Feb. 4, 1941. F. K. VAN ALMELO 2,230,770

CIRCUIT CONTROLLER

Filed Dec. 9, 1939

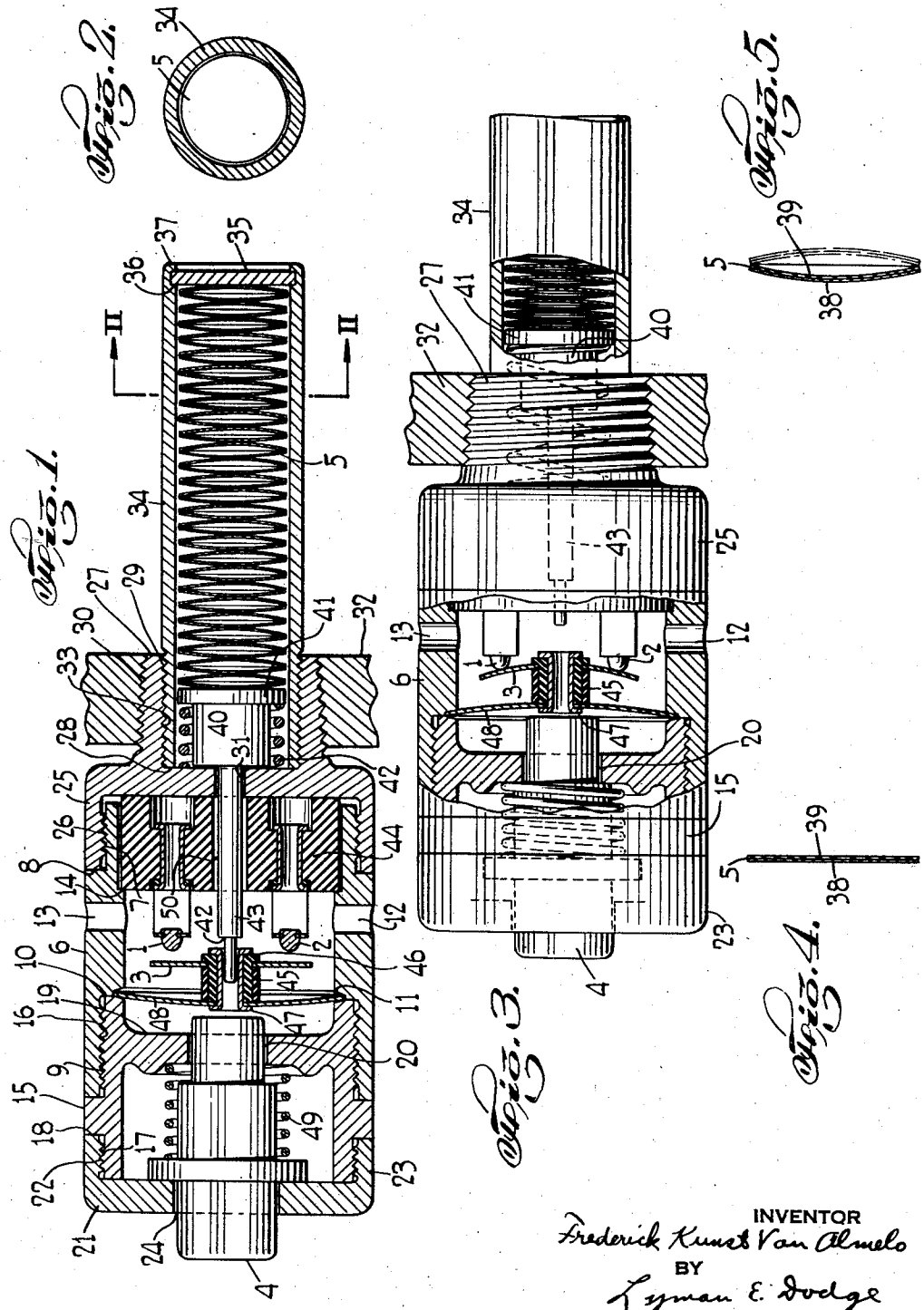

Fig. 2.

Fig. 5.

Fig. 1.

Fig. 3.

Fig. 4.

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Patented Feb. 4, 1941 2,230,770

UNITED STATES PATENT OFFICE

2,230,770

CIRCUIT CONTROLLER

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Application December 9, 1939, Serial No. 308,349

4 Claims. (Cl. 200—138)

This invention relates to electric circuit makers and breakers, and more particularly those operated thermally to one condition and manually to another condition.

A principal object of this invention is the production of a device of the type specified which is so constructed and arranged that it will produce a very large operating movement for a small change in temperature.

A further object of the invention is the production of a device of the type specified which is so constructed and arranged that a change of temperature will produce in it a very great operating force.

