No. 856,328. PATENTED JUNE 11, 1907.

E. F. WOODMAN.

THERMOSTATIC APPARATUS.

APPLICATION FILED NOV. 17, 1906.

Fig. 1.

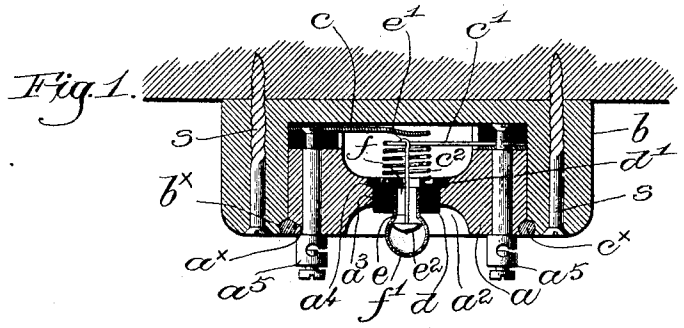


Fig. 2.

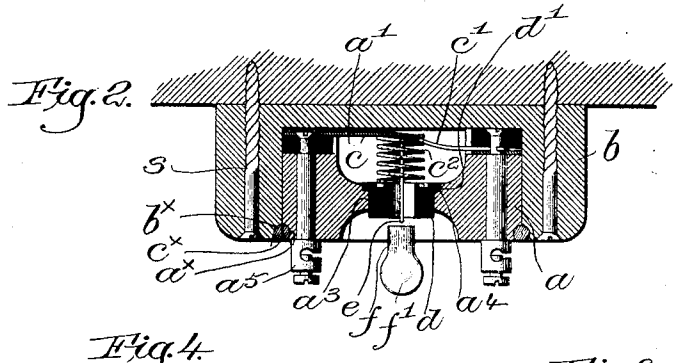


Fig. 3.

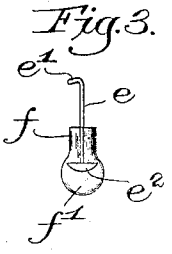


Fig. 4.

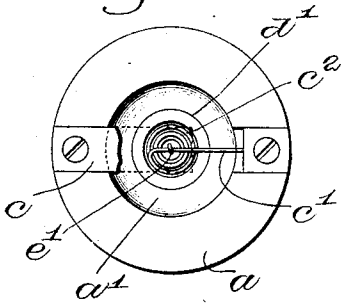


Fig. 6.

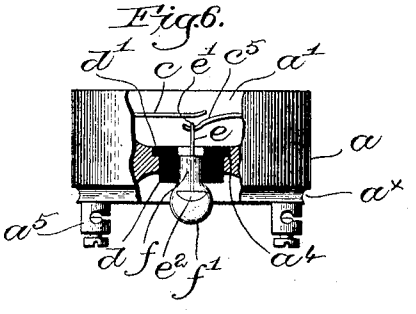


Fig. 5.

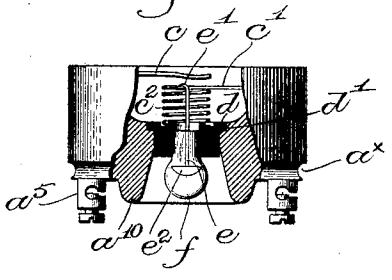
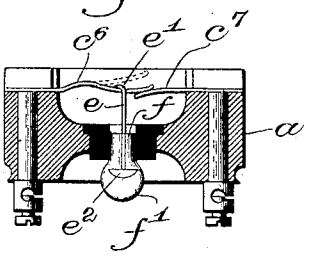


Fig. 7.



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UNITED STATES PATENT OFFICE.

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THERMOSTATIC APPARATUS.

No. 856,328. Specification of Letters Patent. Patented June 11, 1907.

Application filed November 17, 1906. Serial No. 343,871.

To all whom it may concern:

Be it known that I, EDWARD F. WOODMAN, a subject of the King of Great Britain, and a resident of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Thermostatic Apparatus, of which the following description, in connection with the accompanying drawing, is a specification, like letters on the drawing representing like parts.

This invention has for its object the production of a simple, efficient and very sensitive thermostatic circuit-controlling apparatus whereby the condition of an electric circuit is changed automatically by or through the distintegration or fusion of a fusible member or part of a controlling device when the temperature in the vicinity of the apparatus has risen to a predetermined point.

Apparatus of this character should be so constructed that the operation thereof will be effected in the shortest possible time and at a relatively low temperature, in order that there may be no delay in giving the indication of abnormal temperature conditions in the vicinity of the apparatus.

