

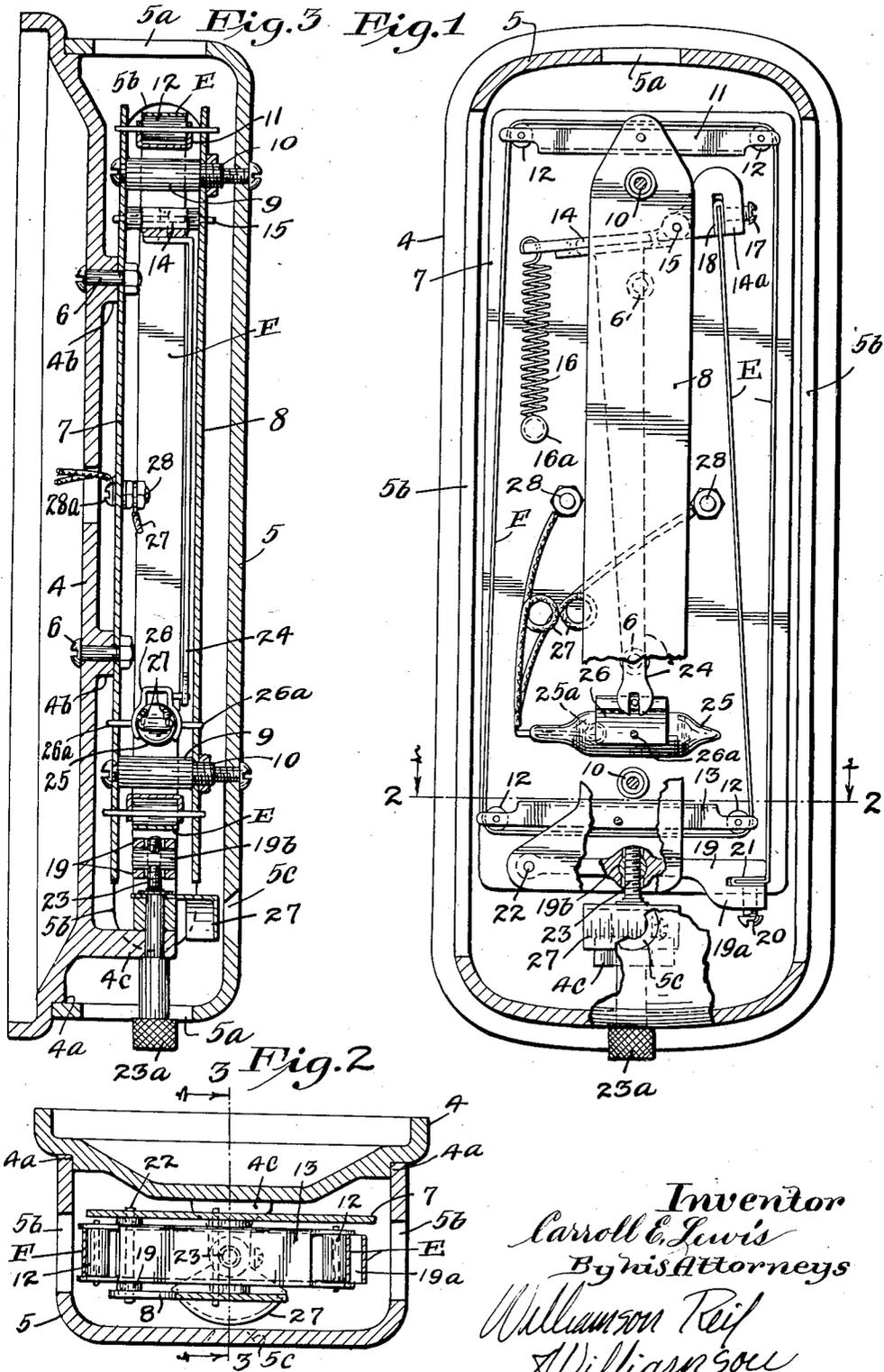
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HUMIDITY REGULATOR

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HUMIDITY REGULATOR

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This invention relates to humidity controlling or responsive devices and has for an object the provision of a humidity regulator, or hygrometer, which is accurate and highly sensitive in nature, responding to slight variations in the humidity of the air to which it is subjected.

