March 14, 1939. G. K. EGGLESTON 2,150,858

CONTROL DEVICE

Filed May 3, 1937

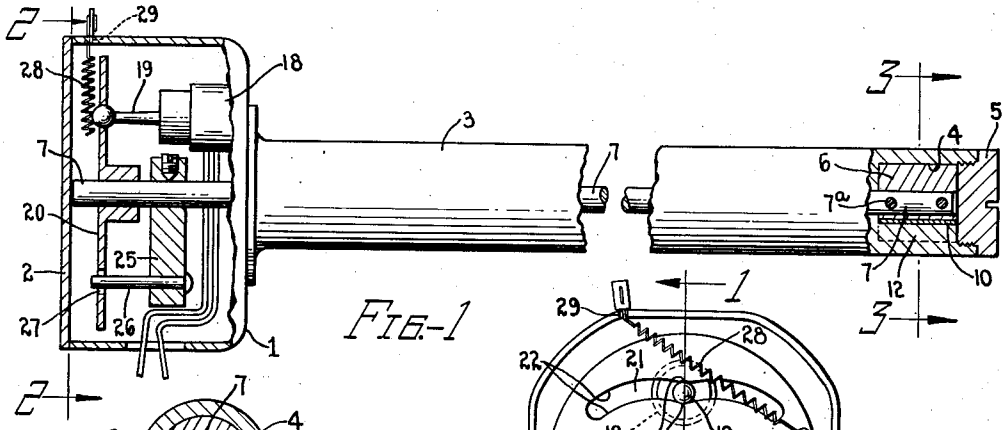


FIG.-1

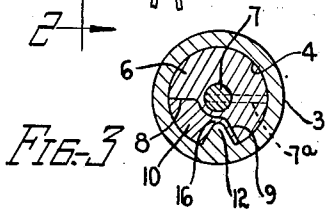


FIG.-3

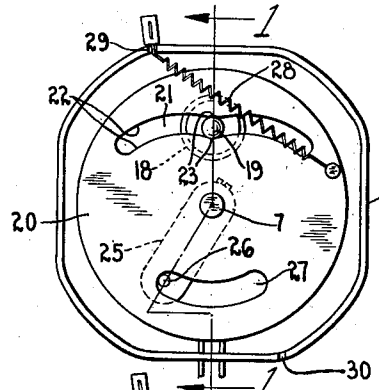


FIG.-2

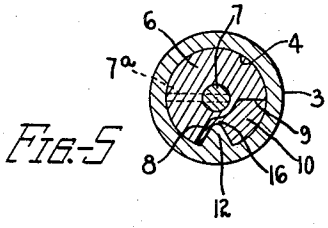


FIG.-5

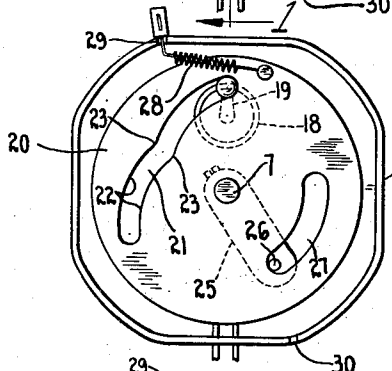


FIG.-4

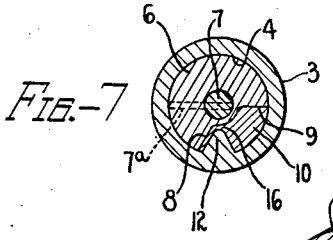


FIG.-7

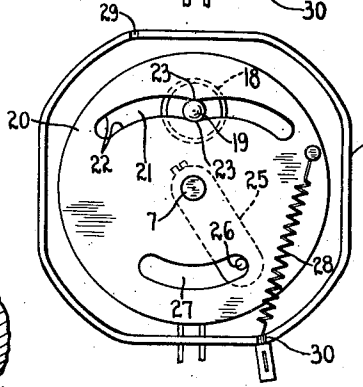


FIG.-6

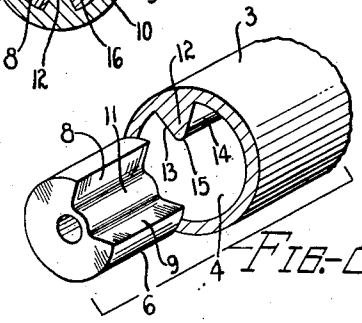


FIG.-8

INVENTOR
Gilbert K. Eggleston
BY
Andrew K. Foulds
his ATTORNEY

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UNITED STATES PATENT OFFICE

2,150,858

CONTROL DEVICE

Gilbert K. Eggleston, Detroit, Mich., assignor to Detroit Lubricator Company, Detroit, Mich., a corporation of Michigan

Application May 3, 1937, Serial No. 140,431

9 Claims. (Cl. 74—2)

My invention relates generally to controls and more particularly to temperature responsive controls.

One of the objects of my invention is to provide a new and improved temperature responsive control of the type employing fusible material for releasably holding an actuator against operation at temperatures below a predetermined temperature.

Another object of my invention is to provide a new and improved control of the above mentioned character which may be reset without the necessity of replacing the fusible material.

Another object of my invention is to provide a new and improved control having provisions for displacing the fusible material on predetermined liquidity thereof to permit actuation of a control.

The invention consists in the improved construction and combination of parts, to be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawing, to be taken as a part of this specification, I have fully and clearly illustrated my invention, in which drawing—

Figure 1 is a side view shown partly in elevation and partly in section of a control device embodying my invention;

Fig. 2 is an end view of the control device taken in the direction of the arrows 2—2 of Fig. 1 showing the relative positions of certain of the parts of the device when the device is set for operation;

