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J. B. FOURNIER.

MEANS FOR USING FROM A DISTANCE THE VARIATIONS IN TEMPERATURE.

APPLICATION FILED NOV. 17, 1904.

FIG. 2.

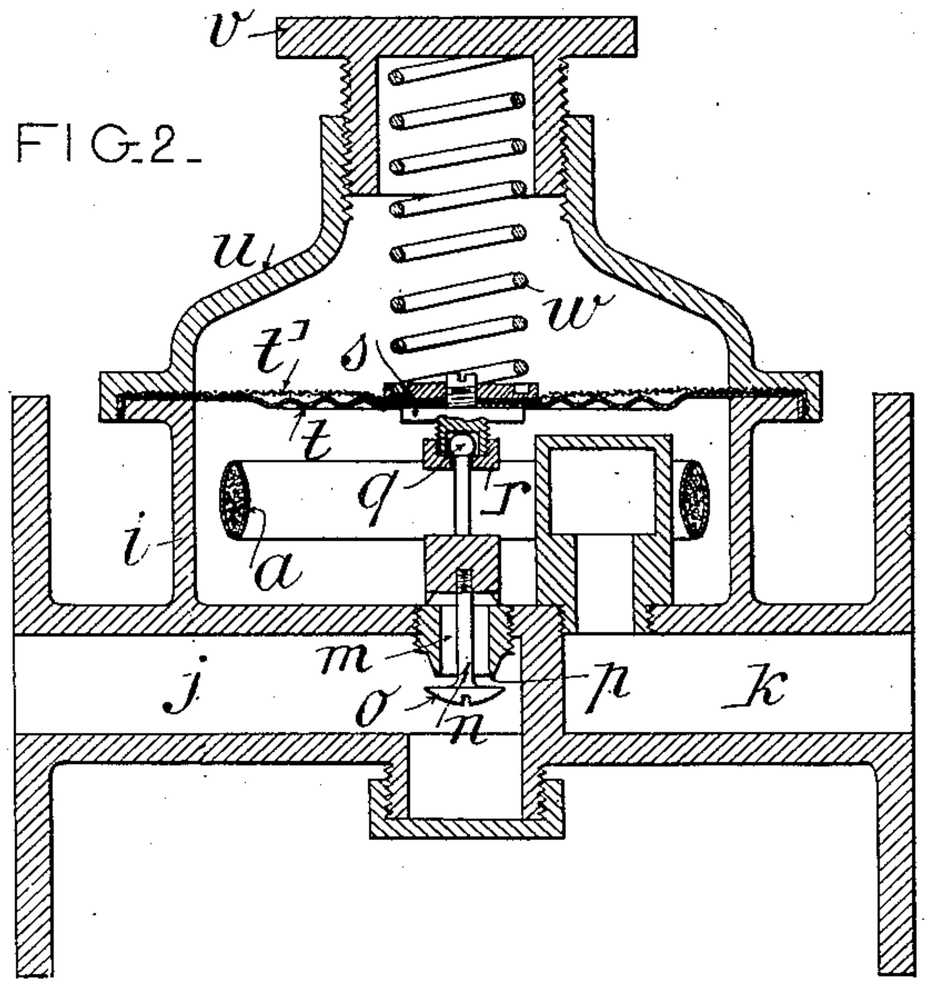


FIG. 1.

