G. P. CARROLL & F. N. ROEHRICH.

SPARKLESS THERMOSTAT.

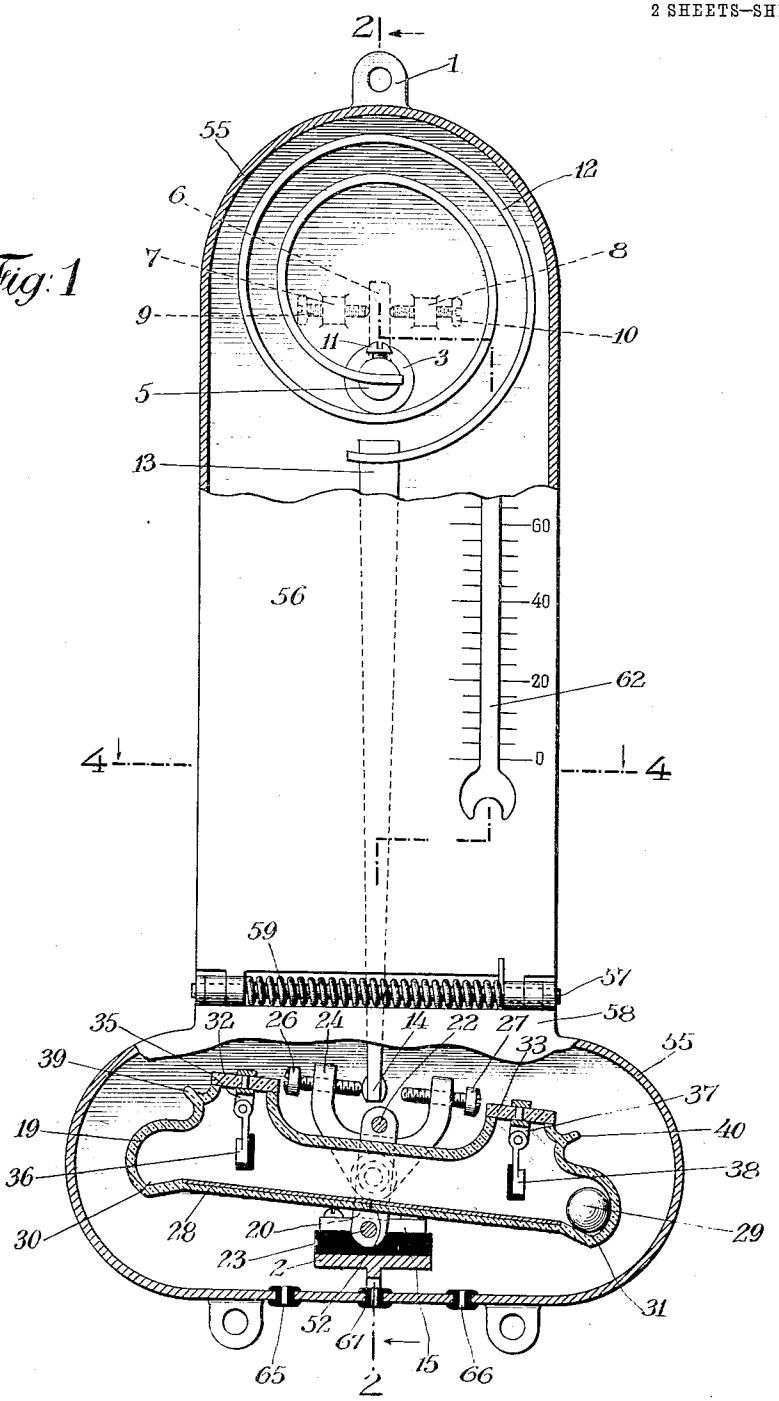
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1,125,059.

Patented Jan. 19, 1915

2 SHEETS—SHEET 1.

Fig. 1



Witnesses:

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2 SHEETS—SHEET 2.