Fig. 3 is a view shown in cross section taken along the line 3—3 of Fig. 1 of certain other parts of the device showing the relative positions thereof and which positions correspond to the positions of the parts shown in Fig. 2;

Figs. 4 and 5 are views similar to the views of Figs. 2 and 3, respectively, showing the positions that the parts of the device will assume after operation of the device;

Figs. 6 and 7 are views similar to the views of Figs. 4 and 5, respectively, showing the device reset and the relative positions that the parts will assume, and

Fig. 8 is a view of certain of the parts of the device in perspective to show the structural details thereof.

Referring to the drawing by characters of reference, the device shown includes a supporting member 1, preferably a hollow casing, one wall of which may be formed by a movable closure member or cover 2. Supported by the casing 1, externally thereof, there may be a tubular extension member or casing 3 that may be rigidly secured at one of its ends to the casing 1, the extension tube preferably being secured to and projecting from the casing wall that is opposite the cover 2. Adjacent its free or outer end the extension member 3 is preferably provided with a chamber 4 that may be closed by a closure plug 5 that may screw thread into the outer end of the extension member 3. The chamber 4 is preferably cylindrical, or in the form of a bore, having its axis extending longitudinally of the extension member 3, and disposed in the cylindrical chamber 4 there is a movable fluid displacement member, preferably in the form of a rotor 6. The rotor 6 preferably has an aperture longitudinally therethrough for receiving an end portion of a shaft 7 that rotates with the rotor 6 and extends therefrom longitudinally through the extension member 3 and projects into the casing 1. The rotor 6 and the shaft 7 may be secured together by pins 7^a, or these parts may be secured together in any other suitable manner.

