J. E. GEE.

THERMOSTAT.

APPLICATION FILED JUNE 1, 1920.

1,419,246. Patented June 13, 1922.

2 SHEETS—SHEET 1.

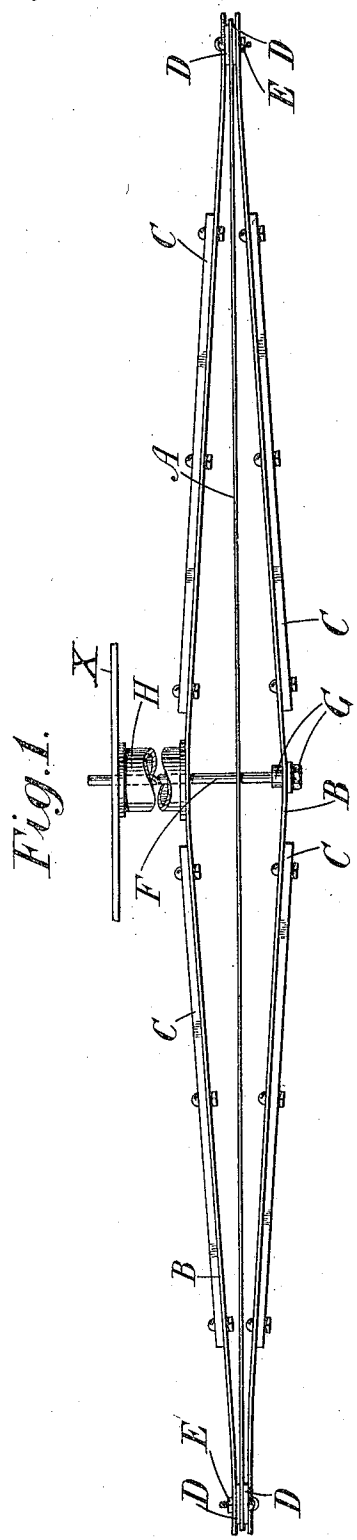


Fig. 1.

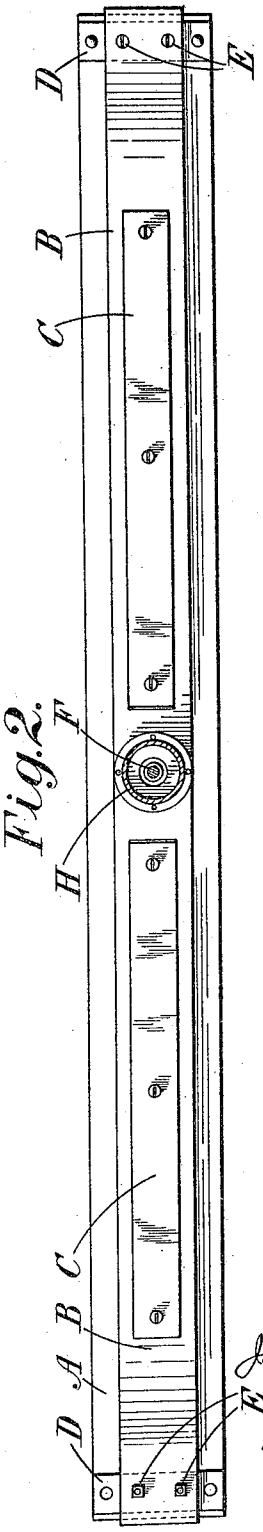


Fig. 2.

Inventor
James Edwin Gee
by
Bakewell, Byrnes & Church
Attys.

J. E. GEE.

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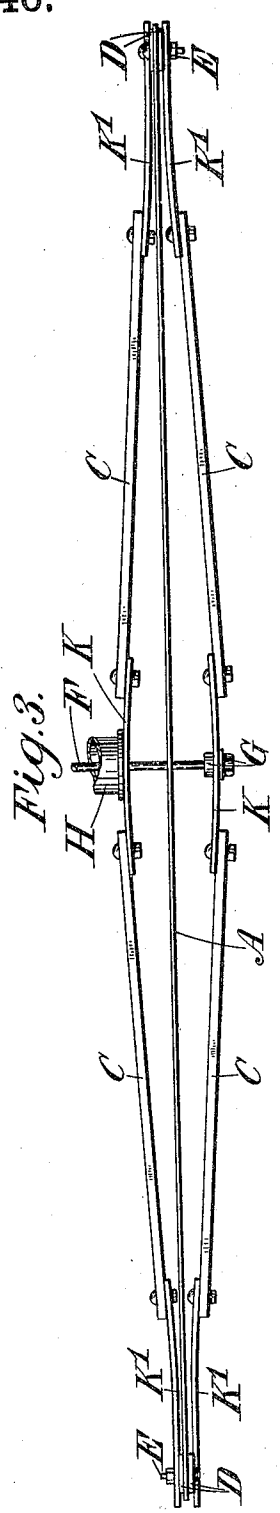


Fig. 3.

