No. 751,854. PATENTED FEB. 9, 1904.

G. D. HOFFMAN.

THERMOSTAT.

APPLICATION FILED MAY 25, 1903.

NO MODEL.

Fig. 1.

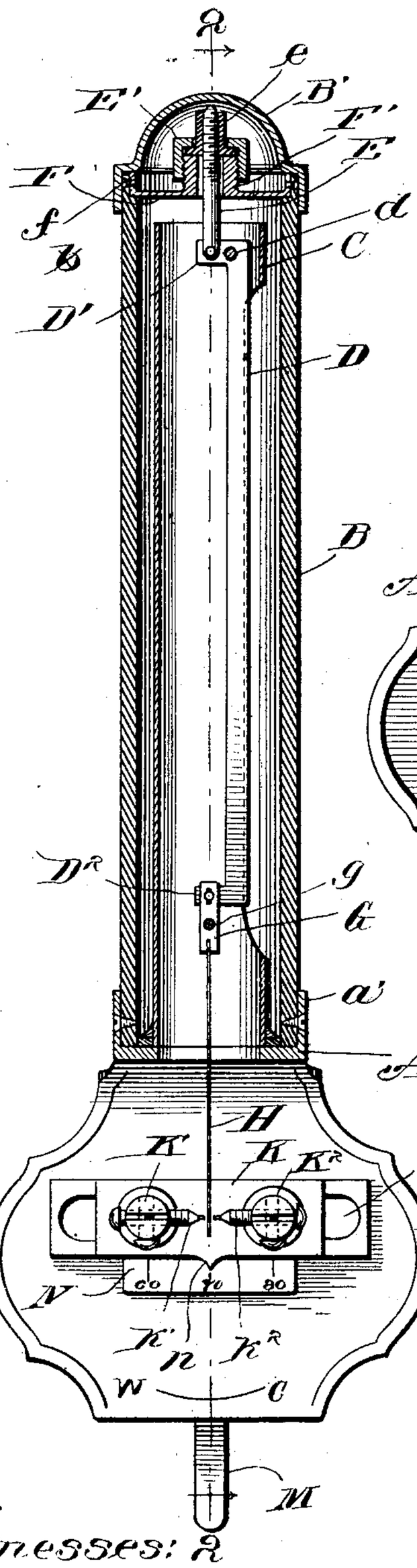


Fig. 3.