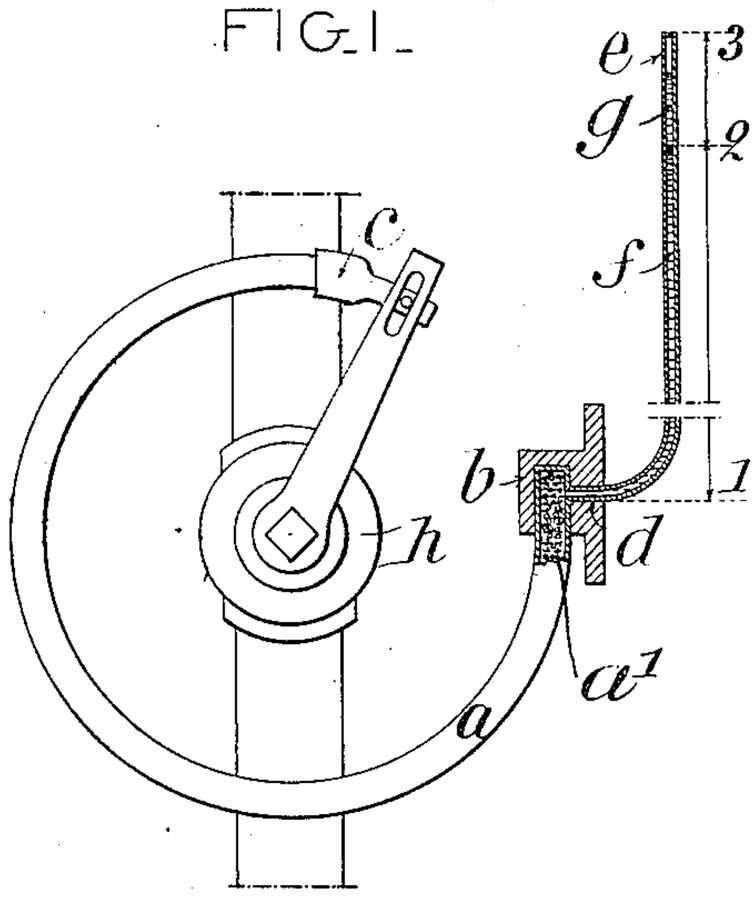
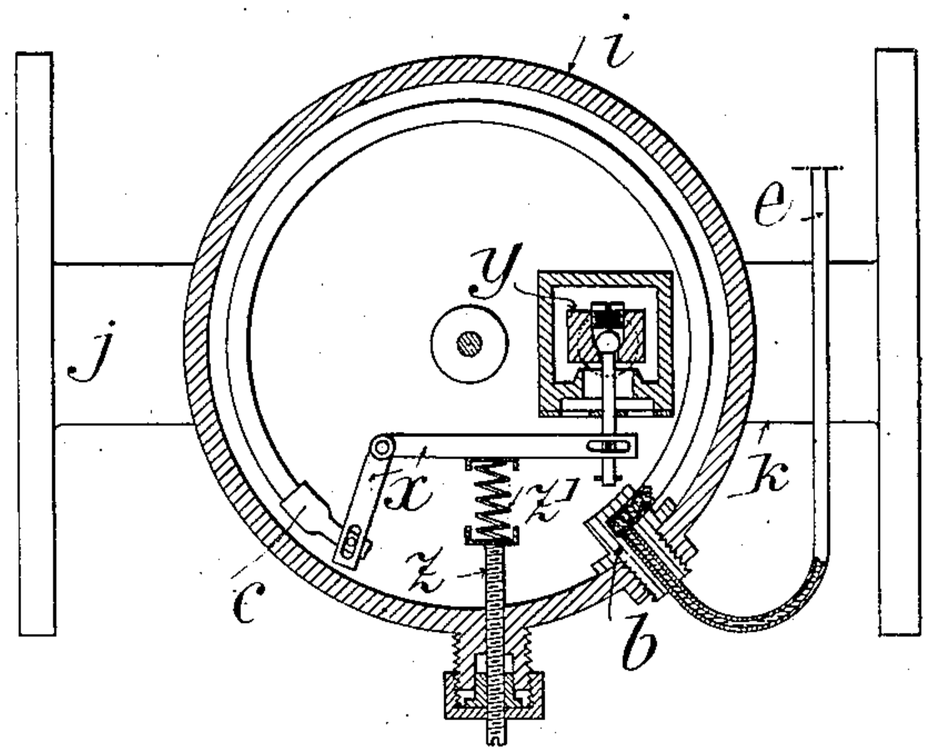


FIG. 3.



WITNESSES :

W. M. Avery

Walton Harrison

INVENTOR

Joseph Barbe Fournier

BY

ATTORNEYS

UNITED STATES PATENT OFFICE.

JOSEPH BARBE FOURNIER, OF PARIS, FRANCE.

MEANS FOR USING FROM A DISTANCE THE VARIATIONS IN TEMPERATURE.

No. 886,201. Specification of Letters Patent. Patented April 28, 1908.

Application filed November 17, 1904. Serial No. 233,158.

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 Using from a Distance the Variations in Temperature, of which the following is a specification.

This invention relates to improvements in means for using from a distance the varations of temperature.

It relates more particularly to means which comprise a curved or manometric tube 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 a regulating valve or a brake, or some other kind of mechanism.

In the accompanying drawing, which shows several ways in which my invention may be carried out: Figure 1 is an elevation of an apparatus so fitted as to be used as a thermo-regulator. Fig. 2 is a vertical section of a similar regulator combined with a compensation device. Fig. 3 is a horizontal section of the same apparatus.

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 of the tube *a* are closed by means of metal stoppers *b*, *c* soldered to the same. The stopper 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 space inclosed by the tubes *a* and *e* there is introduced a suitable liquid volatile to the smallest extent possible, *f*, 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 tupe *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 sensible to the heat; it is this part which is to be put in contact with the medium.

