on the same rod 78 which is guided by passageway 80 in the wall 48a. A spring 82 is interposed between the wall section 48a and the valve member 74, thus assisting gravity to urge the valve members 74 and 76 downwardly (as viewed in Figure 1, where the valve mechanism has been turned into the horizontal plane in order to provide a sectional view which is more illustrative of the structure). The movable valve member 74 is urged by the spring and by gravity away from its valve seat 73 and the valve member 76 is simultaneously urged toward its seat 38.

The heat responsive means for actuating the movable valve members will now be described. This heat responsive means is exemplified by the use of Curie point metal, but other heat responsive means such as bi-metallic strips; bulb and bellows, either liquid or gas filled; thermocouple energized solenoid; electric solenoid, etc. may be employed. One such other form will be described hereinafter. At the upper end of the rod 78 is fixed a permanent magnet 84 which is attracted toward a piece of ferromagnetic Curie point metal 86 when said metal 86 is at a temperature below its Curie point. This Curie point metal 86 is supported by a heat conducting member 88 having apertures 89 around the metal 86. The member 88 extends out of the housing of the valve 34 from between the casing 90 and the lid 92 into the vicinity of a pilot which may be the oven burner pilot 68. When the pilot 68 is lit from a source of gas, heat is transferred through the conducting member 88 to the Curie point metal 86 which, because of such heating, loses its magnetic qualities and fails to exert an attractive force on the permanent magnet 84 when a temperature above its Curie point is reached. Thereupon, the spring 82, together with the force of gravity, forces the valve members 74 and 76 downwardly, as viewed in Figure 1. This results in the valve member 74 being unseated and in the valve member 76 being seated upon the seat 38.

At this time, there is a means of communication between the inlet chamber 36 of the automatic valve 34 and its outlet chamber 46, namely, passageway 72, and gas under pressure will, therefore, flow from conduit 32 and the gas supply line 10 into chamber 36. From chamber 36 the gas will go through the passageway 72 and be directed by wall sections 48 and 48a all about the Curie point metal 86 which is directly in the path of flow of gas to the outlet chamber 46 and the conduit 50, with resulting cooling action on said Curie point metal. When the oven burner pilot 68 is lit, any flow of gas past the Curie point metal 86 will fail to bring said metal below its Curie point, once it is heated above that point. However, continued flow of gas past the metal, after the pilot 68 and any other source of heat affecting the conducting member 88 have been extinguished, will assist in cooling the Curie point metal 86 and the heat conducting strip 88, so that the Curie point metal 86 will more quickly reach a temperature below its Curie point and thus regain its magnetic qualities for purposes of attracting the magnet 84 and thus closing the passageway 72 to prevent further flow of gas through the automatic valve to the outlet chamber 46 and thence from the chamber 46 to the conduit 50.



When the movable valve member 74 is seated upon the seat 73 by reason of the magnet 84 being attracted to the Curie point metal 86, when the latter has cooled below its Curie point, movable valve member 76 will be lifted from its valve seat 38, thereby permitting communication between the inlet chamber 36 of valve 34 and the conduit 40. The continued flow of gas through the valve 34 and about the Curie point metal 86 when the valve is open and the pilot 68, or other heating means, has just gone out, will very quickly reduce the temperature of the Curie point metal below its Curie point with a resulting quick closing of the valve by movable valve member 74.

A modification of the automatic heat responsive valve 34 of Figure 1 is shown in Figure 2, wherein it is indicated generally by the reference numeral 134. The only substantial difference between the valve 134 and the valve 34 of Figure 1 is in the Curie point metal element 186 which serves both as a ferromagnetic member and also as a heat transmitting member, comparable to member 88 of Figure 1. The entire element 186, therefore, is a Curie point metal element which serves as its own conducting member and its outermost end 187 is subjected to the flame of a pilot, such as the oven burner pilot 68, or other heating means. A depressed portion 189 of the element 186 serves as the magnetic element directly above the permanent magnet 84.

It will also be observed that the element 186 forms the closure member for the top of the valve 134 and therefore eliminates the need of a lid, such as lid 92 of the valve 34 in Figure 1. By combining three functions as it does, the element 186 makes the valve 134 less expensive than the valve 34. In the structure of Figure 2, the flow of gas through the valve can be directed by the wall structures 48 and 48a against one side of the sheet of Curie point metal instead of all about it, as may be done in the case of valve 34 of Figure 1. However, since the element 186 serves as the closure of the valve 134, the top surface thereof is largely exposed to air which is able to carry away heat. Consequently, the rapid cooling of the Curie point element 186 after the pilot light 68 is extinguished permits the Curie point element rapidly to cool below its Curie point so that it will regain its magnetic properties and thereby attract the magnet 84 and cause the movable valve member 74 to seat upon the valve 73 and to lift the movable valve 76 from its seat 38.