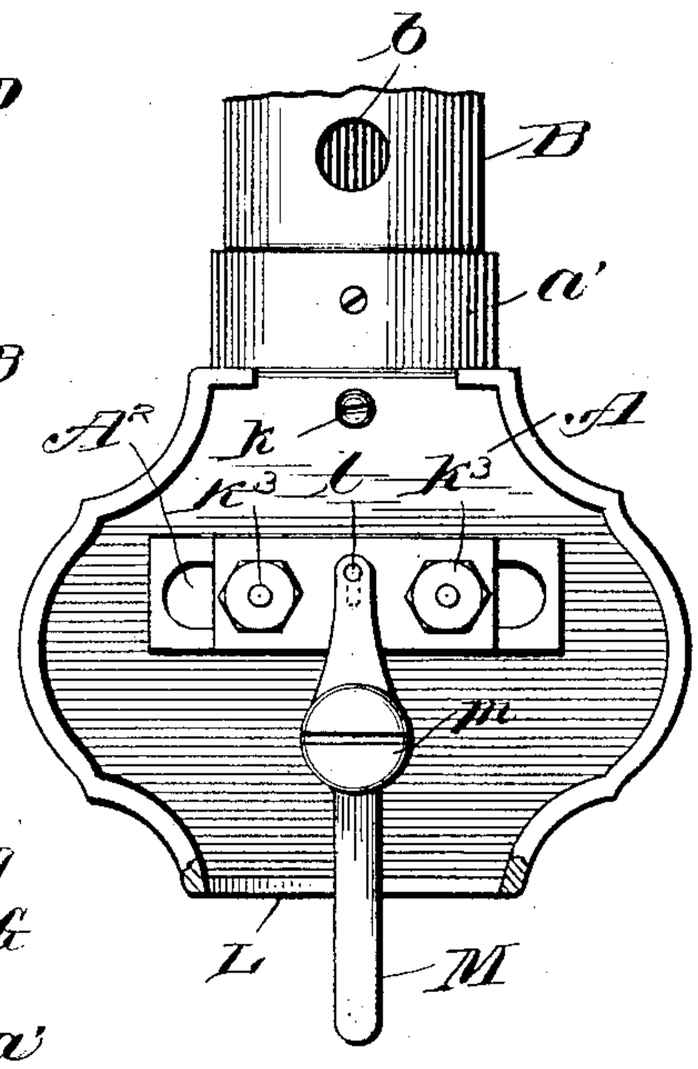
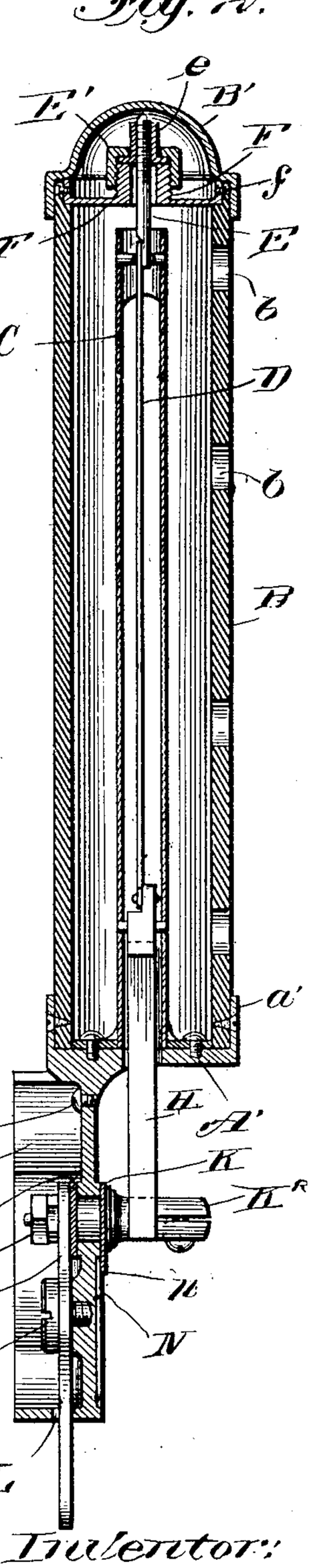


Fig. 2.



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UNITED STATES PATENT OFFICE.

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THERMOSTAT.

SPECIFICATION forming part of Letters Patent No. 751,854, dated February 9, 1904.

Application filed May 25, 1903. Serial No. 158,746. (No model.)

To all whom it may concern:

Be it known that I, GEORGE D. HOFFMAN, a citizen of the United States, residing at Chicago, county of Cook, State of Illinois, have invented a certain new and useful Improvement in Thermostats; and I declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates in general to thermostats, and more particularly to thermostats for automatically maintaining the temperature of a room at a predetermined degree through the medium of mechanism controlled by the thermostat, which in turn controls the supply of heat.

It is desirable that the temperature of a room should be automatically maintained practically constant, and to accomplish this result it is necessary that the regulator should possess sufficient sensitiveness to increase or decrease the supply in temperature.

The primary object of my invention is to provide a thermostat in which a comparatively slight contraction or expansion of the operating member will produce a relatively great movement of the member which controls the supply of heat upon a slight variation in temperature.

A further object of my invention is to provide a thermostat of the character described which will be simple in construction, inexpensive in manufacture, and efficient in use.

My invention, generally described, consists in a tubular expansible member rigidly connected at one end to a base, a non-expansible frame rigidly secured to said base and surrounded by said expansible member, a member for controlling the heat-supply pivotally supported upon said frame, a bell-crank lever also pivoted to said frame, having a short arm connected to the free end of the expansible member and a long arm operatively connected to said heat-controlling member.