A further object of the invention is to provide a mechanism of the type described, adapted to control electric circuits for operating a device which supplies and controls the admission or distribution of water or moisture to a humidifier.

It is a further object to provide a humidity controller which may be readily and accurately adjusted to maintain the humidity of a room or building at a desired level.

These and other objects and advantages of the invention will be fully set forth in the following description made in connection with the accompanying drawing wherein like reference characters refer to similar parts throughout the several views and wherein;

Fig. 1 is a vertical section taken through the casing of an embodiment of my invention showing most of the working mechanism of the device in plan;

Fig. 2 is a horizontal cross section taken on the line 2-2 of Fig. 1; and

Fig. 3 is a vertical section taken on the line 3-3 of Fig. 2.

The embodiment of my invention illustrated, in the drawing, is mounted on a suitable shell base 4, as shown of oblong shape having a rectangular flange or shoulder 4a about which a protective casing 5 is detachably fitted. Casing 5 may be provided at its upper and lower ends with apertures 5a and at its longitudinal sides with apertures 5b to permit the free circulation of air through the interior of the casing.

As shown, the working parts of my device are assembled in the form of a unit, which is detachably secured to the shell base 4 by means of bolts 6 and spaced from said base by a pair of outwardly projecting bosses 4b, as shown, integrally formed with the base. It will, of course, be obvious that the several working parts of my device may be directly connected with the base if so desired. My said control unit may include a rectangular backing plate 7 and a relatively narrow front plate 8 spaced from plate 7 in any suitable manner, such as by a pair of spacing sleeves 9 through which clamping bolts 10 extend securing the plates 7 and 8 together in the form of a frame. A substantially horizontal bracket 11 is mounted in the upper end of said frame between plates 7 and 8 and may comprise a channel member hav-

ing notched or cut out end portions to afford forked extremities and a small roller 12 may be journaled in each of the forked ends positioned somewhat inwardly of the extremities in order that said extremities may cooperate therewith to form guides. A similar bracket 13 is mounted adjacent the lower end of the frame between plates 7 and 8 provided with suitable rollers 12. A relatively short actuating lever 14 is pivoted on a pin 15 between plates 7 and 8 and at a point below the upper guide bracket 11. Lever 14 extends transversely across my said unit frame and has its longer or left hand end connected with a contractile spring 16, which yieldingly impels the lever in one direction, spring 16 being anchored to backing plate 7 by a rivet 16a.

The shorter or right hand end of lever 14 is provided with a clamping head 14a which, as shown, has a deep receiving slot in the lower portion thereof and is provided with a set screw 17 adapted to cooperate with the slotted receiving portion.

My humidity responsive element E, in the form of an elongated flexible strip of material, which is contractible and expansible with variations in the degree of humidity to which it is subjected, is secured at one end to clamping head 14a, usually provided at said end with a small clip 18, which snugly fits the receiving slot of the clamping head. Element E may be constructed from any suitable material, which has moisture absorbing qualities, strength and durability and which is longitudinally expansible and contractible with variations in humidity. Elements constructed from silk floss, moisture expansible paper, woven textile material and human hair, have been found entirely satisfactory for the purpose, although other numerous flexible materials may be used. The preferred form of element E illustrated in the drawing comprises an elongated, flexible, integrally constructed ribbon in the form of a relatively wide strip of very thin sheet material, such as moisture-expansive paper or other uniformly manufactured or synthetic material. I have found that the sensitivity and accuracy of such an element as contrasted with natural filaments, tissues or threads is greatly superior in that maximum tensile strength can be obtained with minimum thickness of material and further in that a relatively large exposed area is presented to the air or fluid medium and further in that due to the very thin construction substantially the entire cross section of the element will be impregnated or affected by the moisture, while with cords or filaments the longitudinal center or core

is not quickly affected by variations in moisture. The strip or element E extends downwardly from clamping head 14a and is trained about the rollers 12 of bracket 13 and about the rollers of bracket 11, the forked extremities of brackets 11 and 13 assisting in guiding the strip or element and preventing lateral displacement thereof from the guide rollers. The opposite end of element E extends downwardly from the right hand end of bracket 11 and is clamped in a suitable clamping head 19a of a relatively fixed anchoring member 19. Clamping head 19 may be formed similar to the clamping head 14a of lever 14 having a set screw 20 adapted to react against a clip 21 on the said engaged end of element E.