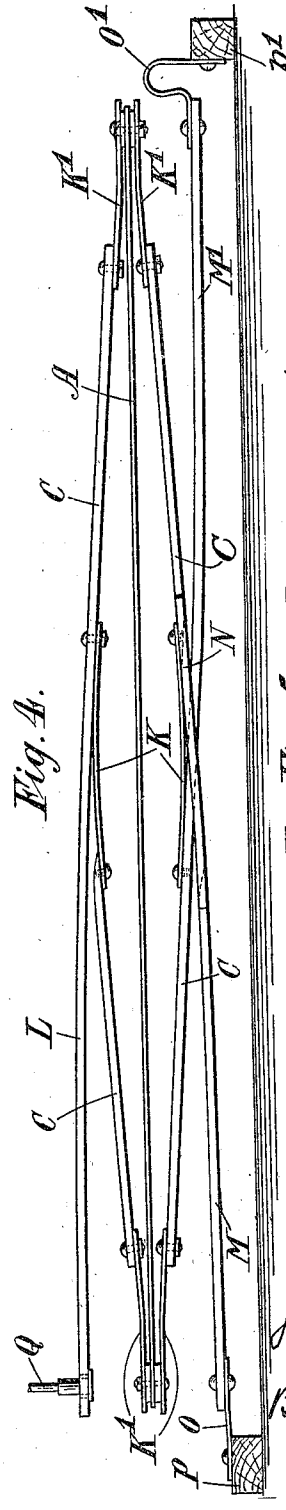


Fig. 4.

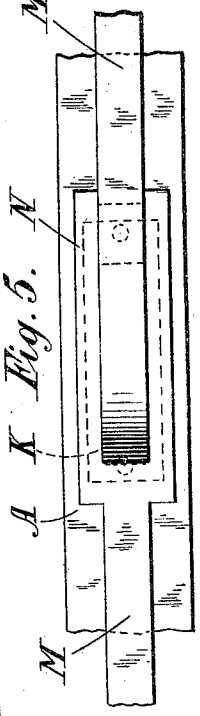


Fig. 5.

Inventor
James Edwin Gee
by
Bakewell, Byrnes & Parmelee
Attorneys.

UNITED STATES PATENT OFFICE.

JAMES EDWIN GEE, OF LONDON, ENGLAND.

THERMOSTAT.

1,419,246. Specification of Letters Patent. **Patented June 13, 1922.**

Application filed June 1, 1920. Serial No. 385,505.

To all whom it may concern:

Be it known that I, JAMES EDWIN GEE, a subject of the King of England, residing in London, England, have invented certain new and useful Improvements in Thermostats, of which the following is a specification.

This invention is for improvements in or relating to thermostats of the type constructed of two elements connected together in triangular or bow-like form of which one is formed as an elongated "straight" member of material, such for example as zinc having a comparatively high coefficient of expansion, and the other is in the form of an arch of material having a comparatively low coefficient of expansion and connected at its two ends at or near the extremities of the first named element. In practice the base has been generally used as a common base of two triangular formations one on each side of it.

Many suggestions have been made for the construction of thermostats of this type and the present invention has for its object to provide a thermostat which will be more sensitive than those hitherto in use, the object being attained by the particular construction and co-operation of the parts described more fully hereinafter.

The use of the term "straight" as applied herein to the first-named element, is intended to cover a plate which in longitudinal section is of straightline form. Also the term "arch" as applied to the second member is used herein to denote any convenient form of arched or bow-like or angled part, as for instance a member forming two sides of a triangle.

According to the present invention a thermostat of the type described is characterized by the straight member being constituted by a thin flexible sheet of metal and the arched member or members being each constituted by a springy metal strip stiffened at each side of its central portion so as to leave that portion and both ends flexible and resilient, the said arched member or members being such as to exert a tension along the straight member in the direction of its length to draw the straight member substantially taut notwithstanding its expansion and contraction by reason of changes of temperature. The purpose of stiffening each arched member is to render those stiffened portions inflexible and to leave the middle and end portions sufficiently flexible and resilient so as to concentrate the movement of the arched member in the region of the central portion and to provide the necessary resilience of the arched member to maintain the straight and otherwise flexible member substantially taut.

