July 30, 1929. E. H. WHITE 1,722,361

HEAT REGULATOR

Filed July 20, 1927 5 Sheets-Sheet 1

Fig. 1

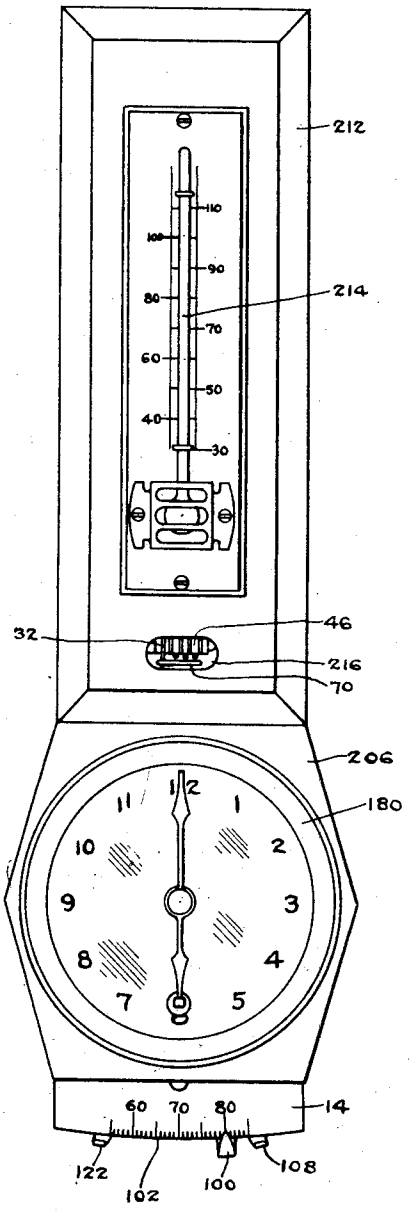
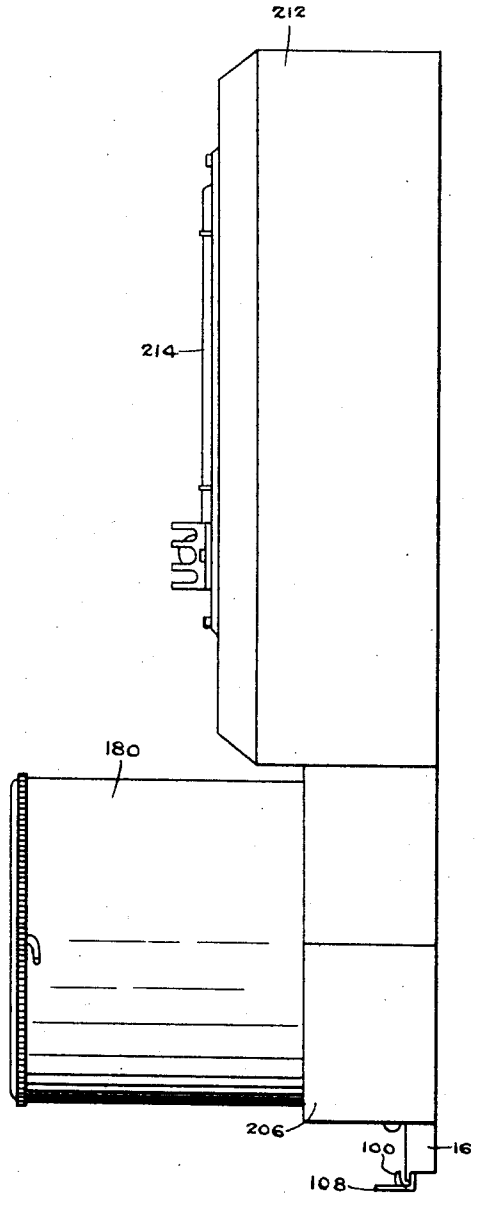