Fig. 2

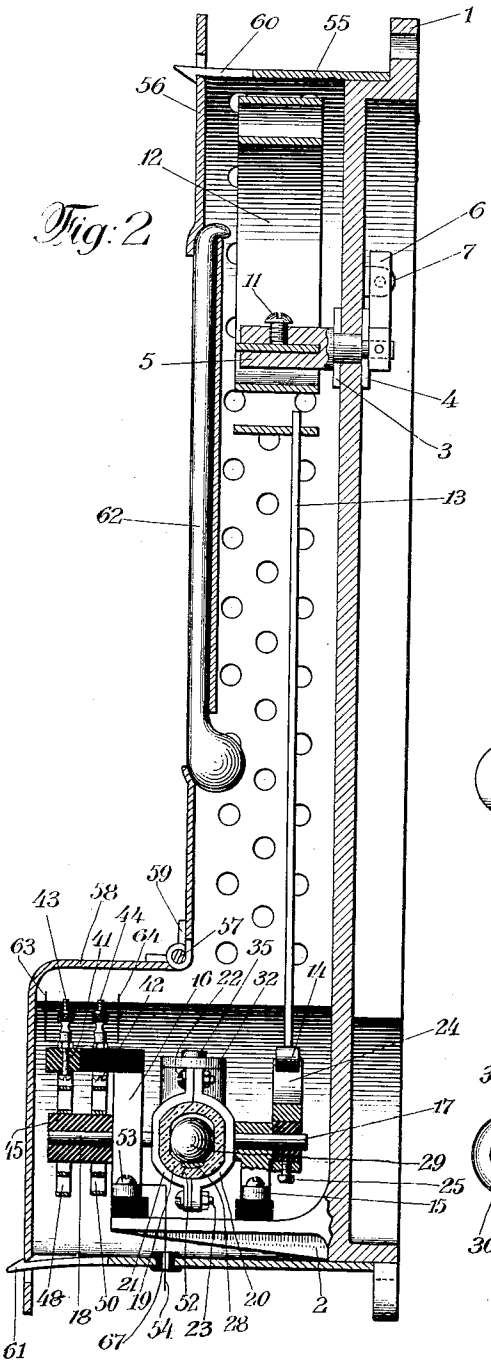


Fig. 3

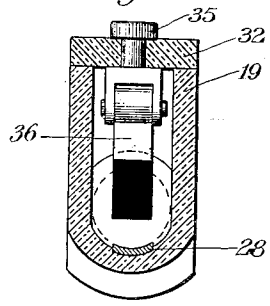


Fig. 4

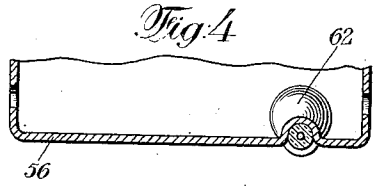


Fig. 5

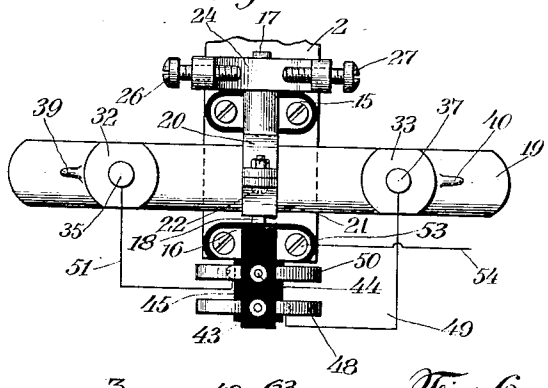
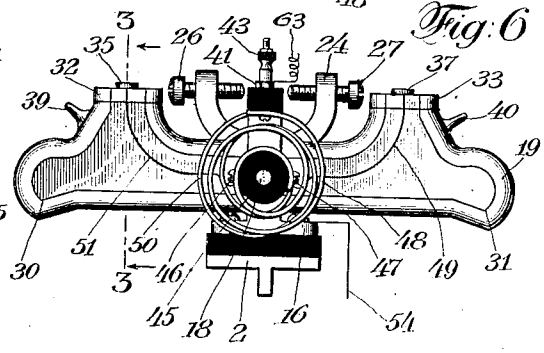


Fig. 6



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UNITED STATES PATENT OFFICE.