The rotor 6 has a rotatable sliding fit with its cylindrical chamber 4 but does not completely fill the chamber, the rotor 6 having a recess or cut-out that is preferably defined by angularly or radially disposed wall surfaces 8, 9 that extend longitudinally and preferably coextensive of the rotor 6. In the present instance, the angularly disposed wall surfaces 8, 9 are spaced slightly more than 90° apart, but it will be understood that the angle between these wall surfaces may be selected as desired. The wall surfaces 8, 9 cooperate with the inner wall surface of the extension member 3 to provide an enclosed space or well for fusible material 10 which may be solder, or any other suitable material. Partly surrounding the shaft 7 the rotor 6 has a wall portion 11 that joins the wall surfaces 8, 9, and this wall portion 11 is preferably rounded, as shown. The fusible material 10 is adapted to hold the rotor 6 against rotation in its chamber 4 at temperatures of the fusible material below a predetermined temperature, or at temperatures below the temperature at which the material will liquify and flow. Projecting into the well there is a dam 12 over which the fusible material 10 flows when the fusible material becomes sufficiently liquified to permit rotation of the rotor which, as will later be seen, is biased to rotate. The dam 12 may be an integral, extended wall portion of the side wall of the extension tube 3 and it preferably projects radially therefrom toward the axis of the rotor 6. The dam 12 preferably has side wall surfaces 13 and 14 extending longitudinally of and co-

extensive with the well, and these wall surfaces are preferably angularly disposed and converge inwardly from the side wall of the extension tube 3 toward the axis of the rotor 6. The dam 12 has an overflow portion 15 which is preferably rounded to reduce resistance to flow thereover, and this overflow portion 15 is spaced from the wall portion 11 to provide a flow restricting passage or space 16 for flow of the fusible material from one side of the dam to the other side thereof. The fusible material 10, when serving to prevent rotation of the rotor 6, need not adhere to the inner wall surface of the extension tube 3 for when the fusible material is in a solid state, or substantially so, the dam 12 will prevent it from moving. When the fusible material 10 becomes liquified, the rotor 6 rotates and pushes the fusible material over the dam 12 to the other side thereof where the rotor recess forms the well to receive the fusible material. It will thus be seen that the chamber 4 has relatively movable walls and has a flow restricting passage for flow of the fusible material on predetermined degrees of liquidity thereof.

Mounted within the casing 1 there is a control, designated in general by the numeral 18, which may be a switch having an operating arm or lever 19. Within the casing 1 and freely mounted on the shaft 7 there is a lever member 20, preferably in the form of a wheel or plate-like disc. The plate 20 preferably has a cam, and to this end the plate may be provided off center with a slotted aperture 21 therethrough providing spaced, opposed, parallel cam surfaces 22 defining the slotted aperture. The slot 21 is preferably formed so that its ends, which may be rounded as shown, are equidistant from the axis of rotation of the plate 20 and so that they are spaced further from said axis than cam surface portions or points 23 midway between the ends of the slot 21. An end portion of the switch arm 19 positions and travels in the slotted aperture 21 in sliding engagement with the cam surface 22, and the cam and switch arm 19 may be arranged so that when the plate 20 is in a position such that the switch arm is midway between the ends of the slot 21, as shown in Figs. 2 and 6, the switch 18 will be in closed position. When the plate 20 is rotated in either direction the cam will pivot switch arm 19 upward to open the switch 18.

Rigidly secured on the shaft 7 within the casing 1 there is preferably an arm 25 that extends laterally from the shaft. Carried by the arm 25 and rigidly secured thereto, adjacent its outer end, there is a pin 26 that projects into an elongated, slotted aperture 27 in the plate 20. A helical coil spring 28 is provided and acts to rotate the lever or plate 20, and in so doing acts to rotate the shaft 7. The spring 28 may be under tension having one end attached to the plate 20 adjacent the outer periphery thereof and having its other end attached to the casing 1. A pair of opposite side walls of the casing 1 may be provided with recesses 29, 30, one in each wall, and in one or the other of these recesses, depending upon the positions of the parts of the device, the anchored end of the spring 28 is held against movement. When the anchored end of the spring 28 is held in the recess 29, the spring holds the plate 20 at one end of its recess 27, against pin 26 of the arm 25, and acts to rotate the plate 20 in a counterclockwise direction, as seen in Fig. 2. When the anchored end of spring 28 is held against movement in the recess 30, the spring will hold the plate 20 at the other end of its recess 27 in engagement with the pin 26 of arm 25, and will act to rotate plate 20 in a clockwise direction, as seen in Fig. 6.

