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C. B. SAWYER

THERMOSTATIC CONTROLLING MECHANISM

Filed Nov. 17, 1922

Fig. 1

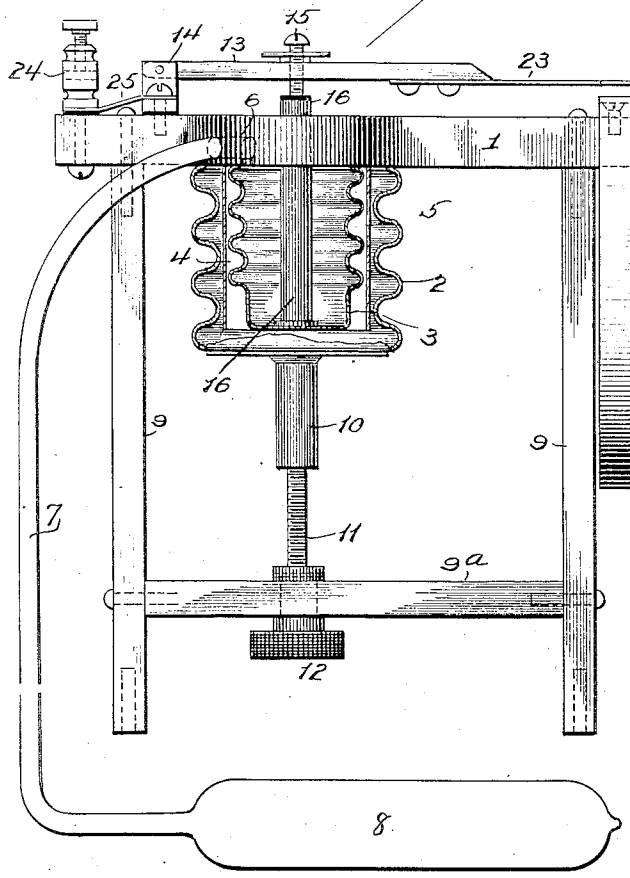


Fig. 2

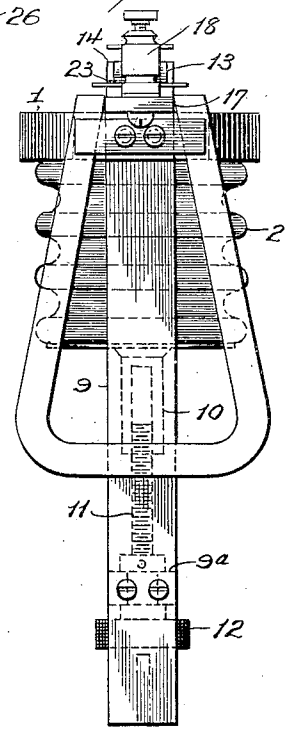
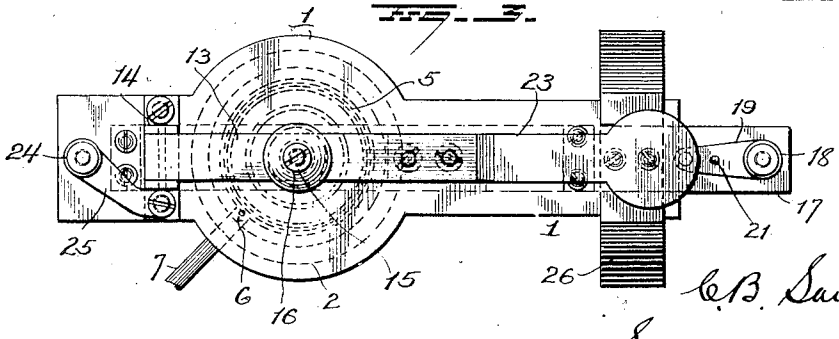


Fig. 3



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UNITED STATES PATENT OFFICE.

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THERMOSTATIC CONTROLLING MECHANISM.

Application filed November 17, 1922. Serial No. 601,653.

This invention relates to improvements in controlling mechanism and more particularly to electric circuit making and breaking mechanism especially adapted to be operated and controlled by thermostatic means, whereby electrical heating means for a chamber or a controller for such heating means shall be accurately controlled in accordance with slight temperature changes in such chamber and thus accurately maintain a substantially constant temperature in said chamber.

One object of my present invention is to provide simple, accurate and efficient mechanism which shall be operable by thermostatic devices, for controlling the electric circuit for a heater or the circuit of a controller for such heater, and thus insure the maintenance of a substantially constant temperature in a chamber with which said heater may be employed.

