Feb. 23, 1932. J. PICARD ET AL 1,846,752

THERMOSTAT APPARATUS

Filed Jan. 30, 1928

Fig. 1

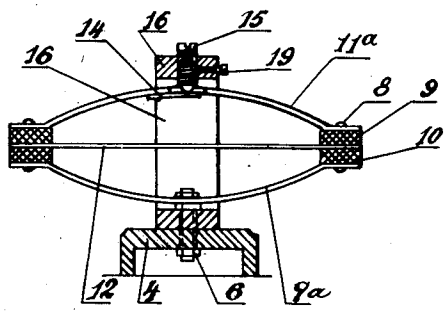


Fig. 2

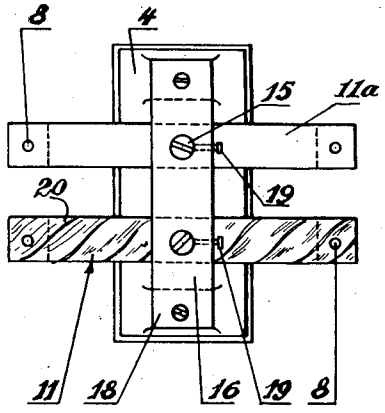
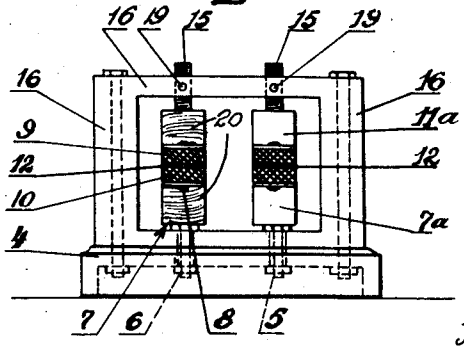


Fig. 3



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UNITED STATES PATENT OFFICE

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THERMOSTAT APPARATUS

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The present invention relates to a detecting apparatus of the thermostat type adapted to control the operation of an indicating or an alarm device, should any part of the said apparatus be subjected to an abnormal rise of temperature, whether this rise is too rapid or the temperature attains a determined degree, showing in either case an abnormal condition to which attention must be paid.

The said detecting apparatus essentially comprises a band of a readily expansible substance which subtends a double spring device preferably consisting of two strips forming an elliptical set or combination which will be flattened when the middle band is elongated by its heating which is independent of the elliptical set.

The elongation of the middle band will flatten the elliptical set, and this motion is utilized to control the indicating or alarm device coacting with the apparatus.

To provide for the lengthening of the middle band independently of the strips of the elliptical part, during an abnormal rise of temperature, which is either too high or too rapid, the strips of the said elliptical set are so constructed that in the first instance they will heat up more slowly than the middle band, for example by covering them with a heat-protecting covering or by giving them a higher calorific capacity, and in the second instance they consist of a substance having a very low coefficient of expansion, such as invar metal.

In our complete apparatus we thus employ two different detecting elements corresponding to the two types described.

In the case of an electric indicating plant operating upon constant current, the elliptical part of each detector is preferably secured to a support at the middle part of one of its strips, and at the middle part of the other strip is mounted a small spring plate or an electric contact piece coacting with an adjustable screw mounted in the said support; said plate and screw forming part of an electric circuit which may be common to both detectors of the same apparatus.

In the accompanying drawing:

Figures 1 and 2 are, respectively, a vertical section and a plan view of the improved apparatus or device, and Fig. 3 is an end view.

The apparatus herein represented comprises a base 4 upon which are mounted by means of screws 5 and 6 two suitable detecting elements disposed side by side in spaced parallel relation, one of which consists of a strip 7 which is secured at its center to the said base by the screw 6. To the ends of the strip 7 are secured by rivets 8, or by soldering, the ends of an upper strip 11, similar to the strip 7.

Between the ends of the strips 7 and 11 are secured the respective ends of a band 12 consisting of a substance having a high coefficient of expansion, preferably interposed between heat-insulating disks 9 and 10.

The band 12 subtends the strips 7 and 11, and it is given a length such that it will hold the strips in curved position, despite their natural tendency to become flattened.

The strips 7 and 11 are so constructed that they will heat up less rapidly than the band 12, and this may be obtained by covering the strips with a heat-protecting layer, indicated at 20 on Figs. 2 and 3, or by giving to them a heating capacity greater than that of the band 12, i. e., by making them thicker.

The other detecting element of the apparatus is secured by the screw 5 to the support 4, and it has the same disposition as the first, except that the two strips 7^a and 11^a of this element consist of a substance, such as invar metal, having a very low expansion coefficient. The disks 9 and 10 are no longer necessary in this case.

The middle part of the upper strip of each element comprises a resilient metal plate 14 coacting with an adjustable contact screw 15 mounted in a metal frame 16 secured to the base 4.

In the usual case in which the strips of the two elements consist of metal, the ends of the electric wires are connected to the respective screws 5 and 6 which are insulated from the frame 16, so that the circuit is closed through the said strips, the plates 14, the screws 15 and the bar 16.

The apparatus thus arranged may be protected by a perforated envelope or wire netting, not shown.