The operation of the herein described device is as follows: The device may be employed, among other uses, for controlling the circuit of a heating apparatus control (not shown) to decrease or stop heat input to a boiler (not shown) when the temperature of the boiler becomes dangerously high. When the device is employed for the above mentioned purpose the extension tube 3 is preferably inserted into the boiler with the fusible material 10 in good heat transfer relation therewith. Assume now that the parts of my device are in the positions shown in Figs. 2 and 3 and that the fusible material 10 is in a solid state holding the rotor 6 against rotation by the spring 28. If the temperature of the fusible material 10 reaches a predetermined, high temperature the fusible material will liquify which will permit the spring 28, acting through the plate 20, arm 25 and shaft 7, to rotate the rotor 6 in a counterclockwise direction, as seen in Fig. 2. As the rotor 6 is rotated by the spring 28, the liquid fusible material 10 is displaced by the rotor 6 and is pushed ahead of the wall 8 thereof and forced to flow over the dam overflow 15 until substantially all of the fusible material is on the other side of the dam. The spring 28, through rotation of the rotor 6, forces the fusible material 10 from one side of the dam 12, through the flow restricting passage or outlet 16 to the other side thereof, on predetermined liquidity of the fusible material, and the rotor 6 forms the well on the said other side of the dam for receiving the fusible material. Also, as the plate 20 is rotated in a counterclockwise direction as seen in Fig. 2, its cam pivots the switch arm 19 to closed circuit position. In the present instance, the switch arm 19 when moved to open position serves as a stop to limit rotation of the rotor 6, but it will be appreciated that other means may be provided to limit rotation of the rotor 6. Preferably the rotor 6 is stopped at a position such that there will be some fusible material left between the rotor wall 8 and the dam wall 13, as shown in Figs. 5 and 7. The parts of the device now assume the positions shown in Figs. 4 and 5. After a short time the fusible material 10 will harden in the position shown in Fig. 5, and will thus prevent movement of the rotor 6 in a clockwise direction. By reason of the slot 27 in the plate 20, and the pin 26 of arm 25 operating in the slot 27, it will be seen that a lost motion connection is provided which permits rotation of plate 20 to close switch 18 after the fusible material has hardened. To reset the device the anchored end of spring 28 is detached and anchored to the casing 1 in the recess 30, which causes the plate 20 to be rotated in a clockwise direction, to the position shown in Fig. 6, which moves the switch arm 19 downward to its closed circuit position. When the fusible material 10 again fuses, the spring 28 will rotate the plate 20 in a clockwise direction, as seen in Fig. 6, and move the switch arm 19 to closed position. As this is occurring the fusible material is forced back over the dam overflow 15 to the position shown in Fig. 3, and after the fusible material has hardened, the device can again be set by anchoring the outer or readily detachable end of the spring 28 in the recess 29 of casing 1.

It will now be seen that I have provided a new and improved temperature responsive control having a fuse, and one which can be readily reset without the necessity of replacing the fuse. It will also be seen that by reason of the dam in my device, the fusible material will not need to adhere to the wall of its well to prevent operation of the device, for the dam will prevent movement of the fusible material until such time as the fusible material becomes sufficiently liquefied to flow over the dam.

What I claim and desire to secure by Letters Patent of the United States is:

1. In a control device, a body member having a recess with spaced end walls, a second body member closing an open side of said recess and having a wall member rigid therewith and extending into said recess in spaced opposing and overlapping relation to one of said end walls, fusible material confined in and substantially filling said recess, operating means to move one of said body members relative to the other of said body members so that the space between said wall member and said one end wall will be decreased, said fusible material when solid blocking movement of said wall member and opposing operation of said means, and means for flow of said fusible material out of blocking position and from and to the opposite sides of said wall member.