Other objects and advantages will appear as the description of the particular physical embodiment selected to illustrate the invention progresses, and the novel features will be particularly pointed out in the appended claims.

In describing the invention in detail and the particular physical embodiment selected to illustrate the invention, reference will be had to the accompanying drawing and the several views thereon, in which like characters of reference designate like parts throughout the several views, and in which:

Figure 1 is a cross-sectional view of a device embodying my invention; Fig. 2 is a vertical cross-sectional view on the plane indicated by the line II—II of Fig. 1, as viewed in the direction of the arrows at the ends of the line; Fig. 3 is a side elevational view with some parts broken away to more clearly show the internal construction and a position of the parts different from that as shown in Fig. 1; Fig. 4 is a cross-sectional view of a thermostatic metal used in connection with my invention; Fig. 5 illustrates two portions of thermostatic metal, as shown in Fig. 4, which are bowed by the application of heat.

In Fig. 1, two electrical terminals 1 and 2 are illustrated. These electrical terminals have in conjunction therewith a cooperating electrical conducting metallic bridge 3. At times, the bridge 3 is out of contact with the terminals 1 and 2 as shown by Fig. 1. At other times, the bridge 3 is in contact and bridges the terminals 1 and 2.

The entire device illustrated in the drawing is for the purpose of causing the bridge 3 to at times connect terminals 1 and 2 and at other times to be separated from the terminals 1 and 2.

Two means are used to cause a movement of bridge 3: one, a manually operable means acting through the instrumentality of the manually operable button 4, and the other a thermal responsive means acting through the intermediary of the thermally responsive bodies 5. The bridge 3 is moved in one direction by the manually operable button 4 and in the other direction by the thermally responsive means 5 and in one direction of movement it connects the terminals 1 and 2 and in the other direction it disconnects the terminals 1 and 2.

The main body of applicant's device is a body annulus 6 which is formed with external threads 7 and a base member stop shoulder 8 at the end of the threads; internal threads 9 with a diaphragm securing member stop shoulder 10 at the ends of the threads; a diaphragm receiving recess 11 opening on one side in the face of the shoulder 10; through wire passages 12 and 13 passing through the wall of the body annulus for receiving the electrical conducting wires for connection with terminals 1 and 2 for the purpose of including these terminals in a desired electrical circuit; and in addition the body annulus 6 is formed with an insulating block stop shoulder 14.

Cooperating with the body annulus 6 is a diaphragm securing member 15 which is formed with external threads 16 and 17; a cap stop shoulder 18; and a cross wall 19 formed with a through passage 20 for receiving and guiding the manually operable button 4.

The diaphragm securing member 15 cooperates with the body annulus 6 through the threads 16 thereof cooperating with the threads 9 of the body annulus and when the diaphragm securing member 15 has been completely screwed into place, as shown in Fig. 1, it bears against the diaphragm securing member stop shoulder 10 to limit further inward movement.

A cap member 21 is provided having an internal thread 22 formed in a skirt or inturned rim 23. The cap 21 further is formed with a through passage 24 for the reception and guiding of manually operable button 4.

The threads 22 of the rim or skirt of the cap 21 cooperate with the internal threads 17 of the diaphragm securing member so that when the cap is screwed down into place the end of the skirt abuts the cap stop shoulder 18 on the diaphragm securing member.

The body annulus 6 on its other end carries the base member 25 which is formed with internal threads 26 cooperating with threads 7 of the body annulus. The base member 25 is provided with a skirt 27 which forms a recess having an end wall 28 and has the wall, formed by the skirt, both internally threaded at 29 and externally threaded at 30. The base member 25 also is formed with a through central passage 31 for the reception of a plunger.

The base member 25 cooperates with the body annulus 6 and is attached thereto by the cooperation of the threads 7 and 26 and it further cooperates with the stop shoulder 8 to determine its final position.

The external threads 30 of the base member

are usable for attaching and supporting the entire device to a stationary wall or the like, 32, as the stationary wall 32 may be provided with internal threads to cooperate with the external threads 30 of the base member 35.

The threads 29 cooperate with the threads 33 formed on a container 34. This container or restraining means for bodies 5, in the form shown, is a cylindrical tube having an abutment 35 at one end which abutment may be in any of the usual and well known forms but is here illustrated as a disc held in place against a shoulder 36 of the container 34 and by bending over the material 37 of the container.

Within the container 34 are placed a plurality of thermally responsive bodies 5. These bodies 5 are in the form of sheet material, and preferably in the form of discs, and, by preference, are bimetallic members made of two metals, one of which has a different coefficient of expansion for heat than the other. In Fig. 4 the metal having the lower coefficient of expansion has been designated 39 and may well be steel and the metal having the larger coefficient of expansion has been designated 38 and may well be brass. These metals may be united in any of the well known or usual ways.