My invention will be more fully described hereinafter with reference to the accompanying drawings, in which the same is illustrated as embodied in a convenient and practical form, and in which—

Figure 1 is a vertical central section, the supporting-base being shown in elevation; Fig. 2, a vertical central section on line 2 2, Fig. 1; and Fig. 3, an enlarged elevational view of the rear side of the base, the lower end of the expansible member being shown as broken away.

The same reference characters are used in the several figures of the drawings to designate the same parts.

Reference character A indicates a supporting-base upon which the thermostat and its coöperating mechanism are mounted. A disk A′, disposed in a plane at right angles to the base A, is rigidly secured to and preferably formed integral with said base. A flange *a′* projects upwardly from and surrounds the disk A′.

An expansible member B, preferably tubular in form, is mounted upon the disk A′ and is surrounded at its lower end by the flange *a′*, to which it is rigidly secured by a suitable fastening device—such, for instance, as screws. A series of holes *b* are preferably provided extending through the wall of the expansible member, so as to permit the free passage of air, whereby the interior surface as well as the exterior surface of the expansible member is exposed to the temperature of the room in which the thermostat is located.

A supporting-frame C is rigidly secured at one end to the upper surface of the disk A′ of the base and is surrounded by the tubular expansible member. The frame C is made of any material which is non-expansible when compared to the material of which the expansible member is formed, the latter being preferably composed of hard rubber. A bell-crank lever D is pivoted at *d* to the supporting-frame C near the upper end thereof. The short arm D′ of the bell-crank lever is pivotally secured to the lower end of a screw-threaded rod E, which extends upwardly through a cap F, located within the upper end

of the expansible member. The screw-threaded rod E extends through a boss F′, formed upon the cap F and provided with exterior screw-threads. A nut *e* engages the screw-threads on the rod E and is provided with a laterally-projecting flange at its lower end, which rests upon the upper end of the boss F′.

E′ indicates a lock-nut which engages the screw-threads on the exterior of the boss F′ and is provided with an inwardly-extending flange which clamps the flange on the nut *e* upon the end of the boss F′. The cap F is rigidly secured within the end of the expansible member by suitable fastening devices, as shown at *f*. The removable cover B′ is mounted upon the upper end of the expansible member and incloses the cap F and the parts mounted thereon. The cover B′ is provided with a depending flange *b*′, which surrounds the upper end of the expansible member. The longer arm of the bell-crank lever extends downwardly within the supporting-frame C and is provided with a laterally-projecting portion D^2, which is pivotally connected to the upper end of an oscillatory block G, the latter being pivotally mounted upon a pin *g*, the ends of which are supported in the side walls of the supporting-frame C.

Secured to and depending from the block G is a member for controlling the supply of heat, which in the present embodiment of my invention is shown as a movable electrical contact H. This contact extends downwardly through a slot formed in the disk A′ of the base and terminates between two contacts *k*′ and k^2, which are adjustably mounted in studs K′ and K^2, respectively. The studs referred to are preferably laterally adjustable upon the base A, such adjustment being secured by means of a plate K, upon which the studs are mounted. This plate is supported by means of the studs K′ and K^2 being extended through a slot A^2, formed through the base. The slot is such a length with respect to the distance between the studs that the plate K may be moved laterally in either direction upon the base. The ends of the studs which project through the plate K after passing through the slot A^2 extend through a plate K^3, located upon the back of the base A. Nuts k^3 are screwed upon the ends of the studs and retain the plates K and K^3 against the opposite sides of the wall of the base A around the slot A^2. The lever M is pivotally mounted by means of a screw *m* or other suitable device upon the back of the base at a point below the plate K^3. The upper end of the lever M is pivotally connected to the plate K^3 by means of a pin *l*, which extends into the vertical slot formed in the plate K^3 at a point intermediate of the studs K′ and K^2. The lower end of the lever M extends through a slot L, formed in the flange at the bottom of the base.

