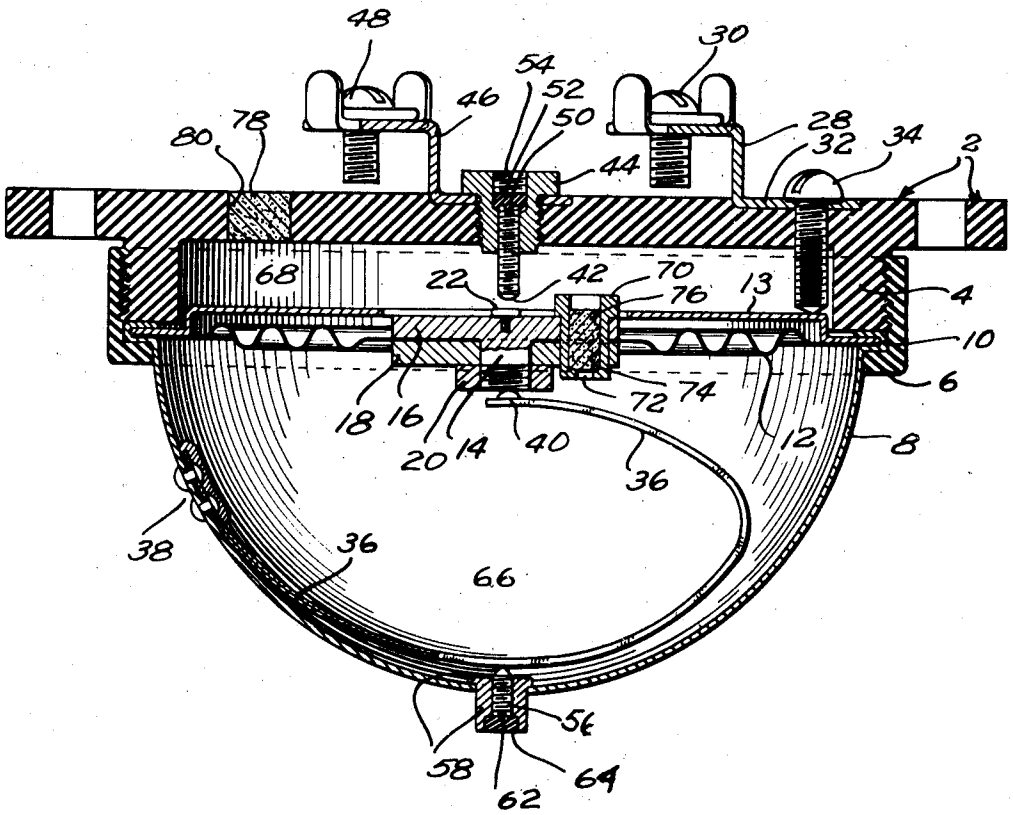
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THERMOSTATIC FIRE DETECTOR

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THERMOSTATIC FIRE DETECTOR

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This invention relates to thermally operated circuit controlling devices and particularly to thermally operated circuit controlling devices which control the circuits of fire alarm or fire control systems.

Thermally operated circuit controlling devices for fire alarm or fire control systems are usually of one of two types now in general use, that is, they operate usually either upon a rise of temperature above a predetermined critical temperature for which the device is calibrated or they operate when the rise in temperature exceeds a certain minimum rate per unit of time. Each type of device has advantages for certain uses. For example, the rate of rise thermostatic circuit control device for fire alarm or fire control systems is more sensitive to fires that start suddenly and may thus give an alarm for an incipient fire before the room temperature would reach the critical point for the operation of a fixed temperature circuit control device. The rate of rise circuit controlling devices, however, have a disadvantage in that they frequently give false fire alarms for rapid temperature rises in the controlled space which exceed the calibrated rate but which are perfectly harmless. Such rises may be caused by the opening of a door between a highly heated room and one not so heated, by the uncovering of a kettle in which a liquid is boiling, by release of a steam safety valve and by the occurrence of various other events which are perfectly harmless in themselves but which bring about the critical rate of rise of temperature necessary to operate the circuit control devices.

To insure ideal protection, therefore, it is advantageous to combine the rate of rise thermostatic circuit controlling device with the fixed temperature circuit controlling device thereby not only giving warning of fires producing quick temperature rises below the critical temperature of the fixed temperature thermostat but also, through the fixed temperature thermostat, giving a warning where the fire is of such a nature that the temperature rise to the danger point is below the calibrated rate for the rate of rise element.

