(No Model.)

H. S. TUNNARD & A. M. KEAYS.

THERMOSTAT.

No. 509,056. Patented Nov. 21, 1893.

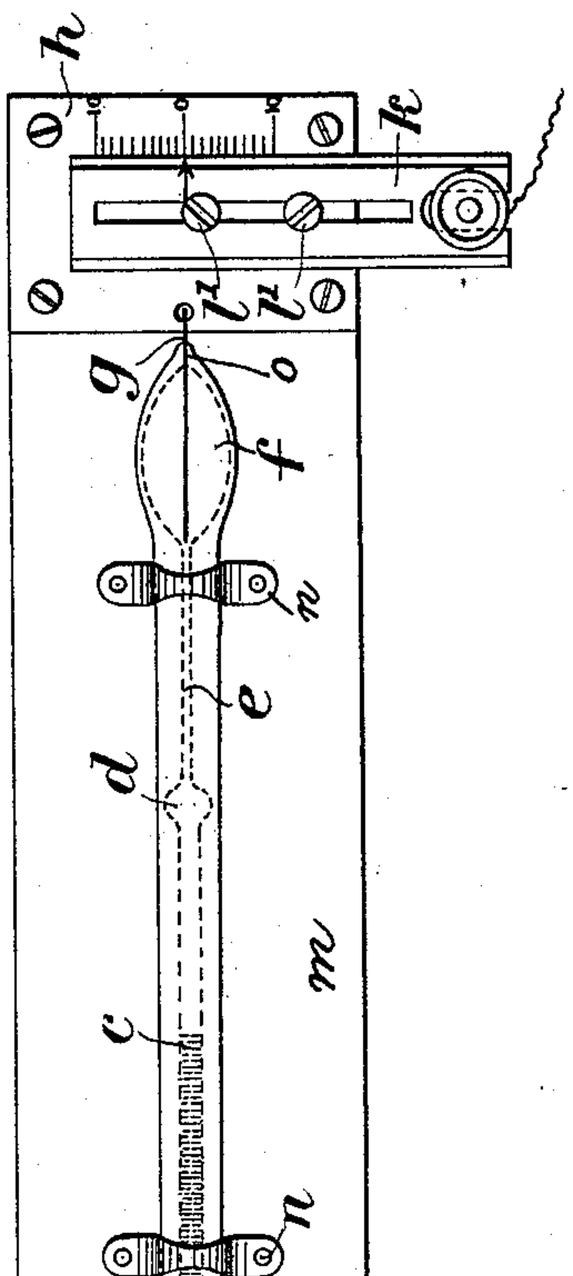

FIG. 1.

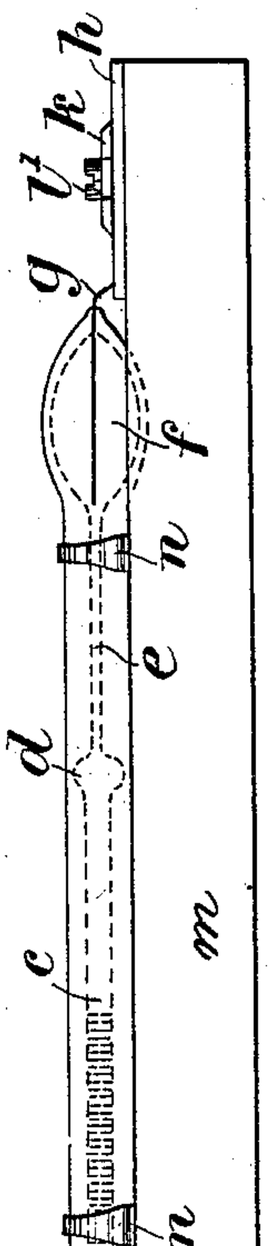

FIG. 2.

Witnesses.

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HENRY STOPFORD TUNNARD, OF RUGBY, AND ARTHUR MAITLAND KEAYS, OF SUTTON, ENGLAND.

THERMOSTAT.

SPECIFICATION forming part of Letters Patent No. 509,056, dated November 21, 1893.

Application filed March 27, 1893. Serial No. 467,803. (No model.)

To all whom it may concern:

Be it known that we, HENRY STOPFORD TUNNARD, residing at Bilton Road, Rugby, in the county of Warwick, and ARTHUR MAITLAND KEAYS, residing at Wandle Cottage, Sutton, in the county of Surrey, England, subjects of the Queen of Great Britain and Ireland, have invented new and useful Improvements in Thermostats or in Self-Registering Apparatus for the Variation of Temperature, of which the following is a specification.

It is desirable for a variety of purposes that great exactitude should be obtained and that great facilities should be given for regulating the temperature in certain apparatus, such as fire alarms, incubators, and other appliances.

Our present invention consists of an improved form or construction of thermostat which has a much higher degree of sensitiveness than has been hitherto obtained in apparatus of like nature. In our improved form of thermostat we obviate the fault hitherto found in this class of instruments, of the mercury getting out of order or disconnected in the transit of the instruments. We further provide an easy, accurate and efficient means of adjustment.