It will be seen that my humidity responsive element is compactly arranged within casing 5 in coil formation and thus a relatively long element may be used in a small device having relatively large longitudinal variation with changes in the humidity of the air to which it is subjected.

The anchoring member 19 is provided with fine adjustment of micrometer type and to this end, is pivoted at its left hand extremity by means of a pivot member 22 between plates 7 and 8, forming a lever of the second order. The intermediate portion of the anchoring member 19 carries a ball or other element 19b which is threadedly engaged by a short vertical adjusting worm 23, which may be journaled in a suitable bearing-provided lug 4c projecting outwardly from the lower end of the base 4 and, if desired, formed integrally therewith. Worm 23, as shown, is provided at its lower end with a knurled handle or knob 23a which projects through the lower aperture 5a in casing 5 for convenient manipulation. The adjusting worm may rigidly carry an indicator segment 27 having graduations or other indicia on the exterior surface thereof, which may be viewed through a small sight opening 5c formed in the lower portion of the face of casing 5.

An elongated depending arm is rigidly fixed to the longer arm of lever 14, extends longitudinally of the control unit and between plates 7 and 8, this arm with lever 14 forming a bell crank lever and greatly multiplying, at its outer end, the movement of the shorter end of lever 14. Below the outer end of elongated arm 24, an oscillatory mercury tube switch is mounted, of the type comprising a sealed glass capsule 25 having therein a small quantity of mercury and provided with a pair of insulated electrical contacts 25a projecting some distance into the interior of the capsule and electrically connected by the mercury when the tube is oscillated to a predetermined position. A clip 26 is secured to the medial portion of the tube 25, and this clip is provided by means of pins or trunnions 26a between the plates 7 and 8. The outer end of elongated arm 24 is suitably connected with the clip 26 at a point eccentric of the pivot in the mercury tube. This connection may be in the form shown consisting of a slotted pin connection. The contacts 25a are connected by short flexible wires 27 with a pair of binding posts 28 extended through plate 7 and having terminals 28a at the rear of plate 7 to which suitable electric service wires 29 may be secured, said service wires passing through a suitable aperture in the shell base 4, the concavo-convex shape of the base serving to house and conceal any additional length of service wires required.

In most humidifying systems a humidifier is provided to supply moisture to the air, and where humidity control is used a magnetically con-

trolled valve, or other electrically operated mechanism is usually furnished for controlling the supply of moisture to the humidifier. My humidity regulator is, of course, adapted to be utilized for controlling the electrical circuit for opening and closing the valve, or for controlling the device for supplying moisture to the humidifier.

Operation

The operation of my improved device may be briefly described as follows:

The worm of screw 23 is first adjusted so that the tension of the spring 16 will be balanced by the tension of the element or strip E to cause the mercury tube 25 to be maintained substantially in the position shown in the drawing, when the humidity of the air is at a predetermined percentage. In this position, the contacts of the mercury tube are not covered with mercury and the circuit is open.

A decrease in the humidity of the air to which element E is subjected with cause element E to contract longitudinally, pulling the shorter arm of lever 14 downwardly against the tension of spring 16, and thereby causing the elongated arm 24 of bell crank lever to swing to the left. This swinging movement oscillates mercury tube 25, swinging the left end of said tube downwardly and thereby causing the mercury to run to that end, covering the contacts enclosing the circuit.

When the humidity of the air exceeds a predetermined percentage, element E will be expanded a sufficient distance to permit contractual spring 16 to swing lever 14 sufficiently to return the oscillator tube 25 to a position where the contact 25a will not be electrically connected by the mercury.

It will be noticed that while the anchoring element 19 is a relatively fixed element, its position can be very finely adjusted by means of worm 23, thus varying the tension strip or element E, thereby adjusting the mechanism for various humidities desired within, of course, certain limits.

It will further be seen that a very slight movement of the short end of actuating lever 14 produces a relatively larger movement on the lower or outer end of the arm 24 which is connected with the mercury tube. This, coupled with the fact that a relatively long flexible humidity responsive element, is utilized with my structure, producing a device which is very quickly responsive to slight variations in the humidity of the air to which it is subjected.