Fig. 2



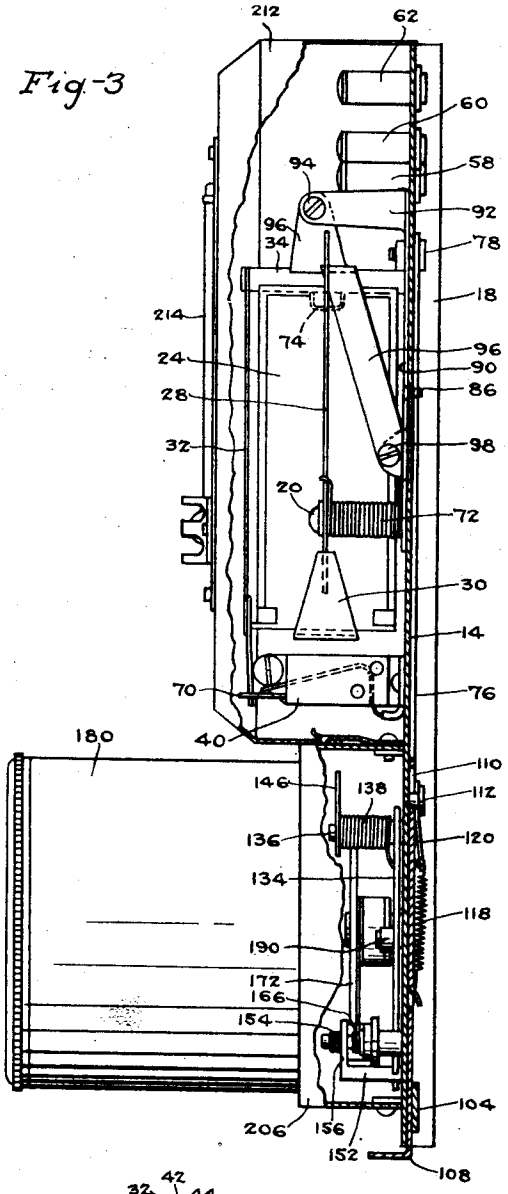
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Fig-3



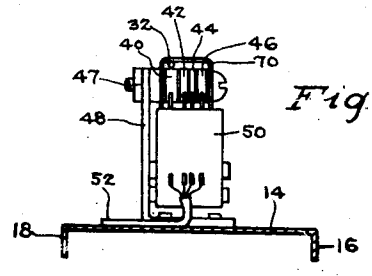


Fig-5

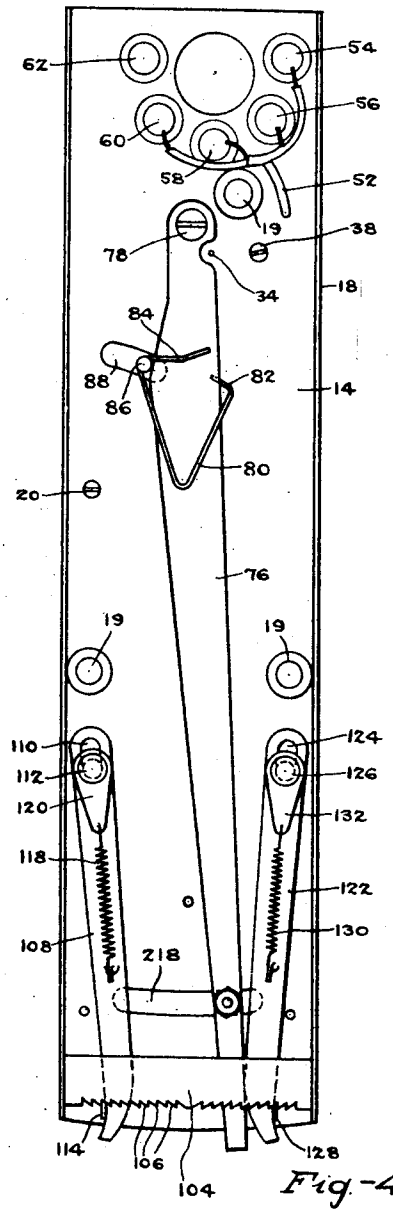


Fig-4

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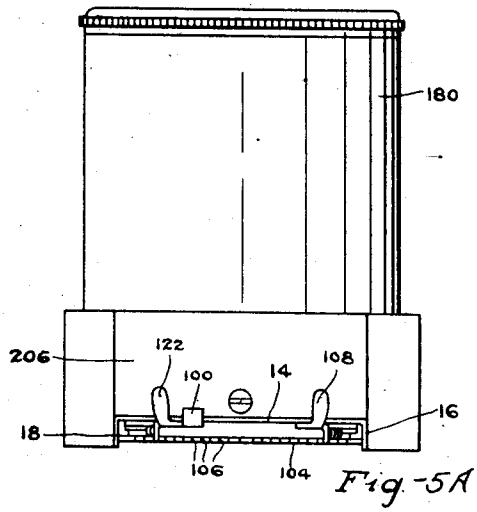