According to a modification of the invention each arched member is constructed in the form of a thin flexible and resilient strip to which inflexible stiffening bars are rigidly secured.

A further feature of the invention is that it enables a thermostat of any one of the above-described constructions, to be used in conjunction with an incubator in such a manner that the "straight" or non-arched member, that is to say the member with the high coefficient of expansion, is, throughout its length, substantially on the level of the egg-line of the incubator. Conveniently the "straight" member can be constituted by two sheets of material spaced apart and arranged one on either side of the egg-line and at equal distances away from that line.

Some specific and preferred forms of the invention will now be described in detail with the aid of the accompanying drawings, in which—

Figure 1 is an edge view of the thermostat elements;

Figure 2 is a plan of Figure 1;

Figure 3 is a similar view to Figure 1 of a modified form of the invention;

Figure 4 is an edge view of a modified form of thermostat; and

Figure 5 is a plan looking from the underside of the thermostat.

Like letters indicate like parts throughout the drawings.

In Figures 1 and 2 the central member of the thermostat comprises a rectangular and comparatively thin sheet of zinc A, the length of which is great in comparison with its width. This member constitutes the base of a triangular construction of which the other sides are formed by arched elements B.

Each of the latter elements is preferably composed of elongated thin strips of steel which are both flexible and resilient. Each member B is provided with stiffeners in the form of bars C also of steel which are in themselves rigid and are secured to the member A by nuts and bolts as shown. The bars C are of such dimensions as to leave the central portions and the extremities of the members B free of this added stiffening. Each of the members B, therefore, constitutes two

comparatively rigid steel members, the inner ends of which are spaced apart and are connected or bridged by means of a springy steel strip and which are connected at their outer extremities to the zinc plate A through the medium of the springy steel strips.

To each end of the member A, and on each face of it, are secured transverse bars D riveted to the plate A. To the outer surfaces of the bars D are secured the ends of the members B by means of nuts and bolts E.

The central portions of the members B and their extremities are sufficiently flexible to allow ready movement of the parts during expansion or contraction.

It is preferred to assemble each member comprising the parts B and C in the form of a flat plate sufficiently greater in length than the zinc plate, so that when it is connected to the latter the ends of the member B meet the plate A at an angle of about 4 or 5 degrees. When the members B are secured to the member A, the springiness of the members B tends to draw the member A taut, and to retain it so during variation in temperature. The effect of the stiffening plates C is to concentrate the movement of the thermostat in the region of the rod F.

Either or both of the members B are connected in known manner to whatever device the thermostat is required to control. In the form shown, a rod F is connected by means of nuts G to the lower member B and passes through orifices in the member A and in the upper member B respectively for free endwise movement. The upper end of the rod F can then be connected to any desired controlling device. The thermostat is secured to a portion of the incubator-casing, for example the top wall indicated by the letter X, by means of a tube H secured at its opposite ends to the middle or apex of the upper member B and to the part X respectively. The rod F passes through the member H and through an orifice in the part X, and it will be appreciated therefore that the combined movements of the two members B are added to one another in the movement which is imparted by the rod F to the controlling device.

It will be readily appreciated that with a rise in temperature the zinc plate A expands in length to a greater extent than do the steel arches B, so that the latter are straightened out or collapsed towards the zinc plate. With a fall in temperature a reversal of this movement takes place.

In the modification illustrated in Figure 3, the members C, instead of being applied to a single length of springy or flexible material such as B, are connected or spanned as to their adjacent or inner ends by a strip of flexible material K suitably connected therewith and their outer ends are similarly provided with flat plates K^1 of flexible material by which they are connected with the member A.

In Figures 4 and 5 a modified form of thermostat is shown in which the straight and arched members are constructed mainly in a similar manner to the form in which they are illustrated in Figure 3. Of the upper arched member, however, one of the stiffening members C is extended free of the flexible connector K and beyond it in a portion L which extends approximately to the opposite end of the thermostat couple as shown. Of the lower arched member both of the parts C are extended in opposite directions beyond the central connecting strip K to opposite extremities of the thermostat couple in portions M M^1. In order to permit of a symmetrical construction the extended portion M of the right-hand member C is enlarged at N and the central part of the enlargement is removed. This affords an orifice through which the extension M^1 of the left-hand member C can pass. The free end of the extension M is secured by means of a strip spring O to a base-block P mounted on any desired support and the corresponding end of the extension M^1 is connected by means of a looped strip spring O^1 to a fixed block P^1.