A pointer *n* is mounted upon the lower edge of the plate K and is located at a point intermediate of the contacts *k*′ and k^2. A scale N is located upon the base in the path of movement of the pointer *n*.

A screw *k* is carried by the base A at any suitable point and serves as a connection for an electrical conductor. Other electrical conductors are connected to the contacts *k*′ and k^2, and as the base A, supporting-frame C, and contact H are made of conducting materials it is obvious that the engagement of the movable contact H with either of the contacts *k*′ and k^2 will close a circuit between the screw *k* and the contact engaged by the movable contact H, it being understood, of course, that the contacts *k*′ and k^2 are insulated from the base A and from each other.

The operation of my invention is as follows: When the member B expands, it elevates the short arm D′ of the bell-crank lever, and consequently swings the lower end of the long arm of the lever inwardly. The proportion between the long and short arms of the bell-crank lever is such that a slight upward movement of the short arm will produce a relatively great movement of the lower end of the longer arm. The block G is oscillated through its pivotal connection with the lower end of the long arm of the bell-crank lever, and it in turn swings the depending contact H toward the right into engagement with the contact k^2, thereby closing a circuit which operates any suitable mechanism for reducing the supply of heat. As such mechanism forms no part of my invention, it need not be illustrated or described herein, especially as various devices—such, for instance, as dampers operated by the closing of an electrical circuit—are well known in the art. The distance between the pivot *g* of the block G and the lower end of the movable contact H is so great with respect to the distance between the pivot *g* and the connection of the block with the bell-crank lever that it is obvious a slight movement of the lower end of the bell-crank lever will produce a relatively great movement of the lower end of the contact H. It is consequently evident that a very slight expansion of the member B will be multiplied through the bell-crank lever D and the block and contact carried thereby, so as to produce the necessary movement of the contact H to cause it to engage the fixed contact k^2 upon a slight increase in temperature in the room. When the temperature in the room falls below the standard, the contraction of the member B through the screw-threaded rod E forces downwardly the short arm of the bell-crank lever and through the oscillating block G swings the movable contact H toward the left into engagement with the contact *k*′, thereby closing a circuit to the heat-supply regulator, which will effect an increase in the supply of heat. By swinging the lever M toward the left in Fig. 1 it is obvious that the plate K would be

moved toward the right and the positions of the contacts k' and k^2 so altered with respect to the movable contact H that contact k' engages the contact H and closes the circuit to effect an increase in the supply of heat, and, conversely, when the lever M is moved toward the right the plate K will be moved toward the left, thereby varying the position of contacts k' and k^2, so that the contact k^2 engages the movable contact H and closes the circuit for lessening the supply of heat. In other words, the movement of the lever M will change the predetermined degree of heat desired, as indicated by the position of the pointer n with respect to the scale N. The position of the movable contact H with respect to the fixed contacts k' and k^2 may also be adjusted by means of the nut e, which through engagement with the screw-threaded rod E and the bell-crank lever D and block G controls the position of the movable contact H. After the nut e has been adjusted as may be desired it is securely retained in such position by means of a lock-nut E'.

From the foregoing description it will be be observed that I have invented an improved themostat for regulating the temperature of a room in which a very slight variation in temperature will effect an expansible member to a sufficient degree to move a controlling member the requisite distance to increase or decrease the supply of heat. It is evident that by the employment of the bell-crank lever having the short and long arms and by the location of the pivot g of the block G adjacent to the lower end of the bell-crank lever the thermostat is rendered extremely sensitive by the multiplication of a slight expansion or contraction of the thermostat.

Having now fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a device of the character described, the combination with an expansible member, of a base upon which one end of said member is mounted, an oscillatory member pivotally mounted upon said base, a bell-crank lever having a short arm connected to said expansible member and a long arm pivotally connected to said oscillatory member, and a fulcrum for said bell-crank lever rigidly mounted upon said base.