Fig. 5A

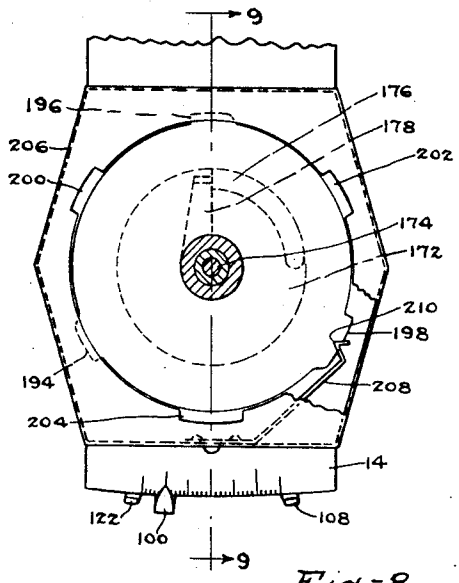


Fig. 8

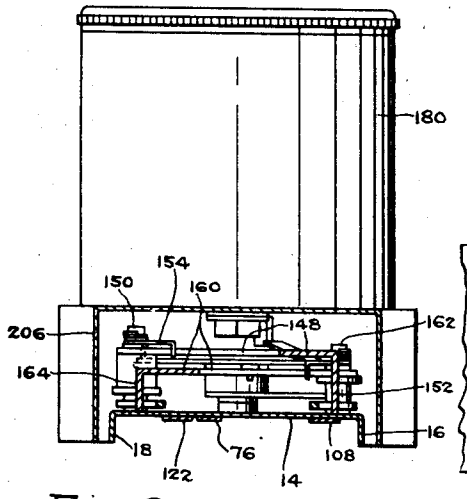


Fig. 6

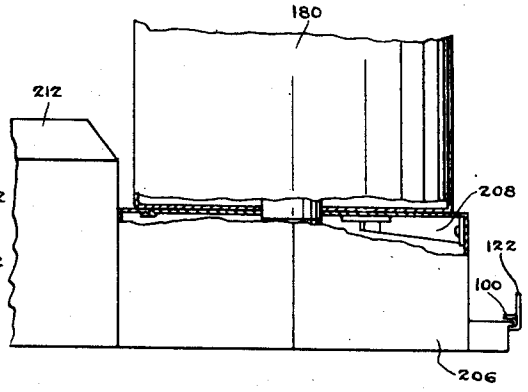


Fig. 9

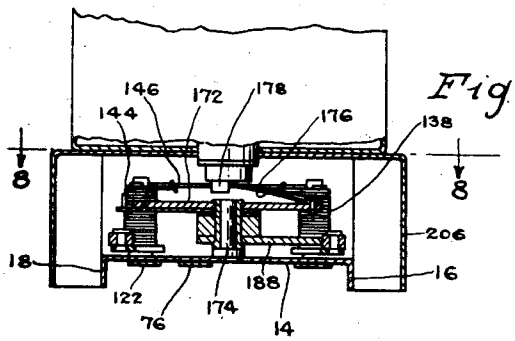


Fig. 7

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Fig-10

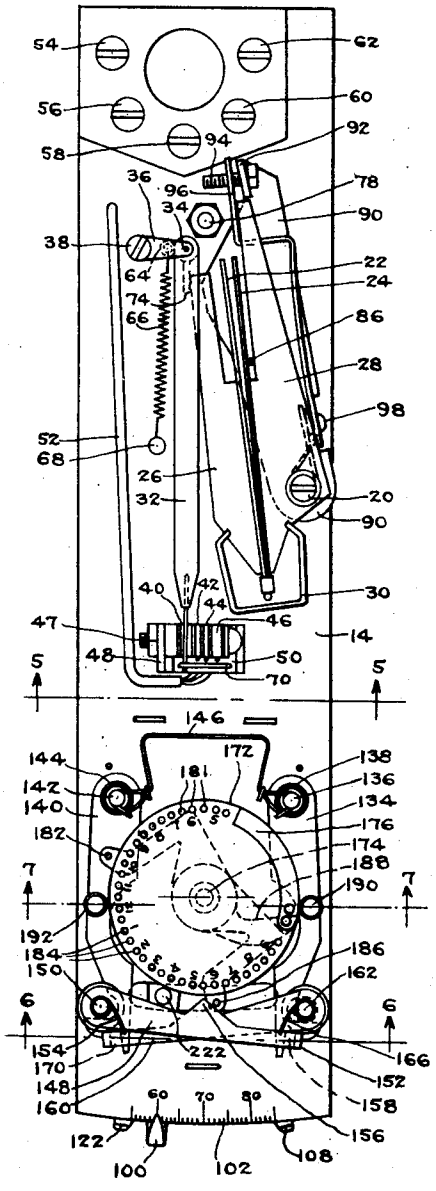
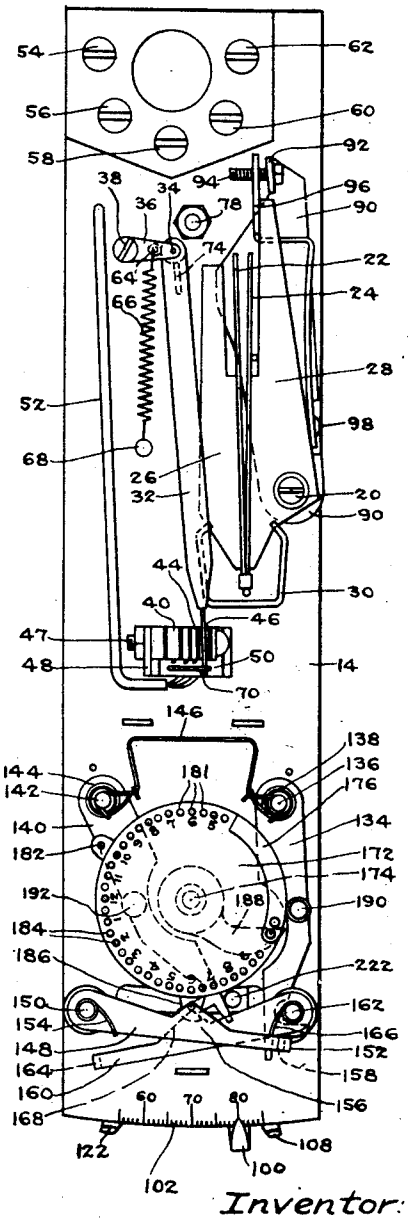