A general object of the present invention is to provide a compact, simple, efficient and substantially dust- and corrosion-proof combined rate of rise and fixed temperature circuit controlling device which combines all of the advantages of each of the aforementioned types of devices and which can be installed in all kinds of locations where fire alarm and fire control thermostatic systems are desirable with assurance that it will operate when needed.

A particular object of the invention is to provide a device of this sort in which a single circuit closer may be operated either by the rate

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of rise operating mechanism or by the fixed temperature thermostatic mechanism or by both.

Another object of the invention is to provide for the enclosure of all of the operating parts of the device within a housing which not only is substantially dust- and moisture-proof, but a part of which also serves as the expansion chamber for the rate of rise mechanism, said housing also enclosing therein a dash pot chamber for preventing the sending in of alarms for flash rises of temperature, exceeding the calibrated rate, but not representing an incipient fire.

An important feature of the invention is the provision of means for varying the calibration of each of the circuit control devices of the combined unit from the outside of the unit, without having to disassemble the unit, the said adjusting means being adapted to be sealed in their calibrated adjustments.

Other objects and important features of the invention will appear when the following description and claims are considered in connection with the accompanying drawings in which the figure is a transverse section through a combined rate of rise and fixed temperature circuit controlling device embodying the present invention, the device being shown in the position in which it is attached to the ceiling or upper part of the space to be protected against fires.

In the illustrative embodiment of the invention, the molded base 2, of Bakelite or other suitable insulating material, has a depending threaded flange 4 on which is screwed a clamping ring 6, which may also be made of Bakelite or other suitable insulating material, although not necessarily so.

The hemispherical air chamber casing 8, which may be formed of copper or brass or other high heat conducting material and which may be painted black to insure more rapid heat absorption, is provided with a reentrant flange portion 10 between the upper and lower parts of which the marginal edges of both the diaphragm 12 and its backing plate 13 are confined. It will be seen that when the ring 6 is screwed up into clamping relation to the flange 10 of the air chamber 8, it will squeeze the marginal edge of the diaphragm 12 and the marginal edge of its backing plate 13 between the upper and lower parts of the flange 10 and thus hold them tightly against slippage under the action of the air expanding in the chamber 8. The diaphragm 12 is preferably corrugated as shown and is cut out in the center to receive the threaded boss 14 on the upper clamping plate 16, the boss 14 having an unthreaded portion between its threaded end and the clamping plate 16 to receive a lower clamping plate 18 fitting about the unthreaded portion. The inner edge of the diaphragm 12 is

clamped between the upper and lower plates 16 and 18 and is secured in its clamped position by a clamping screw 20 screwed on to the threaded end of the cylindrical boss 14.

The upper clamping plate 16 carries at its center a contact member 22, which may have a stem screwed into a threaded opening in the clamping plate 16 or which may otherwise be secured thereto, the plates 16 and 18 being made preferably of some conductive and not readily corrodible material such as copper, brass or bronze and the contact member 22 being made preferably of some non-corrodible metal such as silver.

To limit the movement of the diaphragm 12 under the action of the air expanding in the casing 8, the annular backing plate 13 is provided on the upper side of the diaphragm 12, this backing plate 13 having an offset flange portion which is also clamped between the upper and lower parts of the flange 10 of the air chamber 8, together with the marginal edge of the diaphragm 12, as hereinabove described. The contact member 22 has electrical connection to the one side of the electric circuit to be controlled by the operation of the diaphragm 12, under the action of the air expanding in the casing 8, by means of a terminal 28 having a wire clamping screw 30 threaded therein, said terminal having an offset part 32 clamped in the Bakelite base 2 by a screw 34 threaded thereinto, said screw extending through the base 2 and having a conical end which engages the upper face of the diaphragm backing plate 13. It will be seen, therefore, that electrical connection is made between the terminal 28 and the silver contact member 22 through the screw 34, the backing plate 13 and the diaphragm 12 which is clamped against the backing plate 13, between the upper and lower parts of the flange 10 of the casing 8, by the clamping ring 6, the diaphragm 12 being in electrical connection with the contact member 22 through the upper clamping plate 16.

