

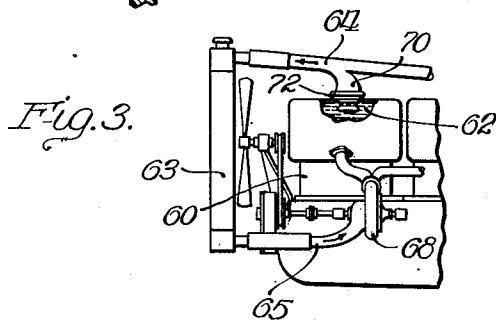
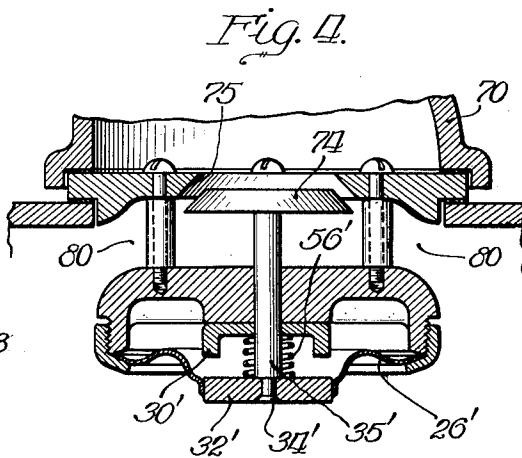
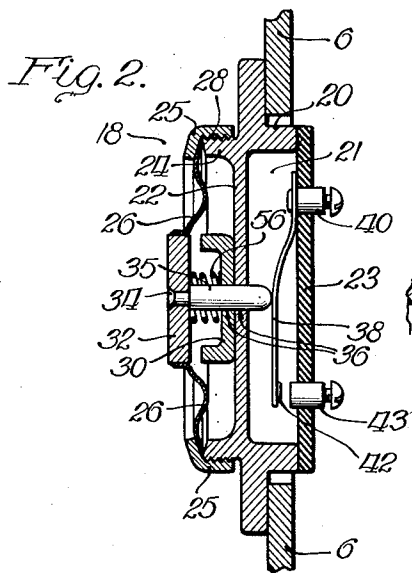
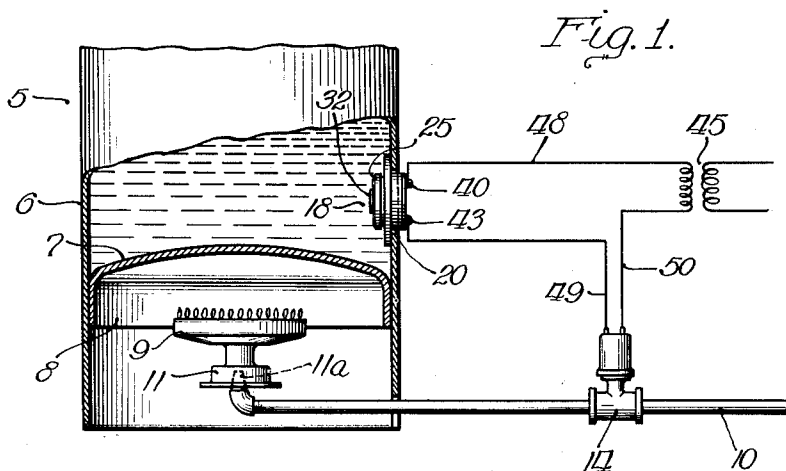
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2,339,087

THERMOSTATIC CONTROL DEVICE

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2,339,087

THERMOSTATIC CONTROL DEVICE

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9 Claims. (Cl. 236—20)

This invention relates to a thermostatic control device.

While the particular embodiments of the invention which I shall describe hereinafter in connection with the drawing are adapted for use with water heaters and the like for shutting off the flow of fuel to the burners for such heaters when the water reaches an undesirably high or excessive temperature and as an automatic water temperature control for the cooling systems for internal combustion engines and the like, it is to be understood that the invention is not limited to such uses but may be employed for other purposes as suitable and desired.