Various forms of thermostatic apparatus have been devised wherein a joint or connection is made by fusible material used as a solder to connect two pieces of metal, the separation of such pieces when the solder fuses effecting the operation of the apparatus, but in such apparatus the temperature required to fuse the joint or connection is frequently higher than the fusion-point of the solder itself.

My present invention belongs to the type of thermostatic apparatus wherein a fusible material is employed, as distinguished from thermostatic apparatus wherein a more or less volatile liquid is used as the element to be acted upon by a rise in temperature.

In the present embodiment of my invention the controller for the circuit-changing means includes a member of fusible material, which is loosely engaged and enveloped by a vitreous casing exposed to temperature changes in the vicinity of the apparatus, the casing serving to normally maintain the said fusible member in such position that the circuit-changing means is retained inactive.

When the fusible member disintegrates or fuses the controller is rendered inoperative and the circuit-changing means acts to effect an immediate change in the condition of the circuit in which said means is included.

The construction herein illustrated and described is such that the apparatus is very quick in its response to a rise in temperature to the predetermined point, and with very little variation as to the fusing point, using fusible material having a given fusion-point.

The various novel features of my invention will be fully described in the subjoined specification and particularly pointed out in the following claims.

Figure 1 is a diametral sectional view of a thermostatic circuit-controlling apparatus embodying one form of my invention, the parts being shown in normal condition; Fig. 2 is a similar view but showing the parts just after fusion or disintegration of the fusible member of the controller; Fig. 3 is a separate view in elevation of the controller and the inclosing vitreous casing therefor; Fig. 4 is a plan view of the base, showing the chamber therein, the circuit-changing means, and a portion of the controller, one member of the circuit-changing means being broken off; Fig. 5 is a side elevation and partial section of a modified form of base embodying my invention; Fig. 6 is a similar view of the base illustrated in Figs. 1 and 2, and showing a modification to be described; Fig. 7 is a diametral sectional view of the base and the parts carried thereby, showing my invention applied to a normally-closed circuit.

Referring to Figs. 1, 2, 4 and 6, I have shown the base a as a circular block of suitable insulating material, such as porcelain, having a chamber a' and an opposite concavity a^2 in the outer face of the base, an aperture a^3 opening into the chamber and forming an annular seat a^4.

The base a fits snugly into a circularly recessed holding-plate b, also of insulating material, and provided with suitable holes to receive screws s or other fastening devices by means of which the apparatus is secured to the ceiling or other portion of a room.

An internal annular groove $b^\times$ is formed in the wall of the plate b, to register with a similar external groove $a^\times$ on the periphery of the base a when the latter is in position, the opposed grooves forming less than a complete circle in cross-section. This groove is filled in with plaster, cement, or other suitable plastic material, as at $c^\times$, to form a tight joint or seal between the base and its holding plate, and also serving to hold the base in place without other fastening means.

The base is provided with suitable bind-

ing-posts a^5 for connection with the line-wires of the electric circuit (not shown) in which the circuit-changing means is to be included, the posts being electrically connected in usual manner with terminals within the chamber a'. Such terminals form a part of a circuit-changer or circuit-changing means, such term being used to designate a device or devices whereby the condition of the electric circuit can be changed, as for instance from an open to a closed circuit, or vice versa. Herein one of the terminals, as c, is formed as a strip of metal extended from the periphery of the base a inward toward the center of the chamber a', see Figs. 1, 2, 4 and 6. The other terminal c' is herein shown as a piece of elastic or spring wire securely held at one end on the base, and at its other end bent or coiled to form a depending spiral coil or spring c^2, located beneath the free end of the terminal c, Figs. 1, 2, 4 and 5. The coil is so wound as to normally expand when free to do so, and its end is adapted to rest upon a bushing d of vulcanite or other heat-insulating material, which I prefer to use, such bushing being inserted in the aperture a^3 of the base and having a flange d' to rest upon the seat a^4. When the coil is free its expansion causes the inner end of the terminal c' to engage the terminal c, to thereby close the circuit, as shown in Fig. 2, whereas, when the spring is compressed, as in Figs. 1 and 5, the terminals are separated and the circuit opened.

I have devised a novel and very efficient controller for the circuit-changer, the controller being shown herein as a shank e of stiff wire, slightly hooked at one end at e' and at its other end having an attached enlargement or button e^2 of fusible material commonly used in thermostatic apparatus.

The hooked end e' is, in use, caught over the free end of the terminal c', Figs. 1 and 4, and also Fig. 5, the shank e passing through the coil c^2 and being long enough to extend through the bushing d, with the enlargement or button e^2 outside of the base. This fusible member e^2 is loosely inclosed in a preferably glass casing, shown separately in Fig. 3, and of bulb-like form, having a substantially cylindrical neck f and a globular portion f'', the latter forming a shoulder adjacent the neck, to loosely engage the member e^2 when abutted against it and hold said member in proper position.