It will further be seen that through the screw 34 and the diaphragm backing plate 13, electrical connection is made between the terminal 28 and the metallic casing 8. The thermostatic circuit closing means which is mounted on the metal casing 8 of the air chamber will now be described. The fixed temperature thermostatic circuit controlling means comprises a bi-metal strip 36 attached to the metal air chamber casing 8 at 38, preferably both by rivets and by solder to insure good permanent electrical and heat conducting connection to the casing 8. The bi-metal strip 36 is curved as shown so that when it expands and tends to straighten, the contact point 40 on the upper side of the curve is caused to press with considerable force against the lower face of the boss 14 on the upper clamping member 16, thus tending to force the diaphragm upwardly and with it the silver contact 22. When the silver contact 22 is forced upwardly a sufficient distance, however, either by expansion of the air in the chamber 8 or by the tendency of the bi-metal strip to straighten when heated, it will be brought into circuit closing engagement with a second contact member 42, comprising a screw threaded through a second screw 44 which serves to clamp the offset arm of the other circuit terminal 46 against the upper face of the Bakelite base 2, said arm being preferably seated in a recess in said base. The terminal 46, like the terminal 28, is provided with a wire clamping screw 48.

It will be seen that the upper end of the contact screw 42 is provided with a kerf 50 to receive a screw driver to facilitate calibrating the control device and that this upper end of the screw is seated in a recess in the upper part of the clamping screw 44 so that, after the calibration has been effected, sealing wax or other suitable sealing means 52 may be placed over the upper end of the contact screw 42 and, if desired, confined therein by means of another short screw 54 screwed into the upper end of the said recess in the clamp screw 44. Calibration of the action of the bi-metal strip 36, that is, calibration of the fixed temperature thermostatic circuit controlling means, may be effected by means of a calibrating screw 56, threaded through a screw case or holder 58 having a flange on the inside of the air casing 8 and preferably soldered to the casing 8 to secure an air-tight joint. The adjusting or calibrating screw 56 has its kerf 62 located at the bottom of a recess in the casing or holder 58 so that it also, when properly calibrated, may be sealed against access by sealing wax 64 or by any other suitable or more permanent sealing means.

It will be noted that, when the parts are in the position shown in the drawings, all of the contacts are enclosed within a casing comprising, as a whole, the base 2 of insulating material, the clamping ring 6 and the metal air chamber casing 8. It will further be seen that the diaphragm 12 and the clamping plates 16 and 18 carried thereby divide this enclosure into two chambers 66 and 68. To prevent gradual expansion of the air in the lower chamber 66 from moving the contact 22 into engagement with the contact 42, a leak or vent is provided in the diaphragm 12 through which the slowly expanding air can gradually leak. As herein shown, this leak or vent comprises a tube 70, preferably of non-corrodible metal, cemented into an opening through the upper and lower clamping plates 16 and 18. As herein shown, the tube 70 has in its lower end an opening 72, about one-half the diameter of the opening 74 in its upper end. The tube preferably has therein a plug 76 of suitable porous material such, for example, as balsa wood or other porous compressible wood. The rate of flow of the air leaking through the plug 76 may be varied by varying the initial compression of the balsa or other wood. The function of this leak is partly to determine the calibration of the rate of rise circuit controlling device. In order to prevent some false alarms, a second calibrated leak or vent is provided in the upper chamber 68. This leak or vent comprises simply a plug of balsa wood or other suitable material 78 in an opening 80 in the Bakelite base 2, this leak being so calibrated that it will pass air therethrough faster than the leak in the diaphragm 12. However, a too sudden movement of the diaphragm 12, caused by a flash expansion of the air in the chamber 66, will be retarded somewhat by a dash pot action of the air in the chamber 68 as it is driven through the leak or plug 78. Both leaks, of course, permit the return of the diaphragm 12 to its normal position under the action of gravity, this return preferably being facilitated by making the clamping plates 16 and 18 of substantial dimensions and of sufficient weight to tend to carry the diaphragm quickly back to its normal inoperative position.

It will be seen that the balsa wood plug 78 in the opening 80 has a further function in that it protects the chamber 68 from the ingress of dust, moisture or other vapors and thus protects the inside plug 76 from becoming clogged.

Opening upon the upper side of the Bakelite base 2, the plug or leak 18 is itself also somewhat protected from dust by the outlet box, within which it is preferably enclosed. It is believed that the use of balsa wood for an air leak of this type is novel.

