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J. B. FOURNIER.

MEANS FOR SHOWING FROM A DISTANCE THE VARIATIONS
IN TEMPERATURE.

APPLICATION FILED DEC. 7, 1905.

fig. 1.

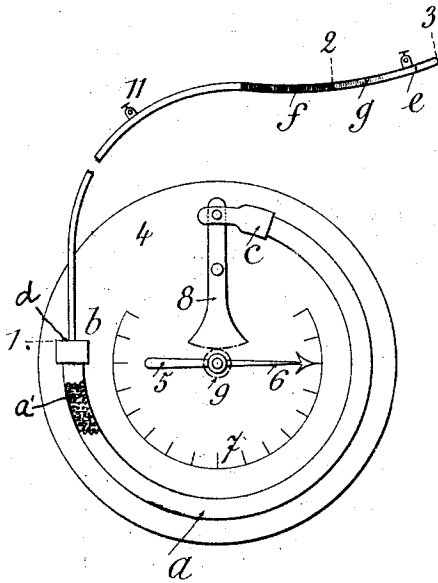
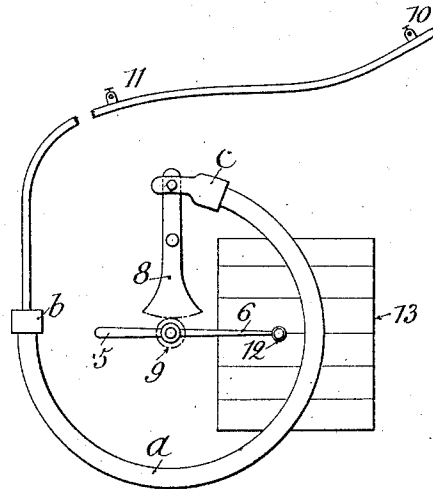


fig. 2.



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MEANS FOR SHOWING FROM A DISTANCE THE VARIATIONS IN TEMPERATURE.

No. 883,159.

Specification of Letters Patent.

Patented March 24, 1908.

Original application filed November 17, 1904, Serial No. 233,158. Divided and this application filed December 7, 1905. Serial No. 290,806.

To all whom it may concern:

Be it known that I, JOSEPH BARBE FOURNIER, a citizen of the Republic of France, residing at Paris, 62 Quai des Orfèvres, in the Republic of France, engineer, have invented certain new and useful Improvements in Means for Showing from a Distance the Variations in Temperature, of which the following is a specification, this being a division of the application filed by me November 17, 1904, Serial No. 233,158.

This invention relates to improvements in means in showing from a distance the variations of temperature; it relates more particularly to means which comprise a curved tube or hand-wheel the ends of which move away or approach each other by the effect of the variations in the pressure within the same, the said tube being connected to a tube of small diameter one end of which is closed and which is partly filled with a liquid which is volatile to a very small extent, while the part near the closed end contains a very volatile liquid as well as vapors of the said liquid. When the medium in which lies the closed end of the small tube undergoes variations of temperature, the tension of the vapor of the volatile liquid increases or decreases, and the liquid which is volatile to only a small extent transmits to the liquid contained in the curved tube a greater or less pressure which causes the tube to expand or contract.

This invention has for its purpose to use these motions of the curved tube to actuate an indicating hand, or some other indicating means.

In the accompanying drawing, which shows two ways in which my invention may be carried out: Figure 1 is an elevation of an apparatus so fitted as to serve as a wattoscope. Fig. 2 shows a modified form of the same apparatus combined with a recording cylinder.

In Fig. 1 the curved tube *a* is similar to the usual manometers. It may be elliptic or of any other suitable shape in cross section. It is in the first place filled with some matter dilatable and volatile to the smallest extent, such as sand, small stones, iron shavings, or the like *a'*, in order to diminish as much as possible its inner capacity.

The ends *b*, *c*, of the tube *a* are closed, for instance by means of metal stoppers soldered to the same. The end *b* has an aperture *d* in which is soldered a flexible tube *e* of very

small inner diameter and which communicates with the inside of the curved tube *a*. Into the capacity formed by the tubes *a* and *e* there is introduced a suitable liquid *f*, volatile to the smallest extent possible, mercury for instance, so as to entirely fill with the said liquid the tube *a* and a certain part 1—2 of the small tube *e*.

In the unfilled part 2—3 of the tube *e* there is introduced a determined quantity of a suitable volatile liquid *g*, such as liquefied gas, sulfurous acid, chlorid of methyl, liquid ammoniac, liquid carbonic acid, or the like, and the end 3 of the tube *e* is hermetically closed. In order to avoid the mixture or the dissolution of the two liquids the one into the other, there may be located in the small flexible tube *e*, between the two liquid columns, a small liquid piston, for instance a drop of mercury, which prevents the contact of the two liquids *f* and *g* and which, being given the small cross section of the tube *e*, is maintained in the latter by the capillary forces. The quantities of the two liquids must be such that if the system formed by the tube *a* and the part 1—2, filled with the liquid *f* which is only volatile to a small extent is immersed in a bath the temperature of which is equal to the highest temperature to which the system will have to be subjected, the tube *a* will only open to a negligible extent. The part 2—3 of the tube *e*, containing the volatile liquid *g*, is therefore the only part which is really sensitive to the heat. Under the action of the heat, the tension of the vapor in the tube *e* varies and determines in the curved tube *a* through the medium of the liquids *g* and *f*, corresponding motions of expansion and contraction.

In the apparatus shown in Fig. 1, the end *b* of the curved tube *a* is fixed to a casing or bracket 4, and its free end *c* is connected to a hand 5—6, movable on a dial-plate 7, through the medium of a lever 8 and of a pinion 9 mounted on the casing 4. In the tube *e*, which is connected to the tube *a*, there is inclosed a liquid *f* volatile to a small extent and a volatile liquid *g*. The said tube carries terminals 10, 11 for the arrival and the departure of an electric current.

If an electric current is passed into the tube *e*, the latter, on account of its electrical resistance, will become heated and the rise in its temperature will be proportional to the intensity of the current, it will be the same in

that which concerns the motion of the free end *c* of the tube *a* and the motion of the hand 5—6, so that after graduating the apparatus either comparatively or directly, the position 5 of the said hand will show the power of the current. The apparatus will then constitute a wattoscope. By providing the apparatus with a style 12 and revolving cylinder 13, as shown in Fig. 2, a recording wattoscope will 10 be obtained.

As the positions taken by the end 6 of the hand on the dial-plate 7 (see Fig. 1) or on the cylinder 13 (see Fig. 2) are the results of the successive temperatures of the part 2—3 of 15 the tube *e*, the apparatus may also be used as a thermometer; it may be graduated by comparison with a standard thermometer. In this case, the terminals 10, 11 are useless. This saturated vapor thermometer has over 20 the usual thermometers based on the dilatation of a suitably chosen substance, the advantage of having indications absolutely independent of the variations of the capacity of its covering or casing, since the elastic

power of a saturated vapor is independent of 25 the volume which it occupies.

Claim:

The combination of a curved tube or manometer, of a movable, flexible, narrow tube, one end of which is connected to the manom- 30 eter tube and of which the other end is closed, of a not very volatile liquid in the manometer tube and a large part of the flexible tube, and of a volatile liquid in a part of 35 the closed end of the tube, the diameter of the flexible tube being sufficiently small to allow of the capillary forces maintaining the liquid columns in the tube in their respective positions, irrespective of the movements im- 40 parted to the said tube.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of subscribing witnesses.

JOSEPH BARBE FOURNIER

Witnesses:

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