In Figure 3, there will be seen a valve mechanism 234 having the same inlet 32 and outlets 40 and 50 as those shown with respect to Figures 1 and 2. The double valve mechanism comprising the movable valve elements 74 and 76 on operating rod 78, with their respective seats 73 and 38, and also the inner walls 48 and 48a, are similar to those previously described above with respect to Figures 1 and 2. The heat responsive operating means of Figure 3 for the movable valve members 74 and 76 comprises a bellows 284 connected with the common operating rod 78 for the movable valve members 74 and 76, which bellows is filled either with liquid or gas, and is connected in pressure-tight relationship to the upper wall 283 of the valve mechanism 234. By means of an apertured screw fitting 285, the interior of the bellows communicates, through a hollow tube 286 with a bulb 287, which is adapted to be positioned above the flame of a

pilot, such as the oven burner pilot **68** of a gas burning system shown in Figure 1. The bellows is flexible and resilient and its resiliency urges valve member **74** to its seat when the pressure within the bellows is below a certain level. At such time the bellows overcomes the tendency of spring **82** to move the valve members **74** and **76** in the opposite direction. When the pilot **68** is lit, it heats the liquid or gas in the bulb **287**, and the heated gas or liquid expands and, through the resilient bellows **284**, moves the operating rod **78**, which is connected with the bellows, downwardly so that gas or other fluid may flow from inlet **32** through the passageway **72** of valve mechanism **234** and be directed by the wall means **48** and **48***a*, around the bellows **284** and out of the outlet **50**. The passage of fluid or liquid past the bellows does not cause the gas therein to be sufficiently cooled to cause the bellows to contract until such time as the flame at the pilot burner **68** is extinguished. But when the flame at pilot burner **68** is extinguished, a flow of gas or other fluid past the bellows **284** will then act to cool the bellows and the expansible material in it, so that such material will contract and the resilient bellows will also contract and draw the valve member **74** upwardly against its seat. In that fashion the valve member **74** is quickly actuated to closed position after the flame of the pilot burner **68** is extinguished. It will be seen that when the valve member **74** is unseated, the valve member **76** is seated, and vice versa.

While I have illustrated two forms of heat responsive means for manipulating the movable valve members, it will be appreciated that other known forms of heat responsive means could also be employed.

Although I have described preferred embodiments of my invention, it will be apparent that modifications may be made therein without departing from the scope of the invention, and I do not intend to be limited thereto except insofar as the appended claims are so limited.

I claim:

1. A heat responsive valve for controlling fluid flow comprising a housing having an inlet port and an outlet port, wall means in said housing including a first portion between said inlet and outlet ports having a valve port located therein, a second portion spaced from said first portion and said valve port and a third portion connecting said first and second portions and extending between said valve port and said outlet port, a valve cooperating with said valve port for controlling fluid flow therethrough, said valve being guided for movement with respect to said valve port by said second portion of said wall means, a second outlet port in said housing



located between said inlet port and said valve port, a second valve provided to cooperate with said second outlet port for controlling flow therethrough, the arrangement being such that, when said first named valve is positioned to preclude fluid flow through said valve port said second valve is positioned to allow fluid flow through said second outlet, a heat responsive Curie point metal element, said first named valve including a permanent magnet member which cooperates with said Curie point element to position said first named valve to preclude fluid flow through said valve port when said Curie point element is cooled below its Curie point, at least a portion of said heat responsive Curie point element being disposed in said housing between said second portion of said wall means and said outlet port and being adapted for actuating said valve, said second and third portions of said wall means cooperating with said first portion to define a channel for directing passage of fluid between said valve port and said portion of said Curie point element, said portion of said Curie point element being positioned directly in the path of fluid passing through said channel and being adapted to be heated from a source of heat outside of said housing to position said first mentioned valve for passage of fluid from said inlet port, through said valve port and said channel, against said portion of said heat responsive means and thence to said outlet, the arrangement being such that, when said Curie point element ceases to be heated by the outside source, the fluid cools said Curie point element whereupon said first mentioned valve is positioned by said Curie point element to preclude fluid flow through said valve port.

2. The heat responsive valve set forth in claim 1 wherein the Curie point metal element is directly heated by the source of heat outside said housing and a depressed portion of said element is positioned directly above said permanent magnet.

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