A further object is to provide, in a simple and efficient structure, circuit controlling mechanism including a magnet cooperable with a movable member of such mechanism to insure quick opening and closing of an electric circuit when said movable member is operated by means independently of said magnet, and to so construct such circuit controlling mechanism, that the armature of said magnet shall be so constructed and arranged that its motion toward the magnet shall compress or flex a spring in opposition to the motion imparted to the armature by the magnet, so that a stop shall be provided which will definitely or positively limit the motion of the armature toward the magnet; and so that a follow-up spring action for one of the contacts shall be so provided that as the armature moves away from the magnet, such follow-up spring action will serve to keep the contacts together until the armature becomes sufficiently removed from the field of influence of the magnet.

With these and other objects in view, the invention consists in certain novel features of construction and combinations of parts as hereinafter set forth and pointed out in the claims.

In the accompanying drawings;

Figure 1 is a view partly in elevation and partly in section showing an embodiment of my invention;

Figure 2 is an end view, and

Figure 3 is a plan view.

In the embodiment of my invention illustrated in the drawings, I have shown a base block or plate 1, to the under side of which, the upper edges of metal bellows 2 and 3 are permanently secured by welding, brazing, soldering or in any other manner to effect an air tight connection. The bellows 3 is appreciably smaller in diameter than the bellows 2 and is located within the latter so that a chamber 4 is formed to contain an expansible liquid,—such as benzine, for example. A cylinder 5 of thin metal and open at its lower end is disposed between the two bellows to prevent possible interlocking of the folds of said bellows. The base block or plate 1 is provided with a duct 6 which communicates at one end with the chamber 4 between the bellows and with the other end of said duct, one end of a tube 7 is connected,—the other end of said tube having a bulb 8 (preferably of metal) connected thereto and intended to be located in a chamber, the temperature of which is to be regulated. The bulb 8, tube 7 duct 6 and chamber 4 are completely filled with expansible liquid so that no vapor space will be left in the system comprising these elements, and such liquid may be introduced through a suitable opening in the bulb and such opening then permanently closed.

The block or plate 1 and the parts carried thereby may be supported on a yoke or frame 9 to which said block or plate may be suitably secured, and the bottom of the bellows 2 is provided with a depending rod or tube 10 which is internally threaded to receive a screw rod 11, the latter having swivel connection with the cross bar 9^a of the yoke or frame 9 and provided with a manually operable knob 12. By thus connecting the bottom of the bellows 2 with the yoke or frame, said bellows will be held normally stationary but the screw connection also affords means whereby said bellows may be adjusted to alter its capacity. The general arrangement of the thermostat cartridge and the adjustment mechanism constitutes the subject matter of my copending application Serial No. 601,652, filed Nov. 17th, 1922 and entitled "Thermostat controlling mechanism."

In the embodiment of my invention shown in the drawings, a lever 13 is pivotally supported at one end by a bracket 14 mounted upon and insulated from the block or plate

1 near one end of the latter and this lever carries an adjusting screw 15, the lower end of which is engaged by the insulated upper end of a post 16 carried by the movable head of the inner bellows 3.

An insulating block 17, secured to the base plate 1, carries a binding post 18, to which is attached a flat spring 19, and the latter carries a contact point 20,—upward motion of the spring 19 being limited by a stop 21. The movable contact 22 of the make-and-break mechanism is carried by the free end portion of a steel spring arm 23 secured to and in effect constituting a continuation of the pivoted lever 13. The contacts 20 and 22 may be connected, in any suitable manner in circuit with an electric heater or with controlling means for a heater, but as these details form no part of my present invention they need not be shown and described herein. It may be explained however, that one circuit wire will be connected with the binding post 18, and the other with a binding post 24 secured to but insulated from the block or plate 1 and connected by a conductor 25 with the bracket 14 to which the lever 13 is pivoted.

A magnet 26 (preferably of the horseshoe type) may be supported on the end of the base plate 1, in such position that its poles will be in proximity to the steel spring 23, the latter acting, in effect, as an armature for said magnet, so that when the contact 22 approaches the contact 20, said spring will come within the lines of force of the magnet and the contacts caused to close quickly, the force of said magnet being sufficient to force the spring 19 down against the insulating block 17 which arrests the travel of the spring 23 and prevents it from striking the poles of the magnet 26.