In order to assemble the parts shown in Fig. 3 I insert in the casing a sufficient quantity of the fusible material, and by means of a flame applied to the bulb 1 soften the material sufficiently to cause it to form a button, into which the end of the shank e is thrust, and then the button is allowed to cool and harden, a firm and rigid connection being secured between the button and the shank.

When solidified the button e^2 does not stick or adhere to the bulb, but is absolutely loose therein and unconnected therewith, but as it is of greater diameter than the neck f said button cannot be withdrawn.

It will be understood that in Fig. 3 I have shown the button as abutted against the shoulder of the bulb, as is the case when the parts are in working position.

To apply the controller to the apparatus the base a is removed from the holding-plate b, and the neck f of the bulb is slipped through the bushing d, and the spiral spring c^2 is compressed until the hook e' of the shank can be caught over the part of the terminal at the adjacent end of the spiral. Thereafter the expansive action of the spring acts to draw the button e^2 against the shoulder of the globular part f'' of the bulb, and in turn the said portion f'' is drawn against the bushing d, seating thereon and closing the opening into the chamber of the base a.

The shank e is of such length that when in the assembled condition described, see Fig. 1, the terminals c and c' are held apart, so that the circuit is open. The base is then placed in the plate b and secured in position, as has been described, and the apparatus is ready for use when the line-wires of the circuit are connected with the binding-posts a^5.

The bulb is made of thin glass, and can be easily and quickly produced at a practically nominal cost.

Supposing the apparatus to be in the condition shown in Fig. 1, a rise in temperature adjacent thereto will, when a predetermined point is attained, disintegrate or fuse the member e^2, immediately loosening the shank e and the spring coil c^2 expands and closes the circuit through the terminals.

Inasmuch as the fusible member of the controller is wholly outside the base, and out of contact therewith, it is by its location sensitive to an abnormal rise in the temperature around the apparatus, and the sensitiveness and rapidity of action appear to be greatly enhanced by the inclosing casing. While the latter is of glass, and thus is a poor conductor of heat, I believe that the radiating action of the glass serves to concentrate and focus the heat upon the button e^2, insuring rapid action and great sensitiveness.

The bushing d is preferably used as it insulates the bulb from the base, and thereby prevents any tendency for the heat of the bulb to be conveyed to the base, which, owing to its material, heats very slowly, even for a very considerable and rapid rise in the temperature of the air about it.

When the member or button e^2 fuses it drops into the bottom of the bulb, and the latter will ordinarily drop from the base, as the neck of the bulb fits loosely into the bushing d.

In Fig. 5 I have shown the face of the base

shaped to form an annular species of guard a^{10} which surrounds the globular portion of the bulb, but at a sufficient distance therefrom to allow free access of the heated air to the bulb. This guard tends to protect the bulb from an accidental blow which might break the bulb. Otherwise the construction of the apparatus is the same as that previously described.

In Fig. 6 I have omitted the coiled spring on one of the terminals, such terminal c^5 having in itself sufficient elasticity or spring action to hold the button and bulb in proper working position, the hook e' of the shank engaging the free end of the terminal.

By a slight change in the terminals my invention is readily adapted to be used with a normally closed circuit, as shown in Fig. 7. The spring-acting terminal c^6 is above the other terminal c^7, the latter being preferably made as a plate or strip of metal, while terminal c^6 is a spring wire. The hook e' of the shank e is hooked over the terminal c^6 near its free end, to hold it in contact with terminal c^7 under normal conditions. When the button e^2 is fused the terminal c^6 is released and springs up into dotted line position, Fig. 7, opening the circuit.

It will be obvious that the circuit-changing means can be made in various forms, for either a normally closed or a normally open circuit, but in all cases the controller is substantially the same, and includes a fusible member unconnected with but loosely engaged by and held normally in position by a glass casing to maintain the circuit-changing means inactive until a predetermined rise in temperature occurs.

The casing which incloses the fusible member of the apparatus acts also as a protective covering to prevent the access of acid or other fumes to the fusible material, a feature of great value in all cases where such controlling apparatus has to be installed in places where such fumes are liable to occur.

It has been found in actual practice that these fumes act in such a manner upon fusible material of the class used in thermostatic controllers that the material will crumble and thus disintegrate becoming perfectly useless and requiring frequent renewal.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a thermostatic circuit-controlling device, a circuit-changer, a controller therefor including a member of fusible material operatively connected with the circuit-changer, an apertured base of insulating material on which the latter is mounted, and a casing having a tubular reduced portion inserted in the aperture of the base, the casing having a shouldered portion against the interior of which the fusible member loosely abuts under normal conditions, to be held thereby in position to maintain the circuit-changer inactive, said fusible member in turn acting to maintain the casing in position on and external to the base.