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SPARKLESS THERMOSTAT.

1,125,059. Specification of Letters Patent. Patented Jan. 19, 1915.

Application filed July 14, 1910. Serial No. 571,926.

To all whom it may concern:

Be it known that we, GEORGE P. CARROLL and FRANK N. ROEHRICH, citizens of the United States, residing, respectively, at Bridgeport, in the county of Fairfield and State of Connecticut, and at Jersey City, in the county of Hudson and State of New Jersey, have invented a new and useful Sparkless Thermostat, of which the following is a specification.

Our invention relates to improvements in two-way thermostats operative upon a predetermined rise of temperature to close one electric circuit and upon a predetermined fall of temperature to close another electric circuit. The most common type of such thermostats consists of a coil and short blade, or of a long blade, of two metals of different coefficients of expansion and firmly fastened together so that, being pivoted at one end, the free end of the blade will move back and forth with a rise or fall of temperature and will make slow electrical contacts first with a high temperature contact and subsequently with a low temperature contact, the electric circuit, upon either contact being made, being completed through the blade, with or without the coil, and the pivoted end. Such a device also is constructed open to the air, so that, on a contact being broken, a spark will jump from the contact to the receding blade end, resulting in a wearing away of the parts. As the contacts are slow, there is a waste of current between the making and breaking of each contact. If the thermostat is placed in a cold place, as a part of a refrigerating system, moisture from the atmosphere will collect on the contacts and the blade end and will cause premature and prolonged contacts to be made. Premature and prolonged contacts are also liable to occur from particles of dirt collecting between the contacts and the blade end. Such premature and prolonged contacts seriously interfere with the accuracy and reliability of such thermostats.

The purpose of our invention is to avoid all such difficulties by causing a temperature controlled member, such as a thermostatic blade, to be operative to tilt to and fro a rocker device, preferably containing a vacuum chamber, in such a manner that the high and low temperature contacts, and also the breaking of such contacts, take place on the rocker device, and preferably in its chamber, in consequence of quick tiltings of the rocker device, in manner as will appear. There are also certain improvements in detail as will be set forth.

In the drawings Figure 1 is a partial front elevation and a partial vertical section of our invention. Fig. 2 is a vertical section through the line 2—2 of the preceding figure, looking toward the left, with some minor parts in elevation. Fig. 3 is an enlarged detail cross vertical section of the rocker shown at the bottom of Fig. 1 as seen through the line 3—3 of Fig. 6, looking toward the left, with some minor parts in elevation. Fig. 4 is a horizontal broken section through the line 4—4 of Fig. 1, looking from above. Fig. 5 is a plan view and Fig. 6 is a front elevation of certain parts shown at the bottom of Fig. 1.

A back frame 1, that can be screwed to any convenient vertical surface, has a frontwardly projecting base 2 and has a small round opening through it near its top and along its vertical center. Through this opening in the frame 1 and through washers 3 and 4 respectively in front and in back of the opening, projects a slotted pivot post 5, being slotted and of largest diameter in front, being of intermediate diameter where it passes through the washer 3 and the frame 1 and being of smallest diameter where it extends through the washer 4. Pinned to the post 5 back of the washer 4 is an adjusting lever 6, extending upward. Through threaded openings in lugs 7 and 8, which extend backward from the frame 1 above the post 5, pass headed adjusting screws 9 and 10. Secured into the slot of the post 5 by a screw 11 is the inner end of a coiled band 12, constructed of two metal strips of different coefficients of expansion; such as soft steel and brass brazed together, the brass, being the more expansive, forming the outside of the band. To the outer end of the band 12 is secured a depending arm 13, more or less parallel with the vertical center of the frame 1, and having a striker 14 at its lower extremity.