The construction of our invention is as follows:—We make in the glass tube which contains the mercury a bulb at one end, but instead of making the bore of the tube of the same diameter from end to end we make the tube as of two parts, the first part having a bore of larger diameter than the second part; we blow an expansion chamber at the point of union of the two tubes and another expansion chamber at the other end of the fine bore tube; we also provide a small expansion chamber at the point of union that the bulb makes with the tube of greater diameter. A platinum wire is fused into each end of the thermostat; the wire that is fused into the bulb is always in contact with the mercury, and the wire that is fused into the expansion chamber at the end of the tube having the smaller bore only makes contact with the mercury when the latter expands and runs up, first into the tube of larger bore and next into the expansion chamber that separates the tube of larger bore from that of the smaller; the mercury then enters the tube of smaller bore, traverses its entire length, coming in contact with the platinum wire. To each end of the base of the thermostat is fixed a plate of copper or other conducting metal, the wires at each end of the thermostat being jointed to the conducting plates forming an electrical connection between the plate and the platinum at each end thereof. Movable connecting pieces of copper or other conducting metal are arranged to form a sliding contact with the fixed plates, one at each end of the thermostat, and are provided with binding screws in such a manner that the movable pieces can be moved up or down, providing a means of ready adjustment. Indications are marked on the movable pieces (such as an arrow head or the like), and on the fixed plates a divided scale is marked off. The movable pieces are capable of adjustment to the whole length of the scale.

In order that our invention may be better understood and more readily carried into effect we will proceed to describe the drawings hereunto annexed.

Similar letters refer to similar parts throughout both figures of the drawings.

Figure 1 is a plan, and Fig. 2 an elevation of our improved thermostat.

a is the bulb of the thermostat.

b is a slight enlargement of the tube *c*.

d is an expansion chamber which unites the tube *c* with the tube *e*. The tube *e* ends in an expansion chamber *f*.

Into the bulb *a* is fused a platinum wire *g'*, one end of the wire being in contact with the mercury in the bulb *a*. The other end is united to the conducting plate *h'*. The plate *h'* is rigidly fixed to the base *m*. The slotted piece *k'* is fixed to the plate *h'* by means of the binding screws *l'*, *l'*. When the screws *l'*, *l'* are slackened the slotted piece *k'* can be moved up or down and a scale of divisions is marked off on the fixed plate *h'*. The mark or arrow head is fixed in such a manner that its point is capable of being brought opposite any of the divisions of the scales admitting of adjustment for the entire length of the scale; the bore of the tube *c* is of greater diameter than the bore of the tube *e*. One end of the platinum wire *g* is fused into the expansion tube *f* at the point *o* and this end of the wire extends to the commencement of the

tube *e*, (but does not enter the said tube) terminating at the exact point at which the tube *e* ends and the expansion chamber *f* commences. The other end of the wire *g* is fixed to the plate *h*, the latter in its turn being fixed to the base *m*.

k is a slotted conducting piece fixed to *h* by means of the binding screws *l'*, *l'*, and is capable of adjustment for the entire length of the scale.

n, *n*, *n*, are clips or retaining pieces which hold the thermostat to the base *m*.

It is obvious that our improved form of glass tube may be employed for thermometers. In this case we should prefer to make the tubes *e* and *c* of equal length and the diameter of the bore of *c* three times as great as the diameter of the bore of *e*. We do not pretend to bind ourselves to the exact size of the bore of *c*, other than it should be much greater than the bore of *e*. It is also obvious that the length and the diameter of the tubes *c* and *e* will vary in thermostats having different ranges of the Fahrenheit scale.

The function of the chambers *b* and *d* and the large tube *c* is to make the mercury in the small tube *e* have a very rapid movement under a very small change of temperature at about its point of making the circuit. Experiment has proved that this construction makes a very sensitive thermostat and one particularly adapted for use in an incubator. When used in an incubator the opening and closing of the circuit are utilized to effect the regulation of the dampers through intermediate mechanism which is not a part of this invention. The plates *k k'* are secured in the egg drawer of the incubator and the tube is moved as near to the hot water tank or other source of radiant heat at the top of the egg drawer as desirable. The air in the egg drawer is always hotter at the top and although the thermostat closes the circuit at a fixed temperature it may be made to close it at a different mean temperature of the air in the egg drawer by raising or lowering it in the drawer.

What we claim is—

1. A mercurial thermostat, provided with a mercury bulb at one end, an expansion chamber at the other end, and a straight tube having a bore of large size leading out of the mercury bulb and a bore of small size leading into the expansion chamber, the said bulb, tube and chamber being arranged substantially horizontal and in line with each other, substantially as set forth.

2. In mercurial thermostats the combination of the bulb *a*, an expansion chamber *b*, a tube *c* communicating with a tube *e* through the expansion chamber *d*, the tube *e* also ending in the expansion chamber *f*, all substantially as described and as illustrated in the drawings annexed.

3. In a mercurial thermostat, the plates *h*, *h'*, fixed to the base *m*, in combination with the slotted slides *k*, *k'*, binding screws *l'*, *l'*, the slotted slides *k*, *k'* being adjustable, all substantially as described and as illustrated in the drawings annexed.

In testimony whereof we have hereunto affixed our signatures in the presence of witnesses.

HENRY STOPFORD TUNNARD.
ARTHUR MAITLAND KEAYS.

Witnesses to the signature of H. S. Tunnard:
W. CUDHURST,
Rugby, Bank-Accountant.
A. AUSTEN,
Cashier Nat. Provl. Bank, Rugby.
Witnesses to the signature of A. M. Keays:
WILLIAM B. CANDY,
WM. H. LEWEES.