Fig-11



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Fig. 12

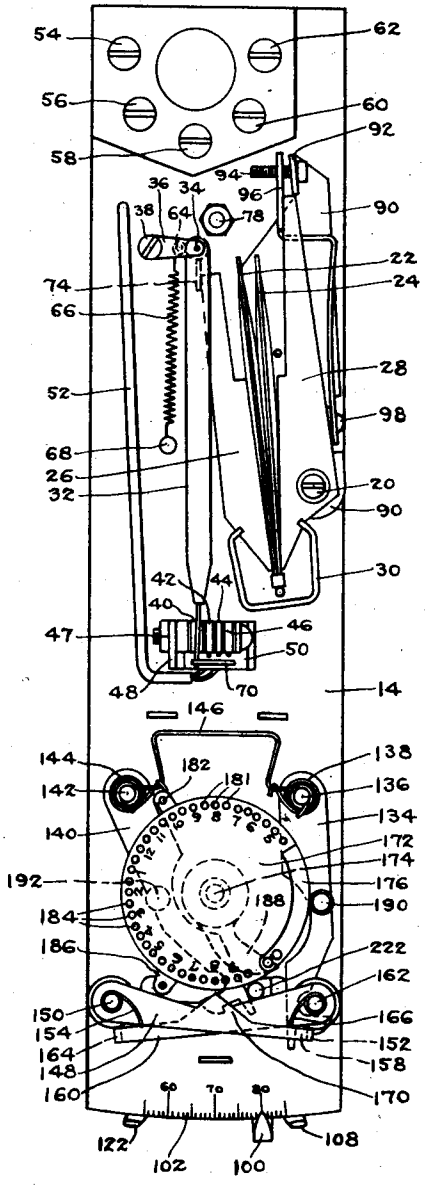
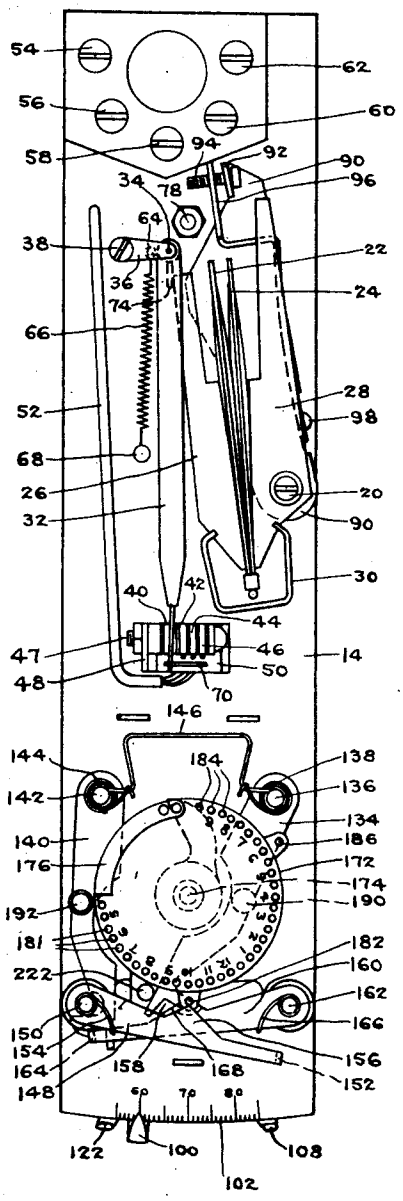


Fig. 13



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UNITED STATES PATENT OFFICE.

EVERETT H. WHITE, OF ST. PAUL, MINNESOTA.

HEAT REGULATOR.

Application filed July 20, 1927. Serial No. 207,194.

My invention relates to heat regulators, and has for an object to provide an improved device for making and breaking electrical circuits governed by the temperature of the room in which the device is located, the making and breaking of the different circuits operating suitable controlling mechanism by means of which the furnace or other source of heat is regulated. The present invention is an improvement on the device disclosed and claimed in my prior Patent Number 1,393,060 issued October 11, 1921, and an object in particular is to provide an efficient mechanism which is automatically set at a predetermined time to maintain a low temperature for a period of time as for instance at night and which will be automatically changed at a predetermined time to maintain a higher temperature for a period of time as for instance during the day. While automatic regulation of this character has been chosen as an example for illustrative purposes, it is to be understood that the times when the device is automatically changed from high to low and from low to high may be varied as desired.

The full objects and advantages of my invention will appear in connection with the detailed description thereof, and the novel features of my inventive idea will be particularly pointed out in the claims.

In the accompanying drawings which illustrate a practical embodiment of my invention in one form,—

Fig. 1 is a front elevational view of the device. Fig. 2 is a side elevational view. Fig. 3 is an elevational sectional view. Fig. 4 is a rear elevational view. Fig. 5 is a view in horizontal section on the line 5—5 of Fig. 10. Fig. 5—A is a bottom plan view. Fig. 6 is a view in horizontal section on the line 6—6 of Fig. 10. Fig. 7 is a view in horizontal section on the line 7—7 of Fig. 10. Fig. 8 is a view in section on the line 8—8 of Fig. 7. Fig. 9 is a view with a portion in section on the line 9—9 of Fig. 8. Fig. 10 is a front elevational view with the casing members removed and with the device set for low temperature. Fig. 11 is a front elevational view with the casing members removed and with the device set for building up a higher temperature. Fig. 12 is a front elevational view with the casing members removed and with the device operated to prevent exceeding the maximum temperature for which it is set. Fig. 13 is a front elevational view with the casing members removed and with the device operated to establish low temperature position.

