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TWO STAGE THERMOSTAT

Filed Nov. 22, 1939

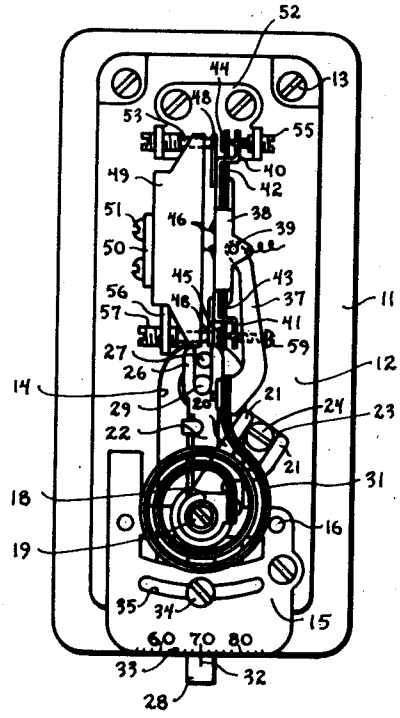



Fig. 1

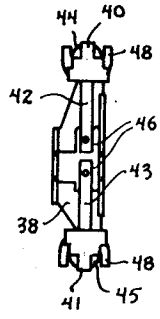



Fig. 2

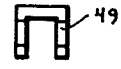



Fig. 3

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# UNITED STATES PATENT OFFICE

2,285,446

## TWO STAGE THERMOSTAT

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14 Claims. (Cl. 200—139)

This invention relates broadly to automatic switches, and is more particularly directed to a condition responsive switching mechanism for providing a two stage action.

The copending application of Albert E. Baak, Serial No. 303,953, filed November 13, 1939, shows a two stage switching mechanism in which an armature is rotatably carried by a condition responsive element (a bimetallic thermostat in this particular case) and in which this armature cooperates with a pair of permanent magnets, the two stage action being accomplished by placing one of the magnets closer to the point about which the armature rotates than the other. A stationary contact is placed adjacent each magnet and cooperating movable contacts are carried by the armature. In this manner the stationary contact which is adjacent the magnet farthest from the axis of rotation of the armature is made first and broken last because its magnet is operating through a longer lever arm and therefore exerts a greater effective force on the armature than the other.

It is an object of the present invention to change the above construction in order to improve the contact action and reduce the differential between the two switch actions.

A further object is to mount the armature on the bimetallic element by means of a pivotal connection whereby a freer action of the armature is obtained.

A further object is to provide stops to limit the movement of the armature away from the magnetic means, one of these stops being carried by the bimetallic element.

A still further object is to use a signal magnet and have one end attract one end of the armature and the other end attract the other end of the armature.

These and other objects will readily become apparent as the following specification is read in the light of the accompanying drawing, in which

Figure 1 is a view in elevation showing a preferred embodiment of my invention,

Figure 2 is a detail view of the contact construction, and

Figure 3 is a detail view of the channel shaped magnet.

Referring to Figure 1 of the drawing the reference numeral 11 indicates a subbase by means of which the two stage thermostat is mounted on a wall or other flat surface. An insulating base 12 is connected to the subbase 11 by means of the screws 13. The subbase 12 is provided with a channel portion 14 adapted to house the adjusting mechanism for the thermostat. A metallic plate 15 is fastened to the base 12 by means of the screws 16 which enter the plate 15 from the reverse side of the base 12. The plate 15 covers the lower end of the channel portion 14.

The plate 15 carries an axle on which the bracket 18 is pivotally mounted, it being retained thereon by means of the screw 19. The bracket 18 is provided with an upwardly extending arm 20 whose end is bifurcated to form the fingers 21. A second arm 22 is pivotally mounted on the same axle with the bracket 18 and this arm 22 is provided with an extension 23 which carries an eccentric screw 24 extending between the fingers 21. The upper end of the arm 22 is also bifurcated to form the fingers 26 which receive the pin 27 on the upper end of the adjusting lever 28 which is pivoted as shown at 29 to an extension on the plate 15.