From the foregoing description, it will be seen that the invention herein disclosed provides a combined rate of rise and fixed temperature thermostatic unit for fire alarm and fire control purposes having many advantages over previous devices and that it is simple to make, compact and inconspicuous and also substantially dust- and moisture-proof. It will further be seen that it combines the best features both of the rate of rise and of the fixed temperature circuit control devices in a unit in which there is only one pair of circuit closing contacts.

It is to be understood of course, that the embodiment of the invention herein shown is illustrative only and that many other embodiments may be made within the spirit of the invention and the scope of the claims.

I claim:

1. In a thermostatic circuit controlling device, the combination with a hollow casing of good heat conducting material, a diaphragm forming with said casing an expansion chamber for the diaphragm-operating fluid, said chamber being provided in a wall thereof with a restricted pressure equalizing vent for gradual temperature changes, and circuit-closing means comprising a member movable by said diaphragm into circuit-closing position upon expansion of the fluid in said chamber at a rate in excess of the capacity of said vent to effect equalization, of a bi-metallic thermostat enclosed within said expansion chamber, connected to said casing at one end only and bent in an arch-like curve, with the metal having the higher coefficient of expansion on the inside of said curve, between said casing and the diaphragm in such manner that its free end bears against the diaphragm and the opposite side of the arch has its bearing on the casing, said bi-metallic thermostat being so adjusted that its free end exerts pressure on said diaphragm sufficient to effect a circuit closing movement thereof when the temperature in said chamber reaches a selected critical point above normal and returns to its potentially operative position when the temperature in said chamber again falls below said critical point.

2. Thermostatic circuit-closing means according to claim 1 in which the casing, the diaphragm and the bi-metallic thermostat are all in electrically conductive relation to each other and to one side of the circuit-closing means.

3. A thermostatic circuit controlling device according to claim 1 in which the casing bearing of the bi-metallic arch is adjustable toward and away from the diaphragm to provide for variation of the critical temperature at which the bi-metallic thermostat operates to close the circuit.

4. A thermostatic circuit controlling device according to claim 1 in which a critical temperature adjusting bearing for the casing side of the bi-metallic arch has an extension to the outside of said casing by means of which such adjustment may be made.

5. In a thermostatic circuit controlling device, the combination with a hollow casing of good heat conducting material, a diaphragm forming with said casing an expansion chamber for the diaphragm-operating fluid, said chamber being provided in a wall thereof with a restricted pressure equalizing vent for gradual temperature changes, and circuit-closing means comprising a member movable by said diaphragm into circuit-closing position upon expansion of the fluid in said chamber at a rate in excess of the capacity of said vent to effect equalization, of a bi-metallic thermostat enclosed within said expansion chamber, connected to said casing at one end only and having its free end arranged and adjusted to exert pressure on said diaphragm sufficient to effect circuit closing movement thereof when the temperature in said chamber reaches a selected critical point above normal and to return automatically to its potentially operative position when the temperature again falls below said critical point, and means for varying the critical setting of the bi-metallic thermostat, said means being arranged to be accessible from outside the casing without disassembling thereof or removal of the thermostatic circuit controlling device from its operative location.

6. In a thermostatic circuit controlling device, the combination with a hollow casing of good heat conducting material, a diaphragm forming with said casing an expansion chamber for the diaphragm-operating fluid, said chamber being provided in a wall thereof with a restricted pressure equalizing vent for gradual temperature changes, and circuit-closing means comprising a member movable by said diaphragm into circuit-closing position upon expansion of the fluid in said chamber at a rate in excess of the capacity of said vent to effect equalization, of a bi-metallic thermostat enclosed within said expansion chamber, connected to said casing at one end only and having its free end arranged and adjusted to exert pressure on said diaphragm sufficient to effect circuit closing movement thereof when the temperature in said chamber reaches a selected critical point above normal and to return automatically to its potentially operative position when the temperature again falls below said critical point and an insulating base provided with a depending flange to which the casing and diaphragm are clamped, said diaphragm forming with said flange a second substantially dust-proof chamber into which the chamber vent discharges and in which the circuit closing means is located, a less restricted screened vent being also provided in the outside wall of said second chamber, the relative sizes of the chamber vent and the outside wall vent being such as to cause the fluid in said second chamber to effect a dash-pot retardation of the movement of said diaphragm under excessive rates of expansion of the fluid in the first mentioned chamber.

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