In the embodiment of the invention shown, my device includes a back member 14 the two opposite side edges of which are bent backwardly at right angles to form flanges 16 and 18. The back member 14 is constructed of fairly heavy metal in order that it may form a rigid support for the operating parts of the device and it is provided with reinforced perforations 19 in order that it may be secured to a wall or other support. Secured to the back 14, there is a post 20 which supports a thermostat, the general construction of which will now be described in order to explain the operation of the device claimed in the present application although the thermostat per se is claimed in Patent Number 1,689,542, dated October 30, 1928. The thermostat consists of two hollow members 22 and 24, these two members being secured together at their lower ends in the manner of leaves. Upwardly projecting arms 26 and 28 are secured respectively to the outer walls of the members 22 and 24. These members are additionally held together at their lower ends by a U-shaped metal piece 30 which has clamping engagement with the arms 26 and 28. The thermostat as a whole is mounted for rotative movement due to the fact that the post 20 passes through a hole in the lower portion of the arm 28. The hollow members or leaves 22 and 24 are sealed from atmosphere and contain a gas which is readily acted upon by heat to cause said members to expand. A movable contact arm 32 is secured at its upper end to a spindle 34, the ends of which are reduced and have bearings in the back member 14 and in an arm 36 extending out from a post 38 secured to the back member. The lower end of the arm 32 is reduced and is adapted to engage in succession a number of fixed contact members, these members being shown as four in number and designated, 40, 42, 44, and 46. These members are separated from each other by insulation and are held in place by a bolt 47 which is secured to a bracket 48 extending out from the back member as will be understood from Fig. 5. A block 50 of insulating material is secured to the bracket 48. Four wires connected respectively with the four fixed contact members extend through the block 50 and are formed into a cable 52 which extends upwardly toward the upper portion of the back member where said