It can be seen that movement of the lower end of the adjusting lever 28 back and forth will cause it to rotate about the point 29 and cause a slight movement of the pin 27 which will in turn rotate the arm 22 and hence move the eccentric 24. Movement of the eccentric 24 will cause a rotation of the bracket 18. The bracket 18 is connected to one end of a bimetallic thermostat 31. Therefore movement of the adjusting lever 28 will rotate the thermostat 31 and cause an adjustment thereof. The lower end of the lever 28 is provided with a marker 32 which cooperates with a scale 33 on the lower end of the plate 15 to indicate the temperature to which the thermostat 31 has been set. A screw 34 extends through an arcuate slot 35 in the plate 15 and enters a tapped hole in lever 28. In this manner the lever 28 can be moved to any desired position and then can be locked in this position merely by tightening the screw 34. It will be obvious that by rotating the eccentric 24 the angular relationship between the bracket 18 and the arm 22 can be changed in order to calibrate the thermostat with respect to the scale 33.

The free end of the bimetallic thermostat 31 carries an insulating member 37 which in turn pivotally supports the armature 38 by means of the pin 39. The armature carries offset portions 40 and 41 which act as stops for the press-back blades 42 and 43 which carry the movable contacts 44 and 45. These pressback blades are mounted on tongues 46 which are struck from the armature 38 and can be bent to adjust the tension in the pressback blades to the proper value. The armature 38 is provided with a pair of U-shaped magnetic pieces 48 which cooperate with the ends of a channel shaped permanent magnet 49. The magnet 49 is mounted on bracket 50 by means of screws 51.

Bracket 52 adjustably carries the stationary contact 53 which extends through the legs of the U-shaped magnetic piece 48 to cooperate with the contact 44. The bracket 52 also adjustably carries the insulated stop 55 which engages the offset portion 40 of the armature 38 to limit

the movement of this armature away from the magnet 49. A metal piece 56 is connected to the magnet 49 and adjustably carries a stationary contact 57 which cooperates with the movable contact 45. The insulating member 37 adjustably carries screw 59 which cooperates with the offset portion 41 of the armature 38 to limit the movement of the armature away from the magnet 49. It will be noted that the pivot pin 39 for the armature 38 is closer to the lower end of the magnet than to the upper end of the magnet and that the armature 38 is unbalanced. That is, its upper end is longer than the lower end with the result that the upper end of the magnet 49 operates on the armature 38 through a longer lever arm than the lower end of the magnet and hence when the armature 38 is parallel to the magnet 49 the magnet tends to rotate the armature in a counter-clockwise direction.

When the temperature of the bimetallic thermostat 31 is above the control point the parts will be in the position shown in Figure 1 in which the armature 38 is in engagement with stops 55 and 59 and the movable contacts 44 and 45 are out of engagement with the stationary contacts 53 and 57. On a decrease in temperature the free end of the thermostat 31 will move toward the left and the upper end of the magnet 49 will first attract the magnetic piece 48 to pull the contact 44 into engagement with the stationary contact 53 and the pressback blade 42 will be pressed back until it engages the offset portion 40 of the armature 38. On a further decrease in temperature the thermostat 31 will move again toward the left and the lower end of the magnet 49 will attract the lower magnetic piece 48 to move the contact 45 into engagement with the stationary contact 57. On an increase in temperature the free end of the thermostat will move toward the right and first pull the lower end of the armature 38 away from the magnet 49 and into engagement with the screw 59. A further increase in temperature will result in the movement of the upper end of the armature to the right separating the contacts 44 and 53.

Adjustment of the differential of this switching mechanism may be accomplished by adjusting the stationary contacts 53 and 57 to vary the gap between the magnetic pieces 48 and the permanent magnet 49 when both switches are closed. A further adjustment is provided by means of the stops 55 and 59 to adjust the distance which the armature 38 can move away from the permanent magnet 49.