Screwed to the base 2 but insulated from it is a back trunnion bracket 15 and a front trunnion bracket 16, each consisting of a bottom and upper part screwed together. Supported between these brackets by a back trunnion 17 and a front trunnion 18, passing through the upper and lower parts of the brackets 15 and 16 respectively, is a hol-

low rocker 19, made of tough glass and supported at its center by brass clamping bands 20 and 21 to which the inner ends of the trunnions 17 and 18 respectively are secured as constituent parts, the clamping bands being firmly bolted together by bolts 22 and 23 above and below the rocker. To the rear end of the trunnion 17 back of the trunnion bracket 15 is a jawed lever 24, secured at its lowest part by a set screw 25 to the trunnion so as to be able to rotate it. Through threaded openings in the jaws of the lever are two adjusting screws 26 and 27, projecting inwardly so that the striker 14 is between their points and will strike one or the other of them as it is moved back and forth and will thus actuate the lever.

The inside of the bottom of the rocker 19 has secured to it a copper strip 28 forming a patch for a copper ball 29 to roll upon as the rocker is tilted to one side or the other. At the extreme ends of the rocker beyond each end of the strip 28 are slight depressions 30 and 31 in which the ball rests after the rocker has been tilted into its extreme position on one side or the other. Between the center and the ends of the rocker casing on its upper side are two raised openings to which glass caps 32 and 33 are hermetically secured. From the cap 32 at the left of the center of the rocker as seen in Fig. 1 depends a copper support 35, passing through and fused into the cap, to which support a copper contact 36 is pivoted, being insulated on its flat under edge and on the lower part of its broad side toward the right end of the rocker. From the cap 33 at the right of the center of the rocker depends a copper support 37, passing through and fused into the cap, to which support a copper contact 38 is pivoted, being insulated on its flat under edge and on the lower part of its broad side toward the left end of the rocker. As the ball 29 rolls from the right end of the rocker it impinges against the non-insulated part of the contact 38 and lifts it up as it passes without coming in contact with its insulated part until it has lifted it up sufficiently to pass by. As the ball passes by each contact after lifting them up the contacts resume their perpendicular positions. As the ball 29 rolls from the left end of the rocker, the reverse process takes place as the contacts are passed. Through temporary openings at 39 or 40, after the ball 29 has been inserted into the rocker 19 and after the caps 32 and 33 have been hermetically sealed, the air is exhausted from the rocker and the openings are closed by fusion.

The bracket 16 extends upward and has an insulated arm extending frontward through which pass copper bolts 41 and 42 to the top of which respectively are secured the binding posts 43 and 44. The bracket 16 also has an insulated cylinder 45 secured to its front through which the trunnion 18 passes. Inserted into the left and right of this cylinder as seen in Fig. 6 are binding screws 46 and 47 respectively. From the under end of the bolt 41 a light spring 48 coils in one direction around the cylinder 45 to the screw 47, being clamped at each end. From the screw 47 a wire 49 passes in front of the rocker 19 to the copper support 37. From the under end of the bolt 42 a light spring 50 coils in the opposite direction around the cylinder 45 to the screw 46, being clamped at each end. From the screw 46 a wire 51 passes in front of the rocker 19 to the copper support 35. The springs 48 and 50, being opposed to each other, have a slight tendency to keep the rocker 19 in a horizontal position. Fused into the rocker 19 so as to be in contact with the strip 28 is a wire 52 in contact at its other end with the band 21. A binding screw 53 is one of the screws holding down the upper part of the bracket 16. As the non-insulated part of the bracket 16 is of brass, a conductive connection exists between the strip 28 and a wire 54 bound at one end by the screw 53.

Secured to all sides of the back frame 1 is a protecting casing 55 perforated on its sides for a free thermal action of the surrounding atmosphere on the band 12. The front of the casing is divided into an upper part 56, pivoted at its lower end on a rod 57 so as to open downward for free access to the band 12 and the arm 13, and into a lower part 58, projecting frontward so as to cover the parts supported by the base 2 and also pivoted on the rod 57 so as to open upward for free access to these parts. A coiled spring 59 on the rod 57 with projecting ends bearing on the parts 56 and 58 tends to keep the front of the casing closed. Snap pieces 60 and 61 also normally snap into the parts 56 and 58 respectively and hold them closed. In the part 56 toward the right is supported an ordinary mercury glass bulb and tube thermometer 62 for observing the temperature changes. Wires 63 and 64 may lead to the binding posts 43 and 44 respectively through insulated openings 65 and 66 respectively in the bottom of the casing 55; and the wire 54 may lead from the binding screw 53 through a like opening 67 in the casing 55.