The free extremity of the extension L has means Q by which it may be secured to a wire or other connector forming part of an operative connection between the thermostat and the device that it is to control.

With the construction described the movement imparted to the member which is controlled by the thermostat is considerably amplified in comparison with that which would be given by the previously described constructions and during movement of the parts under the influence of heating or cooling the spring Q or flexible connector of other preferred construction will yield sufficiently to allow free movement of the extensions M and M^1 without impeding the operation of the thermostat couple.

When using the thermostat with an incubator it is preferable that the zinc member, that is to say that having the greater coefficient of expansion, be on a level with the egg-line so that variations in temperature of this zone may be the variations of temperature which effect that member. Conveniently two zinc plates may be employed in place of the single member A and these plates can be spaced apart with distance-pieces between them and they can be so disposed that one plate is above and the other plate below at approximately equal distances away from the egg-line; otherwise the construction of the thermostat as a whole may be similar to that described above.

For the purpose of this invention the term "egg-line" is used to denote a line in

any horizontal plane between the limits of the vertical diameter of the egg. As all the eggs will not be of exactly the same dimensions it will be appreciated that the limiting planes above referred to can only be considered in the light of approximate planes to define the region within which the egg-line may be said to lie.

When the thermostat is employed for regulating the temperature of a container other than an incubator it is preferred that the member having the greater coefficient of expansion be situated in a zone in which it is most desirable that temperature variations should be controlled.

Obviously the invention admits of modifications in details of construction. For instance it is not necessary that the particular metals referred to herein should be those employed for the thermostat elements provided that two metals are chosen, as is well understood, having the requisite disparity between their coefficients of expansion.

The zinc or like strip should be sufficiently thin as to be readily affected by the variations of temperature yet strong enough to withstand the stresses to which it is subjected. If difficulty is encountered in obtaining the requisite length with the desired thinness and rigidity, the zinc or "straight" element such as A may be composed of two or more strips superimposed one above the other with spaces between them for the circulation of the air or other medium in which they are employed.

The movement of the thermostat may be multiplied by transmission to a rock-shaft or other part which is to receive movement or adjustment from the thermostat.

What I claim as my invention and desire to secure by Letters Patent is:—

1. A thermostat of the type described comprising in combination a straight member constituted by at least one thin flexible sheet of metal, and at least one arched member constituted by a springy or resilient length of metal which is stiffened on both sides of its central portion so as to leave that central portion and both ends flexible and resilient, thus constituting a spring-element, the said arched spring-element being connected in compression to the straight member so that it is adapted to exert a tension along the straight member in the direction of its length even when the latter is expanded under the action of heat, and thus to tend to draw the straight member substantially taut notwithstanding its expansion and contraction by reason of changes of temperature, substantially as described.

2. A thermostat of the type described, comprising in combination a straight member constituted by at least one thin flexible sheet of metal, and at least one arched member constituted by thin flexible portions and inflexible bars, so secured thereto that the arched member is flexible and resilient at its two ends and at its central portion, the said arched member being adapted to exert a tension along the straight member in the direction of its length to draw the straight member substantially taut notwithstanding its expansion and contraction by reason of changes of temperature, substantially as described.

3. A thermostat of the type described, comprising in combination a straight member constituted by at least one thin flexible sheet of metal and at least one arched member constituted by two substantially straight and rigid arms, which arms at their highest points are separated and bridged by a flexible and resilient strip secured to them and at their other ends are flexibly and resiliently connected to the straight member, the said arched members being adapted to exert a tension along the straight member in the direction of its length to draw the straight member substantially taut notwithstanding its expansion and contraction by means of changes of temperature, substantially as described.

4. A thermostat of the type described, comprising in combination a straight member constituted by at least one thin flexible sheet of metal, at least one arched member secured at its ends to the straight member and constituted by a single thin flexible and resilient strip to which inflexible stiffening bars are secured to leave the two ends and middle portion of the arched member resilient and flexible, the said arched member being adapted to exert a tension along the straight member in the direction of its length to draw the straight member substantially taut notwithstanding its expansion and contraction by reason of changes of temperature, substantially as described.

In testimony whereof I affix my signature.

JAMES EDWIN GEE.