2. In a control device, a body member having a recess with spaced end walls, a second body member closing an open side of said recess and having a wall member rigid therewith and extending into said recess in spaced opposing and overlapping relation to one of said end walls, fusible material confined in and substantially filling said recess, adjustable operating means to reciprocate one of said body members relative to the other of said body members so that the space between said wall member and said one end wall will be decreased and increased alternately, said fusible material when solid blocking movement of said wall member and opposing operation of said means, and means for flow of said fusible material out of blocking position and from and to the opposite sides of said wall member, and means to adjust said operating means to reverse the effective direction of force thereof on said one body member.

3. In a control device, a pair of relatively rotatable body members, said members being generally cylindrical and fitted one within the other, one of said members having a longitudinal recess providing opposed walls, the other of said members having a wall member extending into said recess in opposed relation to said walls, fusible material in and substantially filling said recess, means confining said material in said recess, means for flow of said material from and to opposite sides of said wall member, and means operable upon melting of said material to rotate one of said body members relative to other of said body members.

4. In a resettable control device, a pair of body members, one of said members having a recess, the other of said members closing said recess and having a wall projecting into said recess, said wall having a peripheral portion spaced from a portion of the recess wall to provide a passageway, fusible material filling said recess and transferable through said passageway upon fusion by movement of one of said members relative to the other of said members, a spring having one end anchored to the movable one of said members and having its other end shiftable to change the direction of force of the spring on said movable member, and control means operable upon movement of the movable one of said members, said spring acting upon fusion of said material to move the movable one of said members as the fused material is forced by the spring through said passageway.

5. In a control device, a housing member having a cylindrical chamber, means closing the ends of said chamber, a body member substantially of equal length with and rotatable in said chamber and having a curved surface fitting the curved chamber wall, said body member having a longitudinal recess, a wall member projecting from said housing member into said recess, said wall member and said recess having substantially equal radial cross-sectional areas, means to rotate said body member, and fusible material in said recess, said material when solid opposing movement of said body member, said wall member having an edge portion spaced from the wall of said recess for flow of said fusible material from and to opposite sides of said wall member.

6. In a control device, supporting means, a reciprocally rotatable shaft carried by said means, an arm fixed on said shaft, a plate member journaled on said shaft and having a slot, a projection on said arm cooperable with the end walls of said slot to hold said plate member against rotation, said plate member having a cam slot of substantially twice the length of said first-named slot, said cam slot having duplicate operating portions extending oppositely from its midpoint, a coil spring having one end anchored to said plate member and having its opposite end movable to position the spring on opposite sides of the center of said plate member, a control means, an operating member for said control means and having a cam follower member extending into said cam slot, a casing having a chamber receiving a portion of said shaft, and fusible material confined in said chamber and holding said shaft against rotation.

7. In a control device, a movable control means having an initial position, operating means having an initial position and acting upon movement therefrom in different directions to move said control means from its said initial position, said operating means acting upon return movement to its initial position to move said control means to its initial position, a spring having one end anchored to said operating means and having its other end shiftable, said spring acting when its other end is in one position to move said operating means in one direction and acting when its other end is in another position to move said operating means in another direction, a releasable member having two positions and acting in each of said two positions to oppose movement of said operating means beyond its initial position by said spring, and fusible material operable to hold said releasable member alternately in each of its said two positions, said releasable member being alternately movable from and to its said two positions by said spring upon fusion of said fusible material.

8. In a control device, a movable control means, drive mechanism movable in opposite directions, said mechanism having means operable on movement of said mechanism in one direction to move said control means in one direction and having means operable on movement of said

mechanism in the opposite direction to move said control means in said one control means direction, shiftable means for urging said mechanism in said one mechanism direction or said opposite direction, and automatically releasable means opposing said shiftable means and holding said drive mechanism against movement.

9. In a control device, a control means having operative action upon movement in one direction, a reciprocally movable means, a cam follower member, a cam member having cam surfaces engageable with said follower member and operable to move said follower member in a single direction upon opposite directions of movement of said cam member, one of said members being carried by one of said means and the other of said members being carried by the other of said means, shiftable means operable in one position to urge said movable means in one direction and operable in another position to urge said movable means in the opposite direction, and automatically releasable means operable to oppose movement of said movable means.

GILBERT K. EGGLESTON.