The method of operation is as follows: While the thermostat may be used to actuate any kind of temperature controlled electrical apparatus, its operation will be sufficiently understood by considering it as a part of a temperature controlled electric refrigerating machine, such as is shown and described in the application of Carroll, filed April 1, 1908, Ser. No. 424,517. Assume that our thermostat is placed in a

refrigerator where it is desired to maintain a temperature ranging say from 35° to 37°. Then the screws 26 and 27 are so adjusted, after lifting up the part 58, that in a rise of temperature approximating two degrees the striker 14 will pass from the screw 26 to the screw 27. The position of the arm 13 is also so adjusted through the screws 9 and 10 that at a temperature of 36° the striker 14 will be midway between the screws 26 and 27 when the latter are perfectly horizontal. The screws 26 and 27 are always used to establish the range of temperature as desired and the screws 9 and 10 are always used to establish the mean temperature to be maintained. The wire 64 is supposed to lead from a source of electrical supply and to be in series with an electrical device for starting the refrigerating machine. Also the wire 63 is supposed to lead from the same supply but to be in series with an electrical device for stopping the machine. And the wire 54 is the return wire. With the parts in the position shown in Fig. 1 the thermostat is just about to stop the machine, the temperature in the refrigerator having fallen nearly to 35°. As the band 12 gives up heat, which passes through the perforations in the casing 55, the band coils up more closely and moves the arm to the left as shown in Fig. 1. Thereupon the striker 14, pressing against the screw 26, rotates the lever 24, the trunnion 17 and the rocker 19 first into a perfectly horizontal position and then so that the strip 28 has a downward decline to the left. Thereupon the ball 29 leaves the depression 31 and rolls along the strip 28 until it reaches the depression 30. This movement of the ball 29 tilts still more the rocker 19 and its rotating connections so that the screw 27 strikes against the striker 14. Meanwhile, just as the ball 29 has begun to roll, it has struck the non-insulated part of the contact 38 and has established a brief connection between the contact 38 and the strip 28. A current now passes through the stopping device not shown, the wire 63, the bolt 41, the spring 48, the screw 47, the wire 49, the support 37, the contact 38, the ball 29, the strip 28, the wire 52, the band 21, the trunnion 18, the bracket 16 and the wire 54 to the source of supply. With the stoppage of the machine the further movement of the striker 14 to the left ceases. When the ball 29 rolls to the left, after the contact 38 has been lifted, it swings back to a vertical position. And since the contact 36 is insulated on its right and under side, no connection is made between this contact and the strip 28 as the ball 29 rolls to the left. The machine having stopped and the temperature in the refrigerator beginning to rise, heat passes through the perforations in the casing 55 to the band 12. As the band 12 gradually uncoils the arm 13 begins to move to the right until the striker 14 hits the screw 27. Thereupon the lever 24, the trunnion 17 and the rocker 19 are rotated first into a perfectly horizontal position and then so that the strip 28 has a downward decline to the right. Thereupon the ball 29 leaves the depression 30 and rolls along the strip 28 until it reaches the depression 31. This reverse movement of the ball 29 tilts still more the rocker 19 and its rotating connections so that the screw 26 strikes against the striker 14 and the parts assume the position shown in Fig. 1. Meanwhile, just as the ball 29 has begun to roll, it has struck the non-insulated part of the contact 36 and has established a brief connection between the contact 36 and the strip 28. A current now passes through the starting devices not shown, the wire 64, the bolt 42, the spring 50, the screw 46, the wire 50, the support 35, the contact 36, the ball 29, the strip 28, the wire 52, the band 21, the trunnion 18, the bracket 16 and the wire 54 to the source of supply. With the starting of the machine the further movement of the striker 14 to the right ceases. As before there is a similar swinging back to vertical positions of the contacts 36 and 38 as the ball 29 rolls to the right. And as the contact 38 is insulated on its left and under side, no connection is made between this contact and the strip 28 on the reverse movement of the ball 29. It is to be noted that, in case no refrigeration takes place and the refrigerator rises to atmospheric temperature, not merely does the striker 14 have some free space in which to move but also the band 12 can expand and move the arm 13 to the right at its top without injuring the parts.