2. In a thermostatic circuit-controlling device, a chambered base of insulating material provided with an aperture, a circuit-changer within the chamber and adapted to be included in an electric circuit, a controller for and operatively connected with said circuit-changer and including a member of fusible material external to the base, and a bulb-like glass casing having a neck to enter the aperture in the base, the fusible member of the controller being inclosed within the bulb and held thereby in position to prevent, through its connection with the circuit-changer, any operation of the latter until fusion of said member.

3. In a thermostatic circuit-controlling device, circuit-changing means adapted to be included in an electric circuit, a controller therefor comprising a button-like member of fusible material, and a connected shank to co-operate with said means, and an exposed glass casing for and having a contracted portion loosely engaged by said member to maintain it in position to maintain the circuit-changing means inactive until the shank and fusible member are separated by fusion of the latter, said fusible member acting to retain the casing in position until the said member and shank are separated.

4. A thermostatic circuit-controlling device comprising circuit-changing means adapted to be included in an electric circuit, a controller therefor comprising a button of fusible material and an attached shank operatively connected with said means, an apertured support on which the circuit-changing means is mounted, and an exposed globular casing in which the button is inclosed and loosely engaged and held in position under tensile strain to act through the shank and maintain the circuit-changing means inactive until fusion of the button, said casing having a tubular neck inserted in the support and held therein by engagement of the button with the interior of the casing.

5. In a thermostatic circuit-controlling device, a circuit-changer adapted to be included in an electric circuit, a controller therefor having at its outer end a fusible enlargement, a support for and on which the circuit-changer is mounted, and a thin-walled, exposed globular casing of vitreous material loosely engaging and inclosing said enlargement and normally maintaining it in position to retain the circuit-changer inactive, the controller acting reciprocally upon the casing to normally maintain it in position upon the support for the circuit-changer.

6. A thermostatic controlling device, comprising a chambered base provided with an aperture, an insulating bushing in the aper-

ture, a spring-actuated circuit-changer within the chamber and adapted to be included in an electric circuit, a controller for said circuit-changer, comprising a shank operatively connected therewith and having a fusible enlargement at its outer end, the shank passing loosely through the bushing, and a globular glass casing having a cylindrical neck to receive the shank and inserted in the bushing, the fusible enlargement being loosely inclosed within the external globular portion of the casing and normally maintained by it in position to retain the circuit-changer inactive, the spring action of the latter acting through the controller to retain the casing in place with its globular portion pressing against the outer end of the bushing, to close the entrance to the chamber of the base.

7. A thermostatic controlling device, comprising a chambered base provided with an aperture, co-operating circuit-terminals within the chamber, one of said terminals being spring-actuated to change its position relatively to the other terminal, a controller comprising a shank operatively connected with the spring-actuated terminal and having a fusible enlargement at its outer end, the shank passing through the aperture of the base, and a thin glass bulb having its neck inserted in the aperture and receiving the shank of the controller, the fusible enlargement of the latter being loosely inclosed within the exposed globular portion of the bulb and normally maintained thereby in position to prevent any movement of the connected circuit-terminal, the spring action of the latter pressing the globular portion of the bulb against the outer end of the aperture in the base to close the chamber thereof.

8. A thermostatic circuit-controlling device comprising a chambered base of insulating material provided with an aperture, circuit-terminals within the chamber, one of the terminals being shaped to form a spiral spring at its free end, supported on the base concentric with the aperture, a controller comprising a shank operatively connected with the terminal and extended through the spiral and the aperture and having a fusible button on its outer end external to the base, and a globular casing loosely inclosing and unconnected with the button and having an opening through which the shank extends, the button abutting against and being held by loose engagement with the casing in position to cause the shank to compress the spiral spring and maintain the circuit-terminals separated, the tension of the spring at the same time acting through the shank and button to retain the casing pressed against the exterior of the base to close the aperture thereof.

9. In a thermostatic circuit-controlling device, a base having a chamber and an aperture opening thereinto, a circuit-changer within the chamber and adapted to be included in an electric circuit, a controller therefor having at its outer end a fusible enlargement, a glass bulb loosely inclosing said enlargement and normally maintaining it in position to retain the circuit-changer inactive, the neck of the bulb passing through the aperture in the base, said aperture being closed by the adjacent globular portion of the bulb, and a guard on the base encircling the bulb to protect the same from breakage.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

EDWARD F. WOODMAN.

Witnesses:

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EMILY C. HODGES.