One of the main objects of the invention is to provide in a control device of the class described a member made of a temperature sensitive magnetic alloy or of a Curie point material well known in the art, and to utilize the characteristic of this member to be ordinarily magnetic and to become substantially non-magnetic when heated to a sufficiently high temperature for securing the desired control upon changes in temperature adjacent the Curie point member.

It is also an object of the invention to provide a control device of relatively simple and inexpensive construction, and which is effective and reliable in operation; also a device which is easy to assemble and install, and a device having a quick or snap acting operation for securing the desired control at the desired temperature.

Further objects and advantages of the invention will appear from the following detailed description taken in connection with the accompanying drawing, in which:

Figure 1 is a vertical section through a fragment of a water heater showing one illustrative embodiment of the invention in connection therewith;

Figure 2 is a section taken axially through the control device shown in Figure 1 on a somewhat larger scale than Figure 1;

Figure 3 is a fragmentary and more or less diagrammatic side elevation partially in section showing another embodiment of the invention as an automatic water temperature control for the cooling system of an internal combustion engine; and

Figure 4 is a section taken axially through the control device shown in Figure 3 on a somewhat larger scale than Figure 3.

Referring first to Figure 1, a hot water heater is indicated generally at 5 and comprises a tank

6 adapted to contain the water to be heated. The tank 6 has a bottom 7 defining the upper wall of a heater chamber 8 in which is disposed a main burner 9.

The burner 9 is supplied with fuel by a pipe 10 which is connected to the burner as shown in the drawing. Where the burner is a gas burner, the fuel supply pipe 10 supplies gas thereto and, in that case, the fuel supply pipe is preferably connected to the burner 9 through a suitable air and gas admixture chamber 11, the fuel delivery nozzle being indicated at 11a.

A solenoid or motor valve 14 is disposed in the fuel supply pipe 10. These valves are well known in the art, and therefore will not be described in detail except to state that as long as the electric circuit therefor is closed, the valve 14 is maintained open and permits fuel to flow to the burner 9, and that when the circuit for the valve 14 is interrupted the valve closes and shuts off the supply of fuel to the main burner.

A pilot burner, not shown, may be associated with the main burner 9 in any suitable or preferred manner. The pilot burner and its fuel supply means forms no part of the present invention, and therefore any showing or further description of the same will be omitted. Where there is a pilot burner, it is intended to remain lighted for the purpose of lighting the main burner whenever a supply of fuel is set up to the main burner. The pilot burner may, for example, be supplied with gaseous fuel by a pilot supply pipe connected to the body of the valve 14 in a manner to by-pass fuel to the pilot burner, or the pilot supply pipe may be connected to the pipe 10 anterior to the valve 14, or otherwise as desired.

The control device, indicated in its entirety at 18, comprises a body or housing 20 having a peripheral wall defining a contact chamber 21. The chamber 21 is closed on one side by the wall 22 which is integral with the peripheral wall of the body 20, and the opposite side of the chamber 21 is closed by an insulating contact and terminal supporting member 23. The insulating member 23 is secured to the body 20 in any suitable or preferred manner.

The opposite end of the body 20 is provided with an annular flange 24, and clamped or otherwise held marginally to the flange 24 by a diaphragm retainer ring 25 is a flexible diaphragm 26. The annular ring 25 is threaded or otherwise suitably secured to the body 20 as indicated at 28. Fixed centrally against the inner side of the wall 22 and coaxial with respect to the body

20 is a permanent magnet 30 which, in the illustrated embodiment of the invention, is of annular form and provided with an inwardly directed annular flange. The magnet 30 may be of any other suitable or preferred form. With the increased magnetic strength now obtainable with the proper materials and the right treatment, the permanent magnet 30 may be relatively small and, at the same time, will have suitable strength for the intended purpose.

Fixed centrally to the flexible diaphragm 26 and in alignment with the magnet 30 is a member 32 which is made of a temperature sensitive and, in this illustrated embodiment of the invention, of a relatively low temperature sensitive magnetic alloy, or of a relatively low Curie point material well known in the art. The permanent magnet 30 constitutes a source of magnetic flux for the Curie point member 32. The diaphragm 26 is preferably of annular form extending inwardly to afford suitable attachment to the Curie point member 32 and leaving the outer surface of the Curie point member directly exposed to the magnet 30, although this of course may vary. At its axis the Curie point member 32 is fixed at 34 to a stem 35 which extends slidingly through registering openings 36 in the magnet 30 and wall 22 and, within the chamber 21, operates against a spring contact arm 38.