Since the interior of the rocker 19 is a vacuum, it is obvious that no sparking and destructive wearing away of the parts can occur when the ball 29 leaves the contacts 38 and 36. Still less can any dust or moisture enter the rocker 19 so as to cause any premature or prolonged contacts. The briefness of the touch of the ball 29 with the contacts 38 and 36 also prevents any waste of current in the actuation of the unshown starting and stopping devices. All parts are readily accessible that require adjustment for obtaining a change of temperature range or mean.

What we have invented and what we desire to have protected by Letters Patent is expressed in claims as follows:

We claim:

1. In combination a rocker member, a conductor, another conductor, each of said conductors having an end mounted on said rocker member, a connective member operating upon a tilting of said rocker mem-

ber forward to connect said ends, and a thermostatic member operating upon a predetermined change of temperature to so tilt said rocker member.

2. In combination a rocker member, a first conductor, a second conductor, a common conductor, each of said conductors having an end mounted on said rocker member, a connective member operating upon a tilting of said rocker member forward to connect the ends of said first and common conductors and upon a tilting of said rocker member backward to connect the ends of said second and common conductors, and a thermostatic member operating upon a predetermined change of temperature in one direction to tilt said rocker member forward and upon a predetermined reverse change of temperature to tilt said rocker member backward.

3. In combination a rocker member, a conductor, another conductor, each of said conductors having an end mounted on said rocker member, a connective member operating upon a tilting of said rocker member forward to connect said ends and thereupon to break such connection, and a thermostatic member operating upon a predetermined change of temperature to so tilt said rocker member.

4. In combination a rocker member, a first conductor, a second conductor, a common conductor, each of said conductors having an end mounted on said rocker member, a connective member operating upon a tilting of said rocker member forward to connect the ends of said first and common conductors and thereupon to break such connection and upon a tilting of said rocker member backward to connect the ends of said second and common conductors and thereupon to break such latter connection, and a thermostatic member operating upon a predetermined change of temperature in one direction to tilt said rocker member forward and upon a predetermined reverse change of temperature to tilt said rocker member backward.

5. In combination a rocker member, a conductor, another conductor, each of said conductors having an end mounted on said rocker member, a connective member operating upon a tilting of said rocker member forward to connect said ends and thereupon to break such connection, a thermostatic member operating upon a predetermined change of temperature in one direction to tilt said rocker member forward and upon a predetermined reverse change of temperature to tilt said rocker member backward, and means preventing said connective member from connecting said ends upon such back tilting.

6. In combination a rocker member, a first conductor, a second conductor, a common conductor, each of said conductors having an end mounted on said rocker member, a connective member operating upon a tilting of said rocker member forward to connect the ends of said first and common conductors and thereupon to break such connection and upon a tilting of said rocker member backward to connect the ends of said second and common conductors and thereupon to break such latter connection, a thermostatic member operating upon a predetermined change of temperature in one direction to tilt said rocker member forward and upon a predetermined reverse change of temperature to tilt said rocker member backward, and means preventing said connective member from connecting the ends of said second and common conductors upon such forward tilting and from connecting the ends of said first and common conductors upon such backward tilting.

7. In combination a rocker member, a conducting pathway strip mounted on said rocker member and adapted to be inclined in opposite directions successively according to the forward and back tilting of the member, a conductor leading from said strip, a conductor ball rolling forward and back along said strip according to such tilting, a contact device depending from said rocker member and presenting a conducting contact surface to said ball as it so rolls forward and an insulating surface thereto as it so rolls back, and means operating upon a predetermined change of temperature in one direction to tilt said rocker member forward and upon a predetermined reverse change of temperature to reverse such tilting.