The bimetallic bodies 5 are placed in the container 34, in pairs, free floating, with like metal touching like metal and preferably with the metal of the higher coefficient of expansion on the outside of a pair so that when the container 34 and the bimetallic bodies 5 are subjected to a rise in temperature the several bodies will bow as illustrated in Fig. 1 and occupy more space longitudinally of the container 34 than before elevated in temperature, although the metal of higher coefficient of expansion may be on the inside of a pair.

One end of the plurality or series of thermally responsive bodies 5 rests against the abutment 35 and the other end of the series rests against a piston 40 which body or piston 40, in the form shown, is provided with an enlarged head 41 on one end which furnishes a shoulder against which the resilient means or spring 42 may act bearing against the end wall 28 to force the piston 40 toward the thermally responsive bodies 5.

As the spring or resilient means 42 force the plunger 40 to the right as viewed in Fig. 1, it will take up a position at any specific temperature determined by the number and size of the thermally responsive bodies 5 in the container 34. If this particular position is not as desired, it may be varied by screwing the container 34 further into the recess or unscrewing the container 34 so as to withdraw it somewhat from the recess. This changing position of 34 acts as a means for adjusting what might be called the zero position of a piston 40, and so the position of the shoulder 42 of the plunger 43 attached to the piston 40. This plunger 43 passes through the through passage 31 in the base member 35 and through a central passage in the insulating block 44 and extends to the position, as shown in Fig. 1, when the thermally responsive bodies 5 have been raised in temperature beyond normal to a predetermined amount, that is, an amount sufficient to cause the bridge 3 to become disconnected from terminals 1 and 2 as shown in Fig. 1.

The bridge member 3 is insulatingly connected by spacing insulation 45 and 46 and metallic clamping sleeve 47 to diaphragm 48. This diaphragm 48 is made of metal and is normally convex, as shown in Fig. 3, toward the right side thereof and rests in the diaphragm receiving recess 11 adjacent its periphery only. When this diaphragm has pressure applied on the right hand side, as viewed in Fig. 3, and it is pushed toward the left it resists until the diaphragm has been straightened out and given the slightest possible convexity toward the left, as viewed in Fig. 3, whereupon the diaphragm snaps to the position as shown in Fig. 1 with the convexity to the left.

If the diaphragm 48 is convex as shown in Fig. 1, then if one manually presses the button 4 against the action of the resilient means or spring 49 the diaphragm 48 will first be straightened out and then make a final snap to the position as shown in Fig. 3.

As bridge 3 is rigidly connected to diaphragm 48 it partakes of the motion of diaphragm 48 so that when the shoulder 42, due to an increase in temperature of the bodies 5 moves to the left, as viewed in Fig. 3, and finally contacts with sleeve 47 and starts a movement of that sleeve to the left, as viewed in Fig. 3, the bridge 3, shown as curved in Fig. 3, will gradually straighten out, and still remaining in contact with terminals 1 and 2, will be moved to the left, as viewed in Fig. 3, as diaphragm 48 is moved to the left, and when diaphragm 48 has been moved so that it has the very slightest convexity to the left, as viewed in the figures, the diaphragm will then snap to its extreme position, as shown in Fig. 1, carrying with it the bridge 3 and snap break contact between bridge 3 and terminals 1 and 2.

When the diaphragm is in the position, as shown in Fig. 1, and the manually operable button 4 is pushed to the right, as viewed in Fig. 1, then the diaphragm 48 will first straighten out and just before it is completely straightened out the bridge 3 will connect terminals 1 and 2 and then a slight further movement of button 4 will push diaphragm 48 over the central position and it will snap the rest of the way rubbing bridge 3 against terminals 1 and 2 and bowing it as shown in Fig. 3.

The insulating block 44 insulatingly supports terminals 1 and 2 and is held between internal shoulder 14 of the body annulus and the inner wall of the base member 25 so that it is securely held in place so that it may not move in either direction and is pierced by the through passage 50 through which the plunger 43 extends.

In the specific illustration shown in the drawing, the electrical circuit through the terminals 1 and 2 is described as being broken with a snap. Of course, it is not to be understood that applicant intends to exclude by such description a construction in which the terminals 1 and 2 are at the other side of bridge 3 and are bridged with a snap.

It is to be understood that container 34 is merely one means of restraining the bodies 5 from buckling sidewise when they begin to exert pressure upon the piston 41 and, by the particular showing, applicant does not intend to exclude other suitable and appropriate means for restraining the buckling sidewise of the stack or series of thermally responsive bodies 5.