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. To regulate, by the help of these motions, the passage of a heating fluid or the operation of any heating apparatus, in such a manner for instance, as to render constant the temperature in an apartment heated by an ordinary fire-place in which coal or other fuel is burned, all that is required is to place the closed end of the tube *e* there where the temperature is to remain constant, and to cause the free end *c* of the tube *a* to act, in a suitable direction, on a valve *h* or other suitable obturator located in the chimney of the fire-place, in such a manner that, by the motion imparted to the said valve or obturator by the tube *a*, the draft of

the chimney will be increased or diminished according as to whether the temperature in the room is less or greater than the required amount. It will be the same in the case of the heating of an apartment or the like by means of a fire-place in which ordinary fuel is burned, such as coal, coke, mineral oil, alcohol, coal gas, or the like. The tube *e* will still be located there where the temperature is to remain constant, and the movable end *c* of the manometer tube will actuate, in a suitable direction, either directly or through the medium of levers, the obturator of the chimney of the gas cock, or any other device controlling the intensity of the heating process.

In the case of a system of heating by steam or any other fluid under pressure, the use of the above described simple apparatus might be insufficient to insure a proper regulation; the sudden and always considerable effects of the pressure which are produced on the clack-valves or on the movable parts of the cocks located on the pipes of the fluid under pressure, are to be feared as to the regularity of the action of the tube *a*. The said effects must therefore be lessened or rather practically done away with in order to avoid jumps in the operation of the apparatus and to get a proper regulation. Such a result may be obtained by means of the device shown in Figs. 2 and 3. The curved tube *a* is located in an air-tight casing *i*, which is provided with pipes *j*, *k* for the passage of the fluid under pressure. The said casing is provided with an orifice *m* opening into the pipe *j*. In the said orifice is engaged a rod *n* provided at one end with a clack-valve *o* having a beveled seat *p*. The said valve is so arranged that it is applied against the seat by the pressure. The other end of the rod *n* is connected with a ball-and-socket joint *g*, clamped by a nut *r* against a washer *s*, fixed to a diaphragm *t;* this ball-and-socket joint allows of the obturator *o* coming always exactly onto its seat *p*. The corrugated metal diaphragm *t* forms the top of the casing *i*. To prevent the said web from being deformed or broken, there may be applied onto its upper face wire-gauze t^1, which is concentric to the same and of which the edges, together with those of the web, are clamped between the flanges of the casing *i* and of its lid *u*. Into the neck of the said lid is screwed a cap *v*, which allows of exercising on the diaphragm a pressure variable at will through the medium of a spring *w*.

The free end *c* of the curved tube *a* acts on a lever *x* one of the arms of which controls a second valve *y* allowing the fluid to flow from the casing *i* into the pipe *k* and from thence into the system of heating pipes. The tube *e* passes through the regulator casing and extends into the space in which the temperature is to be maintained constant, as in the previous cases. An adjusting screw *z* controlling a spiral spring z^1 allows of causing a slight variation in the temperature for which the valve is entirely closed.

We may observe that the apparatus just described allows of obtaining, by operating the cap *v*, the outflow corresponding exactly to the temperature desired.

It will be easily understood how the disturbing effects due to the pressures on the valves are practically done away with.

For each increase in the temperature there corresponds a decrease in the outlet orifice for the heating fluid through the valve *y* and, consequently, an increase in the pressure within the casing *i*. The said increase in the pressure is only temporary, for it has the effect, through the medium of the diaphragm *t*, of diminishing the inlet *m* for the fluid into the casing to a corresponding extent and, as the fluid in the casing flows into the system of heating pipes, the final effect is a decrease in the pressure in the said casing and, consequently, on the outlet valve *y*. The pressure in the casing therefore falls continuously as the outlet valve *o* closes, that is as the temperature increases.

The chief advantages of the apparatus are as follows:

1. The motions of the curved tube are produced by the tension of the saturated vapor of a volatile liquid and not by the dilatation of a liquid, so that the amplitudes of the free end of the tube and consequently, the operation of the regulator, are absolutely independent of the variations of the capacity of the space containing the liquid. Furthermore, the elastic power of a saturated vapor having always a definite and well determined value, there is no need to fear, as in the case of the dilatation of liquids, the production of abnormal pressures leading to a deformation of the covering and to a modification of the elasticity of the curved tube.

2. The apparatus may be placed at any distance from the spot or space where the temperature is to be maintained constant; there is therefore no fear of any escape, in such space, of the fluids from the apparatus on account of the latter being insufficiently air-tight or otherwise.

3. The suppression of the disturbing effects due to the pressure on the clack-valves allows of giving great precision or exactness to the apparatus.

4. The same apparatus may be regulated for different outflows by simply operating an adjustable cap *v*, independently of the desired temperature, according to requirements.

The invention is not limited, in the hereinbefore described applications of the same, to the construction and the arrangement shown which are only given by way of example.

Claim.

A manometer comprising a curved manometric tube and a narrow tube, the latter having one of its ends connected to the said curved manometric tube and having its other end closed, both of said tubes containing liquids and said curved manometric tube containing in addition a solid material distributed substantially throughout its entire length so as to restrict the space left for the liquid contained within said curved manometric tube.

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

JOSEPH BARBE FOURNIER.

Witnesses:

ARCHIBALD R. BAKER,

MAURICE ROUX.