The mounting of the flexible humidity responsive element permits said element to expand or contract throughout its length with a minimum of friction, but it will, of course, be understood that any suitable guides may be used for tensioning and arranging the element E in substantially the manner illustrated.

The indicator mounted upon the worm 23 provides a convenient means for setting the device for predetermined humidity, the reading being taken through the small aperture 5c in the face of casing 5.

In actual practice I have found that my device, constructed in the manner illustrated, is responsive to variations of less than four per cent in the humidity of the air to such extent as to open and close the circuit.

It will, of course, be understood that various changes may be made in the form, details,

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arrangement and proportions of the parts without departing from the scope of my invention.

What I claim is:

5 1. In a humidity regulator, a support, an actuating lever pivoted adjacent one end of said support, means for yieldingly urging said lever in one direction, a series of rectangularly arranged guides projecting outwardly from the face of said support, an elongated flexible element expansible and contractible with variations in the humidity of the air, said element being wrapped around said guides and held in substantially annular arrangement thereby surrounding said actuating lever, one end of said element being anchored, the opposite end being secured to said actuating lever and means for multiplying the movement of said actuating lever rigidly connected therewith.

10 2. In an instrument responsive to humidity variations, a support, a set of guides mounted on said support and arranged in the corners of a polygon, an elongated flexible element expansible and contractible with variations in the humidity of the medium to which it is subjected, said element being wrapped around said guides, means for anchoring one end of said element, a shiftable member connected with the opposite end of said element, elastic means connected with said shiftable member for maintaining said element under constant tension and means connected with said shiftable member for multiplying the movement thereof, said shiftable member, said tensioning means and said movement multiplying means all being mounted within the confines of said wrapped element whereby the exterior of said element will be freely exposed to the air.

15 3. In an instrument responsive to humidity variations, a support, an elongated flexible element expansible and contractible with variations in the humidity of the fluid medium to which it is subjected, a set of guides mounted on said support and arranged to hold said element in annular form, said element as annularly arranged having end runs extending in the same general direction, means for anchoring one of the ends of said element, a pivoted member connected to the opposite end of said element and disposed within the confines of said annularly arranged element, means for maintaining said element under constant tension and means associated with said pivoted member for multiplying the swinging movement thereof.

20 4. In an instrument responsive to humidity variations, a support, an elongated, flexible, integrally constructed ribbon in the form of a

relatively wide strip of thin sheet material of a nature expansible and contractible with variations in the humidity of the air to which it is subjected, several spaced guides mounted on said support around which said flexible ribbon is wrapped in curved formation, means removed some distance from said guides and considerably out of alignment therewith for anchoring one end of said flexible ribbon, actuating mechanism also removed some distance from said guides considerably out of alignment therewith connected with one end of said ribbon and constructed to multiply the expansive and contractive movements of said ribbon and means for maintaining said ribbon under light tension, said ribbon being arranged and held by said guides in more or less annular form.

25 5. In an instrument responsive to humidity variations, a support, an elongated flexible element expansible and contractible with variations in the humidity of the fluid medium to which it is subjected, at least a pair of spaced guides mounted on said support around which said flexible element is wrapped, means for anchoring one end of said element at a point removed some distance from said guides, actuating mechanism also removed some distance from said guides and connected with the other end of said element and constructed to greatly multiply the expansive and contractive movements of said element, means for maintaining said element under constant and light tension, said element being arranged and held by said guides in more or less annular form, said actuating mechanism and said tensioning means being mounted within the confines of said wrapped element whereby the exterior of said element will be freely exposed to the air.

30 6. In an instrument responsive to variations in the humidity of the air, an elongated, flexible, integrally constructed ribbon in the form of a relatively wide strip of thin sheet material, such as paper, of a nature expansible and contractible with variations in the degree of humidity to which it is subjected, said ribbon having a plurality of runs or courses arranged at angles, means for anchoring one end of said ribbon, actuating mechanism connected with the other end of said ribbon and compactly disposed inwardly of the runs of said ribbon, said actuating mechanism being constructed to greatly multiply the expansive and contractive movements of said ribbon and means for maintaining said ribbon under constant and slight tension.

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