When the upward force of the head of bellows 3, acting through the rod or post 16, and pivoted member 13 has flexed spring 23 sufficiently, said spring will leave the magnet 26, but spring 19 will cause contact point 20 to follow-up and remain in contact with contact point 22 until restrained by the stop 21. Thus at the time when the force exerted by flexed spring 23 is almost equal to restraining force of magnet 26, the spring 19 holds the contact points firmly together and prevents fluttering and consequent destructive sparking which might otherwise occur at this time. Furthermore, the spring 19 holds the contact points together until the spring 23 has definitely left the magnet 26 and is moving rapidly, so that the circuit is broken suddenly and with a minimum of sparking when the stop 21 restrains the motion of contact point 20. Should the contact points 20 and 22 stick together by reason of an unduly large electric current through them, or for any other cause, the pivoted member 13 in conjunction with the spring member 23 will constitute a toggle joint system, actuated near its middle point by post 16, so that a large force will be developed tending to slide the contact points 22—20, one over the other in addition to the normal separating force, and in this way break them apart and effect their separation. In normal operation, this toggle joint action is likewise present to some extent, and causes lateral or sliding motion of the contact points with respect to each other, both on opening and closing, which tends to keep the contact surfaces bright and in good electrical condition.

The device will be so initially adjusted that when a predetermined temperature has been attained in the chamber, (the temperature of which is to be kept constant), the circuit closer will be operated to open the circuit of the heater. Such adjustment is effected by adjusting the position of the head of the larger bellows 2 by means of the adjusting screw 11. When the head of bellows 2 is lowered, the atmospheric pressure acting on bellows 3 will extend it sufficiently to maintain constant the volume of space 4 between bellows 2 and 3, since this space and the thermostatic system communicating with it is completely filled with liquid, without vapor or gas space. This extension of bellows 3 will cause the contact points to come together and close the electric circuit, and a higher temperature than before will be necessary to cause the circuit to open, but when this temperature is reached, the device will operate as before to maintain this temperature constant. Conversely, raising the head of the bellows 2 by means of the adjusting screw 11 will cause the device to operate at and maintain constant a lower temperature.

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

1. In mechanism of the character described, the combination of a pivoted member including a flexible part carrying a contact, a contact cooperable with said first-mentioned contact, and a means cooperable with said pivoted member for moving it, whereby said member will have a toggle action to cause the contact carried thereby to wipe the other contact and also to separate one contact from the other, the connection between the contact carried by said pivoted member and the pivotal mounting therefor being substantially inextensible within the normal range of operation of the mechanism.

2. In mechanism of the character described, the combination of a pivoted lever of substantially non-flexing structure, a spring arm rigid therewith and provided with a contact, a contact cooperable with said first-mentioned contact, a thermostatic

device having a movable part cooperable with said lever, and a magnet having cooperative relation to said spring arm between the contact thereon and said lever, the connection between the contact carried by said pivoted member and the pivotal mounting therefor being substantially inextensible for the normal range of operation of the mechanism.

3. In mechanism of the character described, the combination of a pivoted lever provided with a flexible part carrying a contact, another contact for cooperation with the first-mentioned contact, a magnet operatively associated with said flexible part, means operable to limit the movement of said flexible part toward the magnet, and a thermostatic device cooperable with said lever, the connection between the contact carried by said pivoted member and the pivotal mounting therefor and the connection between the second contact member and the mounting of the follow-up spring therefor each being substantially inextensible.

4. In mechanism of the character described, the combination of a pivoted lever provided with a flexible part carrying a contact, a follow-up spring carrying a contact for cooperation with said first mentioned contact, a magnet cooperatively associated with the flexible part of said lever, and a thermostatic device having a movable member operatively associated with said lever, the connection between the contact carried by said pivoted member and the pivotal mounting therefor and the connection between the second contact member and the mounting of the follow-up spring therefor each being substantially inextensible.

5. In mechanism of the character described, the combination of a pivoted lever provided with a flexible part carrying a contact, a follow-up spring carrying a second contact for cooperation with said first mentioned contact, and a stop for limiting the movement of the follow-up spring when the first contact carried on the flexible part of the lever moves away from the second contact, a magnet cooperatively associated with the flexible part of said lever, and a thermostatic device having a movable member operatively associated with said lever, the connection between the contact carried by said pivoted member and the pivotal mounting therefor and the connection between the second contact member and the mounting of the follow-up spring therefor each being substantially inextensible.

6. In mechanism of the character described, the combination of a base plate, a thermostatic device supported by said base plate, a lever pivotally mounted on said base plate and including a flexible member, connecting means between said lever and a movable part of said thermostatic device, a contact carried by the flexible member of said lever, a magnet supported by the base plate and cooperable with said flexible member, an insulating member projecting from said base plate, and a follow-up spring secured to said insulating member and carrying a second contact cooperable with said first-mentioned contact, the connection between the contact carried by said pivoted member and the pivotal mounting therefor and the connection between the second contact member and the mounting of the follow-up spring therefor each being substantially inextensible.