It will be appreciated that two separate magnets may be used instead of the single magnet 49. If this were desired one magnet would be placed adjacent contact 53 to attract the upper end of the armature 38 and a second magnet would be located adjacent the contact 57 to attract the lower end of the armature 38. This arrangement would work just as well as with the single magnet. However, the single magnet is chosen as the preferred embodiment of the invention so that any variation in the magnetic strength of the magnet cannot change the sequence of switch operation. If two magnets were used and the magnet adjacent the contact 53 were to become considerably weaker than the magnet adjacent the contact 57, the switch action would be reversed so that the lower end of the armature would pull in before the upper end.

As various changes and modifications of this invention may occur to those who are skilled in the art, I wish it to be understood that I am to be limited by the scope of the appended claims rather than by the specific embodiment disclosed.

I claim as my invention:

1. In a device of the character described, an armature, a substantially frictionless pivot for said armature about which it is adapted to rotate, magnetic means cooperating with said armature at spaced points, said pivot being nearer one of said points than the other, so that said magnetic means will exert relatively different rotative forces on said armature at said points, and means for moving said pivot toward and away from said magnetic means.

2. In a device of the character described, an armature, a substantially frictionless pivot for said armature about which it is adapted to rotate, magnetic means cooperating with said armature at spaced points, stationary contacts adjacent said points, movable contacts carried by said armature, said pivot being nearer one of said points than the other, so that said magnetic means will exert relatively different rotative forces on said armature at said points, and means for moving said pivot toward and away from said magnetic means whereby certain of said contacts will always make before the others, and said others will always be the first to break.

3. In a device of the character described, an armature, a pivot for said armature about which it is adapted to rotate, magnetic means cooperating with said armature at spaced points, stationary contacts adjacent said points, movable contacts carried by said armature, said pivot being nearer one of said points than the other, means for moving said pivot toward and away from said magnetic means whereby certain of said contacts will always make before the others, and said others will always be the first to break, engagement of said contacts limiting the movement of said armature toward said magnetic means, and means for adjusting said stationary contacts for varying the air gap between said armature and said magnetic means when said contacts are made.

4. In a device of the character described, an armature, a pivot for said armature about which it is adapted to rotate, magnetic means cooperating with said armature at spaced points, stationary contacts adjacent said points, movable contacts carried by said armature, said pivot being nearer one of said points than the other, means for moving said pivot toward and away from said magnetic means whereby certain of said contacts will always make before the others, and said others will always be the first to break, and stops for limiting the movement of each of said points away from said magnetic means.

5. In a device of the character described, an armature, a pivot for said armature about which it is adapted to rotate, magnetic means cooperating with said armature at spaced points, stationary contacts adjacent said points, movable contacts carried by said armature, said pivot being nearer one of said points than the other, means for moving said pivot toward and away from said magnetic means whereby certain of said contacts will always make before the others, and said others will always be the first to break, engagement of said contacts limiting the movement of said armature toward said magnetic means, and means for adjusting said stationary contacts for varying the air gap between said armature and said magnetic means when said contacts are made, and adjustable stops for

limiting the movement of said points away from said magnetic means.

6. In a device of the character described, a bimetallic element having a fixed end and a free end, an arm carried by the free end of the element by means of a freely pivoted connection at an intermediate point on said arm, first and second stops limiting the movement of one end of said arm, third and fourth stops limiting the movement of the other end of said arm, and biasing means resisting movement of said one end away from said first stop with a predetermined force and resisting movement of said other end away from said fourth stop with a predetermined lesser force, whereby said other end always leaves said fourth stop before said one end leaves said first stop on movement of said bimetallic element in one direction and said one end always engages said first stop before said other end engages said fourth stop on movement of said bimetallic element in the opposite direction.