Although I have particularly described one particular physical embodiment of my invention and explained the operation, construction and principle thereof, nevertheless, I desire to have it understood that the form selected is merely illustrative, but does not exhaust the possible physical embodiments of the idea of means underlying my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A thermal responsive device comprising, in combination: a plurality of bimetallic members attached side to side; a container formed with an abutment at one end for receiving the members; a piston within the container bearing against the end of the members remote from the abutment; a fixed member formed with a threaded recess provided with an end wall; resilient means between the end wall and the piston; means operated by a movement of the piston; said container formed with screw threads for cooperation with the screw threads of the recess whereby by entering the container in the recess more or less the position of the piston in the container has its initial position adjusted to a predetermined place.

2. A circuit controller comprising, in combination: an elongated hollow cylindrical container formed with an abutment at one end and external screw threads at the other end, a member formed with a recess having an end wall and internally threaded on the side wall into which the threaded end of the container is entered; a piston in the container and a plunger connected to the piston and extending beyond the end of the container; resilient means between the piston and the end wall of the recess pressing the piston toward the abutment; thermal responsive bodies between the piston and the abutment whereby a change to a higher temperature moves the plunger a distance out of the container, and a circuit controller moved by the plunger, whereby a greater or less entrance of the container in the recess shifts the end of the plunger to a different initial position.

3. A thermal circuit controller comprising in combination: a plurality of contiguous similarly positioned bimetallic bodies formed of metals having different expansion coefficients; a container provided with an end abutment within which said bodies are positioned; a plunger having one end positioned in the container; resilient means pressing the plunger against the said bodies and the bodies against the abutment; a metallic diaphragm secured adjacent its periphery only and operatively positioned in the path of movement of the other end of said plunger and convex toward the plunger; electrical terminals; an electrical conducting bridging member supported substantially from the center portion of said diaphragm and so positioned with relation to said terminals as to bridge the same when in one position; and a resiliently pressed manually operable member positioned on the side of said diaphragm remote from said plunger whereby thermal energy applied to said container causes said bodies to become concavo-convex and move the plunger which in turn presses the diaphragm until it snaps with its convexity away from the plunger and the bridging member is snapped out of its then relation to the terminals and after the container sufficiently cools the said manually operable member may be operated to snap return the diaphragm and bridging member to former position.

4. A circuit controller comprising, in combination: a body annulus formed with an external base member receiving thread at one end, an external base member stop shoulder adjacent the end of the thread, an internal terminal block shoulder spaced from the same end, an internal diaphragm securing member receiving thread at the other end with a diaphragm securing member stop shoulder at the inner end of the internal thread, a diaphragm receiving recess opening in the last mentioned shoulder, and wire receiving passages through the wall of the annulus; a base member formed with an internal thread cooperating with the external thread of the body annulus, said base member abutting the base member stop shoulder and formed with a through central plunger receiving passage and a circular skirt about the passage both internally and externally screw threaded whereby the external threads may be secured in a stationary support and the internal threads may receive a thermal responsive member container; a diaphragm securing annulus formed with external threads at one end engaging the internal threads of the body annulus and abutting the diaphragm securing member stop on the body annulus, and provided with cap receiving external threads at the other end, a cap stop shoulder at the end of the last named threads and an internal cross wall formed with a through manually operable button receiving passage; a cap formed with a depending rim internally threaded to cooperate with the cap receiving external threads of the diaphragm receiving member, and abutting the cap stop shoulder on the diaphragm receiving member and formed with a through passage for a manually operable button; an insulating block secured between the internal shoulder of the body annulus and the base member, and formed with a through central plunger receiving passage and a separated pair of electrical terminals adapted for connection to a circuit by wires passing through the wire passages of the body annulus; a normally convex diaphragm resting a relatively small portion thereof adjacent its periphery in the diaphragm recess of the body annulus and secured therein by the diaphragm securing member, said diaphragm adapted to be reversely convexed by pressure applied adjacent its central portion; an electrical conducting bridge insulatingly borne by the diaphragm and positioned to cooperate with the said electrical terminals when the diaphragm is convex in one direction and to be non-cooperative when the diaphragm is reversely convexed; a button positioned in the cap button receiving passage and resiliently pressed thereagainst and passing through the through wall in the diaphragm securing member and terminating adjacent the diaphragm; thermal responsive means positioned in the thermal responsive member container; a plunger passing through the through passage in the base member and the insulating block and terminating at one end adjacent the diaphragm; a piston in the container attached to the other end of the plunger; resilient means pressing the piston in a direction away from the diaphragm, said thermal responsive means when subject to thermal energy causing movement of the piston in a direction toward the diaphragm whereby the electrical bridge is moved in one direction with a final snap by the thermal responsive means and in the other direction with a final snap by the manually operable button.

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