The contact arm 38 is fixed mechanically and connected electrically at one end to a terminal 40 fixed in the insulating member 23. The opposite end of the contact arm 38 has a contact 42 which is adapted to contact a terminal 43 fixed in the insulating member 23. The contact arm 38 is preferably formed of spring metal of a character to position the contact 42 in open circuit position as shown, and to snap the contact to this position when the contact arm is released.

The circuit for the solenoid or motor valve 14 may include the secondary winding of a transformer 45, the primary winding of which transformer 45 may be connected to a suitable source of current. In the illustrated embodiment of the invention the terminal 40 is connected by a conductor 48 to one terminal of the secondary winding of the transformer 45. The other terminal 43 is connected by a conductor 49 to one terminal of the solenoid or motor valve 14, and the other terminal of this valve is connected by a conductor 50 to the other terminal of the secondary winding of the transformer 45.

The body 20 is adapted to be mounted in the shell or wall of the tank 6 with the Curie point member 32 disposed in the tank 6 and in contact with the water therein, and the terminals 40 and 43 externally disposed as shown.

The Curie point member 32, being ordinarily magnetic, is held in attracted position against the permanent magnet 30 with the stem 35 holding the contact arm 38 in closed circuit position as long as the temperature of the water in the tank does not reach the critical temperature of the Curie point member. In the illustrated embodiment of the invention, the critical temperature at which the Curie point member 32 becomes non-magnetic, or at least of insufficient magnetic strength to be held in attracted position against the magnet 30, is the temperature at which it is desired to operate the valve 14 to shut off the supply of fuel to the main burner. As long as the Curie point member is held in attracted position, closing the circuit for the solenoid or motor valve 14, this valve is held open and the desired supply of fuel flows to the burner 9.

If the safety temperature to which the Curie point member 32 is subjected, i. e. the safety temperature of the water in the tank 6, is exceeded, the member 32 instantly becomes non-magnetic or of insufficient magnetic character to be held in attracted position. As a result, the member 32 is released and moves to the retracted position shown in Figure 2, and the stem 35 releasing the contact arm 38, this arm snaps to open circuit position, thereby opening the circuit for the valve 14. Upon opening of this circuit, the valve 14 operates to closed position to shut off the supply of fuel to the burner 9.

For the purpose of actuating the member 32 to retracted position at the critical temperature thereof, I provide a spring 56 which surrounds the stem 35 and is interposed between the Curie point member 32 and the magnet 30. Any other suitable means may be provided for this purpose. For example, the flexible diaphragm 26 may be formed of a spring metal or alloy of such characteristics that when the temperature adjacent the Curie point member 32 reaches the critical temperature of this member, the diaphragm 26 itself will snap the member 32 to retracted position and will hold the Curie point member in retracted position until the temperature drops below the critical temperature of this member, whereupon the magnet 30 will actuate same to attracted position to close the circuit for the solenoid or motor valve.

Referring now to Figure 3, an internal combustion engine is shown fragmentarily and more or less diagrammatically at 60. The engine 60 has a water-jacket 62, radiator or cooler 63, conduit 64 leading from the top of the water-jacket 62 to the top of the radiator 63, and conduit 65 leading from the bottom of the radiator to the bottom of the water-jacket. A pump 68 or other suitable means forces the water from the bottom of the radiator 63 to the inlet at the bottom of the water-jacket 62 through which it flows to the outlet at the top of the water-jacket, whence it goes to the top of the radiator and flows through the radiator structure to the bottom, as well known in the art. The cooling system may be of the usual form, or of any other suitable or preferred form.

The conduit 64 has an enlargement 70, and the control device, designated in its entirety at 72 and shown in detail in illustrative form in Figure 4, is mounted between the inner end of this enlargement and the engine wall, or otherwise as desired. The Curie point member 32', which corresponds with the Curie point member shown in the preceding embodiment of the invention, is disposed within the top of the cooling system and in contact with the water therein. The stem 35' which is fixed to the center of the Curie point member 32', as before, carries at its opposite end a valve 74 which, as long as the Curie point member 32' is in attracted position against the permanent magnet 30', is seated upon the cooperating valve seat 75 to close, or substantially close, the passage through the conduit 64 to the radiator 63.