cable passes through the latter and the individual wires are separated an secured to binding posts 54, 56, 58 and 60 which are insulated from the metallic back and are connected with any suitable form of operating device which may be employed to regulate the source of heat. A binding post 62 is in metallic contact with the back member and is, therefore, electrically connected with the contact arm 32. The post 62 is intended to be connected with any suitable source of electrical energy. Referring to Figs. 10 to 13, it will be noted that the spindle 34 has a lateral projection 64 to which the upper end of a light coiled spring 66 is attached, the lower end of this spring being attached to a post 68 extending out from the back 14. The tendency of the spring 66 as will be obvious from Fig. 11 is to move the lower end of the contact arm toward the right and into contact with the fixed member 46. A U-shaped wire 70 extending out from the block 40 serves to prevent movement of the contact arm 32 beyond the two extreme contacts 40 and 46. As shown in Fig. 3, a spring 72 is coiled around the post 20 and one end of this spring engages the arm 28 and tends to rock the thermostat so that the upper end of the arm 26 will come into engagement with a projection 74 extending down from the spindle 34. When the thermostat is thus rocked, the contact arm 32 is moved toward the left so that it engages the fixed contact 40 as shown in Fig. 10. This result is due to the fact that the spring 72 is stronger than the spring 66. In order to rock the thermostat at certain desired times, a control device is provided. For this purpose, an arm 76 is located upon the rear of the member 14 and is pivoted upon a screw 78 secured to the upper portion thereof as shown in Fig. 4. A bent spring 80 has an end 82 secured to the arm 76 and an end portion 84 which engages a stud 86 and normally holds the latter resiliently in engagement with one side of the arm 76. This stud passes through a slot 88 in the back 14 and on the front side thereof is secured to an arm 90 which at its lower end is pivoted on the post 20 and engaged by an end of the spring 72 which tends to swing the arm 90 toward the left as viewed in Fig. 10. The upper end of the arm 90 has a forwardly extending projection 92 to which a screw 94 is rotatively secured. The screw 94 is threaded through an opening in the upper end of a thrust plate 96 which is bent into angular shape and has its lower end secured by a screw 98 to the arm 90. The upper end of the thrust plate 96 is adapted to be engaged by the upper end of the arm 28 and by turning the screw 94, the position of said upper end may be adjusted. The lower end of the arm 76 is bent forwardly and upwardly and terminates in a pointed end 100 which is adapted to register with graduations 102 formed on the lower front margin of the back member 14. Just above these graduations but on the rear side of the member 14 and spaced therefrom by being secured to the side flanges 16 and 18, there is a bar 104 having notches 106 on its lower edge as shown in Fig. 4. Near one edge of the device there is a stop arm 108 which is provided at its upper end with a slot 110 through which a screw 112 extends, this screw being attached to the back member. The lower end of the arm 108 is bent forwardly so as to constitute a stop for the pointed end 100 of the control arm 76. The arm 108 carries an outstanding tooth 114 which is engageable with different ones of the notches 106. A spring 118 is attached at its upper end to a projection 120 held by the screw 112 and at its lower end is attached to the arm 108 so as to hold the tooth 114 in engagement with the particular notch which is selected. Near the other edge of the device, there is a similar stop arm 122 which is provided at its upper end with a slot 124 through which a screw 126 extends, this screw being attached to the back member. The lower end of this latter arm is bent forwardly so as to constitute a stop for the pointed end 100 of the control arm 76. The arm 122 carries an outstanding tooth 128 which is engageable with different ones of the notches 106. A spring 130 is attached at its upper end to a projection 132 held by the screw 126 and at its lower end is attached to the arm 122 so as to hold the tooth 128 in engagement with the particular notch which is selected. The stop arm 108 is used to determine the maximum temperature desired, for instance, for daytime, and as shown is set to limit the movement of the control arm toward the right to a position corresponding to 80° F. The stop arm 122 is used to determine the minimum temperature desired as for instance,—for