8. In combination a rocker member, a conducting pathway strip mounted on said rocker member and adapted to be inclined in opposite directions successively according to the forward and back tilting of the member, a conductor leading from said strip, a conductor ball rolling forward and back along said strip according to such tilting, a forward contact device depending from said rocker member and presenting a conducting contact surface to said ball as it so rolls forward and an insulating surface thereto as it so rolls back, a back contact device depending from said rocker member and presenting a conducting contact surface to said ball as it so rolls back and an insulating surface thereto as it so rolls forward, and means operating upon a predetermined change of temperature in one direction to tilt said rocker member forward and upon a predetermined reverse change of temperature to reverse such tilting.

9. In combination a rocker member containing a vacuum chamber, a conductor, another conductor, each of said conductors

having an end extending from within said chamber to the outside of said rocker member, a connective member in said chamber operating upon a tilting of said rocker member forward to connect said ends, and a thermostatic member operating upon a predetermined change of temperature to so tilt said rocker member.

10. In combination a rocker member containing a vacuum chamber, a first conductor, a second conductor, a common conductor, each of said conductors having an end extending from within said chamber to the outside of said rocker member, a connective member in said chamber operating upon a tilting of said rocker member forward to connect the ends of said first and common conductors and upon a tilting of said rocker member backward to connect the ends of said second and common conductors, and a thermostatic member operating upon a predetermined change of temperature in one direction to tilt said rocker member forward and upon a predetermined reverse change of temperature to tilt said rocker member backward.

11. In combination a rocker member containing a vacuum chamber, a conductor, another conductor, each of said conductors having an end extending from within said chamber to the outside of said rocker member, a connective member in said chamber operating upon a tilting of said rocker member forward to connect said ends and thereupon to break such connection, and a thermostatic member operating upon a predetermined change of temperature to so tilt said rocker member.

12. In combination a rocker member containing a vacuum chamber, a first conductor, a second conductor, a common conductor, each of said conductors having an end extending from within said chamber to the outside of said rocker member, a connective member in said chamber operating upon a tilting of said rocker member forward to connect the ends of said first and common conductors and thereupon to break such connection and upon a tilting of said rocker member backward to connect the ends of said second and common conductors and thereupon to break such latter connection, and a thermostatic member operating upon a predetermined change of temperature in one direction to tilt said rocker member forward and upon a predetermined reverse change of temperature to tilt said rocker member backward.

13. In combination a rocker member containing a vacuum chamber, a conductor, another conductor, each of said conductors having an end extending from within said chamber to the outside of said rocker member, a connective member in said chamber operating upon a tilting of said rocker member forward to connect said ends and thereupon to break such connection, a thermostatic member operating upon a predetermined change of temperature in one direction to tilt said rocker member forward and upon a predetermined reverse change of temperature to tilt said rocker member backward, and means preventing said connective member from connecting said ends upon such back tilting.

14. In combination a rocker member containing a vacuum chamber, a first conductor, a second conductor, a common conductor, each of said conductors having an end extending from within said chamber to the outside of said rocker member, a connective member in said chamber operating upon a tilting of said rocker member forward to connect the ends of said first and common conductors and thereupon to break such connection and upon a tilting of said rocker member backward to connect the ends of said second and common conductors and thereupon to break such latter connection, a thermostatic member operating upon a predetermined change of temperature in one direction to tilt said rocker member forward and upon a predetermined reverse change of temperature to tilt said rocker member backward, and means preventing said connective member from connecting the ends of said second and common conductors upon such forward tilting and from connecting the ends of said first and common conductors upon such backward tilting.

15. In combination a rocker member containing a vacuum chamber, a conducting pathway strip in said chamber adapted to be inclined in opposite directions successively according to the forward and back tilting of said rocker member, a conductor leading from said strip to the outside of said rocker member, a conductor ball rolling forward and back along said strip according to such tilting, a contact device depending from within said chamber, presenting a conducting contact surface to said ball as it so rolls forward and an insulating surface thereto as it so rolls back and having an end extending to the outside of said rocker member, and means operating upon a predetermined change of temperature in one direction to tilt said rocker member forward and upon a predetermined reverse change of temperature to reverse such tilting.