Let it be supposed that the apparatus is mounted at the place of use and is suitably regulated; if the temperature should rise abnormally, slowly and to a slight extent, the two detecting elements will not act, but for different reasons. The second element, which is made of invar metal, will not operate because it is regulated for a high temperature, for instance 60° C. In the first element, the band 12 will be lengthened, but at the same time as the strips 7 and 11 whose heat insulation, or great calorific capacity, does not prevent a slow heating, equal to that of the band, so that the deflection of the elliptical set will not appreciably vary, and the device will not operate.

Should the temperature rise in an abnormally rapid manner, for instance 2° per minute, the second detecting element will not operate as long as the temperature for which it is regulated is not attained; but in the first detector, the band 12 will expand without a corresponding expansion of the strips 7^a and 11^a, which heat up more slowly, and thus the deflection of the elliptical set diminishes and the upper strip 11^a ceases to make contact with the screw 15, so that the circuit is broken and the alarm set off.

If the temperature rises to the point corresponding to the adjustment of the second detector, but too slowly to operate the first detector, as in the case of a smouldering fire, the second detector, whose strips 7^a and 11^a consist of invar metal and will not expand, thus breaks the circuit due to the sufficient expansion of its strip 12.

The operating temperatures may be regulated by the screws 15 which are held in the proper position for instance by the small set-screws 19. This adjustment might also be effected by varying the length of the strips, or their curvature, or the length of the band 12. These operations may be effected by pressing the ends or by sliding them under the rivets 8, or by like means.

The advantages obtained by the said apparatus are obvious. It operates under all conditions in a rapid and precise manner, due to the low calorific capacity of its parts, and chiefly of the band 12, and it will also resume the normal position of its own accord when the several conditions which produced its distortion have ceased to act.

This last property allows it to automatically indicate a fire which starts again after an incomplete extinguishing.

The band 12 is subjected to tension stress, and the effort is exerted upon it in the direction of its length, so that the band may be made very thin, thus offering a great sensitiveness and also a great difference in heat capacity as compared with the strips 7 and 11, or 7^a and 11^a. This sensitiveness is increased from the fact that the variation in the deflection of the elliptical part of an element is twice the variation of the deflection of each strip.

Due to the expansion of its parts, the sensitiveness of the element (which operates by the sudden rise of temperature) will slightly diminish as the temperature rises, and will approach the operating point of the other element. This sensitiveness, which can be automatically varied, will thus depend inversely upon the temperature.

The apparatus is practically fireproof, as well as non-rusting, and it will not lose its adjustment. It forms a compact and rigid whole, and can be readily manufactured in standard sizes on a large scale. Its several parts are readily removable.

Obviously, the said invention is not limited to the example herein described, and without departing from the spirit of the invention, we may employ only one detecting element per apparatus, or the detectors may be connected in separate circuits.

The construction of a detecting element may be simplified; for instance, one of the strips 7 may be eliminated, but in this case the sensitiveness will evidently be reduced by one half.

The detecting elements can be used in plants employing electric signalling, or mechanical or compressed air signalling, or other means for this purpose.

We may employ the detecting element to observe the value of an electric current, by sending the whole or a part of the current into the band 12 itself.

The said apparatus can be used for protection against fire or to show an abnormal rise of temperature in any suitable place or apparatus, such as chemical baths, furnaces, or the like.

We claim:

1. Thermostatic apparatus, comprising a skeleton, vertical frame embodying connected top and bottom members; a pair of oppositely-bowed, expansible spring strips disposed one above the other within the frame; a metal band expansible independently of and differently from the spring strips and having its opposite ends interposed between the strip ends and connected with the same; an adjustable contact screw mounted in the top member of the frame to coact with the upper spring strip; and a screw securing the lower spring strip to the bottom frame member; the two screws and spring strips being included in a normally-closed electric circuit which is broken by the separation of the contact screw and upper strip consequent upon the different expansion of the strips and band when an abnormal temperature rise occurs.

2. Apparatus according to claim 1, in which the upper spring strip carries a resil-

ient metal plate which is mounted centrally upon that strip and with which the contact screw directly contacts.

3. Apparatus according to claim 1, in which the top member of the frame has a set screw movably mounted in it to engage the contact screw and retain it in adjusted position.

4. Thermostatic apparatus, comprising a skeleton, vertical frame; a pair of thermostatic devices mounted therein side by side and embodying, each, a pair of oppositely-bowed, expansible spring strips disposed one above the other, and a metal band expansible independently of and differently from said strips and having its opposite ends interposed between and connected to the strip ends; the strips of one device heating less rapidly than the band thereof, and the strips of the other device being made of a substance having a very low coefficient of expansion; coacting contact means on the frame top and the upper strip of each device; and means securing the lower strip of each device to the bottom of the frame; said contact means and securing means and the spring strips of the two devices being included in a normally-closed electric circuit which is broken by the separation of the contact means of either device consequent upon the expansion of the band thereof when an abnormal temperature rise occurs.

5. A device for detecting abnormal temperature rises, comprising two oppositely-bowed strips, and a band subtending the strips and having its ends interposed between the strip ends; said strips and band being made of materials having the same expansibility, the strips having a greater thickness than the band; and insulating disks interposed between the ends of the strips and those of the band.

6. A device for detecting sudden temperature changes, comprising two oppositely-bowed, expansible strips, and a band subtending the strips and having its ends interposed between those of said strips; said band being thinner than the strips and made of a material having the same coefficient of expansion as the strips, so that the heat capacity of the strips is greater than that of the band.

In testimony whereof we affix our signatures.

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ANDRÉ TOURNADRE.