nighttime, and is shown set to limit the movement of the control arm toward the left to a position corresponding to 60° F. It should now be explained that the position of the arm 76 is automatically controlled by the following mechanism. An arm 134 is pivotally mounted at its upper end upon a post 136 projecting forwardly from the right hand portion of the back member 14. A coiled spring 138 surrounds the post 136 and is anchored to the arm 134 in such manner as to tend to swing this arm toward the left and into the position shown in Fig. 13. An arm 140 is pivotally mounted at its upper end upon a post 142 projecting forwardly from the left hand portion of the back member 14. A coiled spring 144 surrounds the post 142 and is anchored to the arm 140 in such manner as to tend to swing this arm toward the right into the position shown in Figs. 11 and 12. The posts 136 and 142 are connected by a U-shaped wire 146 to which the forward ends of the springs 138 and 144 are anchored. An arm 148 is pivotally mounted at one end

on a post 150 projecting forwardly from the left hand portion of the back member 14, the other end of this arm being turned backwardly at right angles to form a catch 152 as best shown in Fig. 6 and the arm being held yieldingly upward by a spring 154 coiled around the post 150. The upper margin of the arm 148 is provided with an inclined cam 156 which when engaged in a manner presently to be described will cause the arm 148 to be depressed in opposition to the tension of the spring 154. The catch 152 is adapted at certain times to engage a notch 158 in the lower end of the arm 134 and hold this arm in vertical position in opposition to the tension of the spring 138. An arm 160 is pivotally mounted at one end on a post 162 projecting forwardly from the right hand portion of the member 14, the other end of this arm being turned backwardly at right angles to form a catch 164 and this arm being held yieldingly upward by a spring 166 coiled around the post 162. The upper margin of the arm 160 is provided with an inclined cam 168 similar to the cam 156 and which when engaged will cause the arm 160 to be depressed in opposition to the tension of the spring 166. The catch 164 is adapted at certain times to engage a notch 170 in the lower end of the arm 140 and thus hold this arm in vertical position in opposition to the tension of the spring 144. A timing disk 172 is rotatably mounted on a post 174 extending forwardly from the back member 14. This disk on its front face carries a projection 176 which is in the shape of a leaf spring secured at one end and this projection is engaged by an arm 178 extending rearwardly from a clock mechanism 180 and operated thereby so that the disk 172 is rotated once every twenty-four hours as will be understood from Figs. 7 and 8. The disk 172 carries a number of perforations 181 around a portion of its periphery and in connection with any one of which an adjustable projection 182 is adapted to be set. The disk carries a number of perforations 184 around the diametrically opposite portion of its periphery and in connection with any one of which an adjustable projection 186 is adapted to be set. The projection 186 carries a rearwardly extending pin which is adapted to engage the rear cam 168 for releasing the arm 140. The projection 182 carries a forwardly extending pin which is adapted to engage the front cam 156 for releasing the arm 134. Secured to the rear of the disk 172, there is a dog 188 which is adapted to engage projections 190 and 192 secured respectively to the arms 134 and 140 in order to reset these arms after they have been tripped in the manner just stated. The casing of the clock at its rear carries three projections 194, 196, and 198 which are adapted to be inserted through notches 200, 202, and 204 formed in a casing 206 secured over the lower portion of the back 14 and the mechanism carried thereby. The clock casing is held in place by giving the same a movement of rotation after the projections have been inserted in the notches. The casing 206 carries a spring finger 208 best shown in Fig. 8 adapted to snap into a notch 210 formed in the projection 198 so as to hold the clock properly positioned with the numeral 12 at the top as shown in Fig. 1. A ventilated casing 212 is secured over the upper portion of the back member and the mechanism carried thereby. A thermometer 214 is secured to the casing and the latter is provided with a window 216 through which the contact members may be observed. The lower portion of the back member 14 is provided with an arcuate slot 218 through which projects a stud 222 carried by the control arm 76.