The member 32', as before, by reason of the material of which it is composed, is ordinarily magnetic but becomes substantially non-magnetic, or at least incapable of being held in attracted position by the permanent magnet 30' when heated to a sufficiently high temperature. In this embodiment of the invention, the critical temperature at which the member 32' is released from the permanent magnet 30' is the tempera-

ture at which it is desired to open the passage through the conduit 64 to the radiator 63 for circulation of the water through the radiator or cooler.

If the temperature to which the Curie point member 32' is subjected, i. e. the temperature of the water in the cooling system, reaches the critical temperature of the Curie point member 32', this member instantly becomes non-magnetic or of insufficient magnetic strength to be held in attracted position against the permanent magnet 30'. As a result, the member 32' is released, and the spring 56', which corresponds with the spring 56 of the preceding embodiment of the invention, moves the valve member 74 to open position, permitting the water to circulate through the conduit 64 to the radiator, and from the radiator through the conduit 65 back to the water jacket 62. Upon movement of the valve 74 to open position, the Curie point member 32' is moved to retracted position as shown in Figure 4.

If the temperature of the water drops below the critical temperature of the Curie point member 32', this member becomes magnetic and is actuated to attracted position by the permanent magnet 30', thereby closing, or substantially closing, the valve 74 to shut off, or substantially shut off, the flow of water through the radiator 63 until the temperature of the water again reaches the critical temperature of the Curie point member.

Likewise in the preceding embodiment of the invention, if the temperature of the water in the tank 6, after reaching the critical temperature of the Curie point member 32 so that this member is actuated to retracted position to shut off the supply of fuel to the burner 9, drops below the critical temperature of the Curie point member, this member is actuated to attracted position by the permanent magnet 30, thereby again closing the circuit for the solenoid or motor valve 14 to set up the desired supply of fuel to the burner 9.

The particular manner of circulating the water through the passages 80 to the valve opening controlled by the valve 74 and through this valve opening so as to pass through the conduit 64 to the radiator may vary widely within the scope of the present invention. The particular showing is merely illustrative and the appended claims are to be considered accordingly. As in the preceding embodiment of the invention, the diaphragm 26' which carries the Curie point member 32' may be of any suitable flexible material. It may be of spring metal to hold the Curie point member 32' in retracted position as long as the temperature of the water is as high as the critical temperature of the Curie point member and to actuate this member to retracted position and the valve 74 to open position, in which case the spring at 56' may be omitted.

I do not intend to be limited to the precise details shown or described. For example, within the broader aspects of the invention the flexible diaphragm for supporting the Curie point member may be omitted and the Curie point member may be supported in any other suitable or preferred manner.

I claim:

1. In a device of the class described, a permanent magnet supported in fixed position, a Curie point member adapted to be held attracted to said magnet when the temperature to which

said Curie point member is subjected is below its critical temperature and released for movement to retracted position at the critical temperature of said Curie point member, control means actuated by the movement of said Curie point member, a flexible diaphragm supporting said Curie point member in proximity to said permanent magnet, said Curie point member being attached to said diaphragm to have support on the diaphragm in the attracted and retracted positions of the Curie point member, and a support for said diaphragm, said support constituting with the diaphragm an enclosure for said magnet on one side of the diaphragm, the Curie point member being exposed to and under the control of the temperature of a substance on the opposite side of the diaphragm.

2. In combination, a tank for water, a burner therefor, a pipe leading to said burner, an electric valve in said pipe, a permanent magnet supported in fixed position, a Curie point member supported for movement within the tank and exposed to the temperature of the water in said tank and adapted to be held attracted to said magnet when the temperature of the water in said tank is below the critical temperature of said Curie point member and released for movement to retracted position at the critical temperature of said Curie point member, and a switch connected in circuit with said electric valve and held closed by said Curie point member as long as said member is in attracted position and released for movement to open position upon movement of said Curie point member to retracted position.