2. In a device of the character described, the combination with an expansible member, of a base upon which one end of said member is mounted, a non-expansible supporting-frame also rigidly secured to said base, an oscillatory member pivoted to said frame, and a bell-crank lever pivoted to said frame and having a short arm connected to said expansible member and a long arm pivotally connected to said oscillatory member.

3. In a device of the character described, the combination with an expansible member, of a base upon which said member is supported, an oscillatory member pivotally mounted upon said base, and connections interposed between said expansible member and said oscillatory member whereby a slight expansion or contraction of the expansible member produces a relatively great movement of said oscillatory member.

4. In a device of the character described, the combination with a tubular expansible member, of a base to which the lower end of said member is rigidly fixed, an oscillatory member pivotally mounted upon said base and located within the lower end of said tubular member, and connections surrounded by said tubular member interposed between the free end of said tubular member and said oscillatory member whereby a slight expansion or contraction of the expansible member produces a relatively great movement of said oscillatory member.

5. In a device of the character described, the combination with a tubular expansible member, of a base to which the lower end of said member is rigidly fixed, a non-expansible supporting-frame rigidly secured to said base and extending upwardly within said tubular member, an oscillatory member pivoted to said frame near the lower end thereof, and a bell-crank lever located within said tubular member and pivoted to said frame near the upper end thereof, said bell-crank lever having a short arm connected to the free end of the expansible member and a long arm pivotally connected to the upper end of said oscillatory member.

6. In a thermostatic circuit-controller, the combination with an expansible member, of a base to which said member is rigidly fixed at one end, a movable contact pivotally mounted upon said base, connections interposed between the free end of said expansible member and said movable contact whereby a slight expansion or contraction of the expansible member produces a relatively great movement of said contact, and fixed contacts mounted upon said base and located in the path of movement of said movable contact.

7. In a thermostatic circuit-controller, the combination with a tubular expansible member, of a base to which said member is rigidly fixed at one end, a non-expansible support rigidly secured to said base and extending upwardly within said tubular member, a movable contact pivoted to said frame near the lower end thereof, a bell-crank lever pivoted to said frame near the upper end thereof and having a short arm connected to the free end of said expansible member and a long arm pivotally connected to said movable contact, and fixed contacts mounted upon said base and located in the path of movement of said movable contact.

8. In a thermostatic circuit-controller, the combination with an expansible member, of a base upon which said member is mounted, a

movable contact, connections interposed between said expansible member and said movable contact, fixed contacts located in the path of movement of said movable contact, a plate upon which said fixed contacts are supported, studs fixed to said plate and extending through a slot in said base, and a lever pivotally mounted upon said base and operatively connected to said plate at one end and depending at its other end below said base whereby oscillation of said lever reciprocates said plate relatively to the base thereby adjusting the position of the fixed contacts with respect to the movable contact.

9. In a thermostatic circuit-controller, the combination with an expansible member, of a base to which said member is fixed at its lower end, a movable contact mounted upon said base, a cap fixed upon the upper end of said expansible member, an exteriorly-screw-threaded boss on said cap, a screw-threaded rod extending through said boss, a nut engaging the end of said rod and having a flange resting upon said boss, a lock-nut engaging the screw-threads on said boss and adapted to clamp said flange against said boss, a connecting mechanism interposed between said movable contact and said rod.

10. In a thermostatic circuit-controller, the combination with an expansible member, of a base to which said member is fixed, a movable contact mounted upon said base, mechanism operatively connected to said movable contact and adjustably connected to the free end of said expansible member, fixed contacts located in the path of movement of said movable contact, and means for adjusting said fixed contacts upon said base whereby their positions relatively to said movable contact may be varied.

In testimony whereof I sign this specification in the presence of two witnesses.

GEORGE D. HOFFMAN.

Witnesses:

R. M. WILBUR,

FRED W. NORWOOD.