7. In a device of the character described, a bimetallic element having a fixed end and a free end, an arm carried by the free end of the element by means of a freely pivoted connection at an intermediate point on said arm, first and second movable contacts carried by said arm at opposite sides of said pivotal connection, first and second stationary contacts for engagement by said first and second movable contacts respectively on movement of said arm in one direction, stops for limiting movement of said arm in the opposite direction, means biasing said first contacts into engagement with a predetermined force and biasing said second contacts into engagement with a predetermined lesser force whereby said first contacts always make first and break last, and means for moving the fixed end of said bimetallic element to vary the temperature at which said contacts are made and broken.

8. In a device of the character described, a bimetallic element having a fixed end and a free end, an armature carried by the free end of the element by means of a pivotal connection intermediate the ends of said armature, magnetic means attracting said armature at first and second points on opposite sides of said pivotal connection, one of said points being nearer said connection than the other, and means for limiting the movement of said armature in each direction.

9. In a device of the character described, a bimetallic element having a fixed end and a free end, an armature carried by the free end of the element by means of a pivotal connection intermediate the ends of said armature, a pair of movable contacts carried by said armature at opposite sides of said pivotal connection, stationary contacts cooperating therewith, magnetic means tending to hold one pair of contacts in engagement with a greater force than the other pair, and stops limiting the movement of both ends of said armature away from said stationary contacts, one of said stops being carried by said bimetallic element.

10. In a device of the character described, a bimetallic element having a fixed end and a free end, an armature carried by the free end of the element by means of a pivotal connection intermediate the ends of said armature, a magnet, one end of said magnet attracting said armature at a point on one side of said pivotal connection, the other end of said magnet attracting said armature at a point on the other side of said pivotal connection, one of said points being nearer the pivotal connections than the other, and means limiting the movement of said armature away from said magnet.

11. In a device of the character described, a bimetallic element having a fixed end and a free end, an armature carried by the free end of the element by means of a pivotal connection intermediate the ends of said armature, a channel shaped permanent magnet extending longitudinally of and adjacent said armature, said pivotal connection being nearer one end of said magnet than the other, and means limiting the movement of said armature away from said magnet.

12. In a device of the character described, a bimetallic element having a fixed end and a free end, an armature carried by the free end of the element by means of a pivotal connection intermediate the ends of said armature, a pair of movable contacts carried by said armature at opposite sides of said pivotal connection, stationary contacts cooperating therewith, a single magnet, one end of said magnet attracting said armature at one point on one side of said pivotal connection to tend to hold one pair of contacts in engagement, the other end of said magnet attracting said armature at another point on the other side of said pivotal connection to tend to hold the other pair of contacts in engagement, one of said points being nearer said pivotal connection than the other, and stops limiting the movement of both ends of said armature away from said magnet.

13. In a device of the character described, a bimetallic element having a fixed end and a free end, an armature carried by the free end of the element by means of a pivotal connection intermediate the ends of said armature, a pair of movable contacts carried by said armature at opposite sides of said pivotal connection, stationary contacts cooperating therewith, a channel shaped magnet extending lengthwise of and adjacent said armature to tend to hold said contacts in engagement, said pivotal connection being nearer one end of said magnet than the other, and means limiting the movement of each end of said armature away from said magnet.

14. In a device of the character described, a bimetallic element having a fixed end and a free end, an armature carried by the free end of the element by means of a pivotal connection intermediate the ends of said armature, a pair of movable contacts carried by said armature at opposite sides of said pivotal connection, stationary contacts cooperating therewith, a channel shaped magnet extending lengthwise of and adjacent said armature to tend to hold said contacts in engagement, said pivotal connection being nearer one end of said magnet than the other, a pair of stops for limiting the movement of the ends of said armature away from said magnet, one of said stops being carried by the bimetallic element, and means for moving the fixed end of said bimetallic element to vary the temperature at which said element will actuate said contacts.

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