16. In combination a rocker member containing a vacuum chamber, a conducting pathway strip in said chamber adapted to be inclined in opposite directions successively according to the forward and back tilting of said rocker member, a conductor leading from said strip to the outside of said rocker member, a conductor ball rolling forward and back along said strip according to such tilting, a forward contact de-

vice depending from within said chamber, presenting a conducting contact surface to said ball as it so rolls forward and an insulating surface thereto as it so rolls back and having an end extending to the outside of said rocker member, a back contact device depending from within said chamber, presenting a conducting contact surface to said ball as it so rolls back and an insulating surface thereto as it so rolls forward, and means operating upon a predetermined change of temperature in one direction to tilt said rocker member forward and upon a predetermined reverse change of temperature to reverse such tilting.

17. In combination a rocker, a first conductor, a second conductor, a common conductor, each of said conductors having an end mounted on said rocker, a connective member operating upon a tilting of said rocker forward to connect the ends of said first and common conductors and upon a tilting of said rocker backward to connect the ends of said second and common conductors, a two arm tilting lever secured to said rocker, opposed actuating faces on said arms, a thermostatic member having a striker near said faces and operating through its striker upon a change of temperature to a predetermined limit to force one of said faces forward until said rocker is tilted forward and upon a reverse change of temperature to a predetermined limit to force the other of said faces backward until the rocker is tilted backward, and means for positioning said striker as desired at a temperature midway between such limits.

18. In combination a rocker containing a vacuum chamber, a first conductor, a second conductor, a common conductor, each of said conductors having an end extending from within said chamber to the outside of said rocker, a connective member in said chamber operating upon a tilting of said rocker forward to connect the ends of said first and common conductors and upon a tilting of said rocker backward to connect the ends of said second and common conductors, a two arm tilting lever secured to said rocker, opposed actuating faces on said arms, a thermostatic member having a striker near said faces and operating through its striker upon a change of temperature to a predetermined limit to force one of said faces forward until said rocker is tilted forward and upon a reverse change of temperature to a predetermined limit to force the other of said faces backward until the rocker is tilted backward, and means for positioning said striker as desired at a temperature midway between such limits.

19. In combination a rocker, a conducting pathway strip mounted on said rocker and adapted to be inclined in opposite directions successively according to the forward and back tilting of the rocker, a conductor leading from said strip, a conductor ball rolling forward and back along said strip according to such tilting, a forward contact device depending from said rocker and presenting a conducting contact surface to said ball as it so rolls forward and an insulating surface thereto as it so rolls back, a back contact device depending from said rocker and presenting a conducting contact surface to said ball as it so rolls back and an insulating surface thereto as it so rolls forward, a two arm tilting lever secured to said rocker, opposed actuating faces on said arms, a thermostatic member having a striker near said faces and operating through its striker upon a change of temperature to a predetermined limit to force one of said faces forward until said rocker is tilted forward and upon a reverse change of temperature to a predetermined limit to force the other of said faces backward until the rocker is tilted backward, and means for positioning said striker as desired at a temperature midway between such limits.

20. In combination a rocker containing a vacuum chamber, a conducting pathway strip in said chamber adapted to be inclined in opposite directions successively according to the forward and back tilting of the rocker, a conductor leading from said strip to the outside of said rocker, a conductor ball rolling forward and back along said strip according to such tilting, a forward contact device depending from within said chamber and presenting a conducting contact surface to said ball as it so rolls forward and an insulating surface thereto as it so rolls back, a back contact device depending from within said chamber and presenting a conducting contact surface to said ball as it so rolls back and an insulating surface thereto as it so rolls forward, a two arm tilting lever secured to said rocker, opposed actuating faces on said arms, a thermostatic member having a striker near said faces and operating through its striker upon a change of temperature to a predetermined limit to force one of said faces forward until said rocker is tilted forward and upon a reverse change of temperature to a predetermined limit to force the other of said faces backward until the rocker is tilted backward, and means for positioning said striker as desired at a temperature midway between such limits.

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