7. In mechanism of the character described, the combination with a support, and a contact member carried thereby, of a movable contact member cooperable with the first-mentioned contact member, said movable contact member including a pivoted arm and a spring arm carried thereby, a thermostatic device connected with said pivoted arm, and a magnet cooperable with said spring arm rearwardly of the free end thereof, the connection between the movable contact and the pivot mounting for said pivot arm being substantially inextensible in the direction of the arm.

8. A sensitively actuated electrical switching mechanism comprising an actuating element capable of exerting relatively great force over small range of positive movement, a pivotal support, a lever actuated by said actuating element pivotally mounted on said support, the pivoted portion of said lever being relatively rigid to provide a substantially non-flexing portion between the point of application of the force from said actuating element and the pivotal support for said lever, said lever also having a flexible portion, an armature carried by the flexible portion of said lever, an electrical contact member carried by the flexible portion of said lever, and a second contact member carried by the support, a magnet adapted to actuate said armature under predetermined conditions to maintain said contact members in contacting relation, the non-flexing portion of said pivoted lever being adapted to follow the movements of said actuating element, said lever being substantially inextensible between the pivot mounting and the contact carrying portion whereby shearing stresses are developed between said contact members at the instant before separation when the actuating mechanism flexes the flexible portion of said lever and the contact elements remain in engagement.

9. In temperature controlling apparatus the combination with a chamber completely filled with liquid and having an expansible portion movable in response to changes in volume of said liquid, an electric circuit opening and closing mechanism adapted to

be actuated by the movable portion of said enclosed chamber, said circuit opening and closing mechanism comprising a pivotally mounted lever having a portion adapted to move with the movable portion of said enclosed chamber and a second relatively flexible portion, a contact member carried by the flexible portion of the lever remote from the pivotal mounting of the lever, and a second contact member adapted to cooperate therewith to control an electric circuit, means adapted to delay the operation of the flexible end portion of the lever in order that its operation may always be slightly delayed relative to the operation of the movable portion of said chamber at the instant of separation of said contact members in order to insure critical operation of the contact members that is materially more rapid than the corresponding movement of the movable portion of the enclosed chamber.

10. An electric circuit controlling mechanism comprising a base, a lever having a relatively rigid portion and a flexible portion, a pivotal support connecting the relatively rigid portion of said lever to said base, an actuating element capable of exerting a relatively great force over a relatively small range of movement adapted to actuate the relatively rigid portion of said lever, a contact member carried by the flexible portion of said lever, the lever between the pivotal mounting and the contact member being substantially inextensible over the normal range of operation of the device, and a second contact carried by the base, means for delaying the operation of the flexible end portion of the lever relative to the movement of the actuating element prior to separation of the contact members to insure critical operation of the contact members that is materially more rapid than the corresponding movement of the actuating element, the operation of said actuating element being adapted to slightly flex the flexible portion of said lever under predetermined conditions when said contact members remain in closed position thereby tending to slide one contact member over the other contact member at the instant preceding separation to effect a positive release of said contact members.

11. An electric switch mechanism, comprising a lever including a rigid member and a flexible member, a support with which the rigid portion of said lever is pivotally connected, a contact member carried by said support, a second contact member carried by the flexible member of said lever and cooperable with said first mentioned contact member, a magnet positioned for cooperation with the end portion of the lever remote from its pivotal support, and an actuating element including a movable member engaged by the rigid member of the pivoted lever.

12. An electric switch mechanism, comprising a lever including a rigid member and a flexible member, a support with which the rigid portion of said lever is pivotally connected, a contact member carried by said support, a second contact member carried by the flexible member of said lever and cooperable with said first mentioned contact member, an armature carried by the lever and positioned intermediate the pivotal mounting for the lever and the contact member carried thereby, a magnet cooperating with said armature, and a thermostatic actuating element including a movable member adapted to engage the rigid member of the pivoted lever.

13. An electric switch mechanism, comprising a lever including a rigid member and a flexible member, a support with which the rigid portion of said lever is pivotally connected, a contact member carried by said support, a second contact member carried by the flexible member of said lever and cooperable with said first mentioned contact member, the connection between the pivotal mounting for the lever and the contact element carried thereby being substantially inextensible, an armature carried by the lever and disposed intermediate the first named contact member and the pivotal mounting for the lever, a magnet positioned for cooperation with said armature, and an actuating element including a movable member adapted to engage the rigid member of the lever to actuate said mechanism.

In testimony whereof, I have signed this specification.

CHARLES BALDWIN SAWYER.