3. In a device of the class described, a body member having a marginal wall defining a control chamber closed on one side by a second wall integral with said body member, a permanent magnet fixed to said second wall, a flexible diaphragm fixed to said body member, a Curie point member carried by said diaphragm in proximity to said permanent magnet and having a stem extending slidably into said control chamber, said control chamber being disposed on one side of said diaphragm, and control means in said chamber actuated by said Curie point member, said Curie point member being fixed at all times to said diaphragm and exposed through the diaphragm to the temperature of a substance on the side of the diaphragm opposite said control chamber.

4. In a device of the class described, a body member having a marginal wall defining a control chamber closed on one side by a second wall integral with said body member, an insulating member closing the opposite side of said chamber, terminal members carried by said insulating member, a permanent magnet fixed to said second wall, a flexible diaphragm fixed to said body member, a Curie point member carried by said diaphragm in proximity to said permanent magnet and having a stem extending slidably into said control chamber, and a contact member disposed in said control chamber and adapted for actuation by said Curie point member and for connecting and disconnecting said terminals.

5. In combination, an internal combustion engine having a cooling system comprising a water-jacket and a radiator, with connections between said water-jacket and said radiator, a Curie point member supported for movement within the cooling system and immersed in the liquid in said cooling system, the temperature of said Curie point member being controlled by and corre-

sponding to the temperature of the liquid in said water jacket, and means controlled by said Curie point member for controlling the circulation of the liquid through the radiator responsive to the temperature of the liquid and independently of the pressure in said cooling system.

6. In combination, an internal combustion engine having a cooling system comprising a water-jacket and a radiator, with connections between said water-jacket and said radiator, a valve seat in said cooling system, a permanent magnet supported in fixed position, a Curie point member disposed within said cooling system in contact with the liquid therein, the temperature of said Curie point member being controlled by the temperature of the liquid and said Curie point member being held attracted to said magnet when the temperature of the liquid is below the critical temperature of the Curie point member and released for movement to retracted position at the critical temperature of said Curie point member, and a valve connected to said Curie point member and held closed against said seat substantially to shut off circulation of the liquid through said radiator when the Curie point member is in attracted position and actuated to open position to permit circulation of the liquid through the radiator upon movement of the Curie point member to retracted position.

7. In combination, an internal combustion engine having a cooling system comprising a water-jacket and a radiator, with connections between said water-jacket and said radiator, a valve seat in said cooling system, a permanent magnet supported in fixed position, a Curie point member disposed within said cooling system in contact with the liquid therein, the temperature of said Curie point member being controlled by the temperature of the liquid and said Curie point member being held attracted to said magnet when the temperature of the liquid is below the critical temperature of the Curie point member and released for movement to retracted position at the critical temperature of said Curie point member, a valve connected to said Curie point member and held closed against said seat substantially to shut off

circulation of the liquid through said radiator when the Curie point member is in attracted position and actuated to open position to permit circulation of the liquid through the radiator upon movement of the Curie point member to retracted position, and a flexible diaphragm supporting said Curie point member in proximity to said permanent magnet.

8. In a device of the class described, magnet means supported in relatively fixed position, a Curie point member adapted to be held attracted to said magnet means when the temperature to which said Curie point member is subject is below its critical temperature and released for movement to retracted position at the critical temperature of said Curie point member, control means under the control of said Curie point member, and means supporting said Curie point member for movement in proximity to said magnet means and constituting an enclosure for said magnet means, the magnet means being disposed within said enclosure and the Curie point member being exposed through a wall of said enclosure to the temperature of a substance outside said enclosure.

9. In a device of the class described, a magnet supported in relatively fixed position, a stem extending slidably through said magnet, a switch at one end of said stem, an electric circuit controlled by said switch, a body of fluid the temperature of which is to be controlled, means controlled by said switch for heating said body of fluid, and a Curie point member on the opposite end of said stem exposed to and having its temperature controlled by the temperature of said fluid and held attracted to said magnet when the temperature to which said Curie point member is subjected is below its critical temperature and released for movement to retracted position at the critical temperature of said Curie point member, said stem holding said switch in closed position when said Curie point member is in attracted position and releasing said switch for movement to open position upon movement of said Curie point member to retracted position.

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