The operation and advantages of my invention will be understood in connection with the foregoing description, attention being called to the fact that the spring 66 when free to act alone holds the movable contact member 32 toward the right for high temperature. However, the spring 72 is stiffer than the spring 66 and hence when not restrained causes the upper end of the arm 26 to come into engagement with the projection 74 and move the movable contact arm toward the left for low temperature. The adjustment shown is such that the device will start to build up a temperature of 80° at 6 a. m. and maintain this temperature during the day and up to 10 p. m. at which time the device is automatically shifted for lowering the temperture to 60° which point is maintained during the night until the next morning at 6 a. m. again. It will be understood as a matter of course that the time when the shifting from low to high and from high to low takes place may be varied as desired and also that the desired maximum and minimum may be varied as desired. Fig. 10 shows the position of the device at 5:30 a. m. with the movable contact 32 on the low side of the fixed contacts. The pointed end 100 of the control arm 76 is at the left and hence, the thermostat has been rocked toward the left by the spring 72 so that the arm 26 has forcibly engaged the projection 74. In this figure, both of the arms 134 and 140 are held in vertical position in the manner previously stated. The projection 186 on the timing disk is just coming into engagement with the cam 168 on the arm 160 for depressing the latter. Fig. 11 shows that at 6 a. m. the arm 160 has been fully depressed so that the spring-pressed arm 140 is released and by its engagement with the stud 222 has forced the control arm 76 toward the right. This latter arm through the connections previously described causes the thrust plate 96 to engage the upper end of the arm 28 and tilt the thermostat toward the right.

This removes the arm 26 from engagement with the projection 74 so that the spring 66 causes the contact arm 32 to move over toward the high side of the fixed contacts. Fig. 12 shows the position which it may be assumed the parts are in at about 8 a. m. The temperature has risen and the thermostat has expanded which causes the arm 26 to engage the projection 74 and gradually force the movable contact arm over the fixed contacts toward the low side thereof. Should the temperature fall, the thermostat contracts and the arm 26 recedes so that the contact arm 32 is forced toward the right. Thus the selected maximum temperature is maintained during the day. However at some time during the day fixed by the position in which the dog 188 is secured, this dog engages the projection 192 on the arm 140 so that the latter is reset in vertical position as shown in Fig. 13. This latter figure represents the position of the parts at 10 p. m. The projection 182 on the timing disk has just engaged the cam 156 on the arm 148 to depress the latter and release the arm 134 which forces the control arm 76 toward the left. This also moves the plate 96 toward the left so that the contact arm 32 is swung to the low side by the action of the spring 72. At some time during the night, the dog 188 engages the projection 190 on the arm 134 and resets it in the vertical position shown in Fig. 10. Should the temperature tend to fall too low during the night, the contraction of the thermostat will remove the arm 26 from engagement with the projection 74 and permit the contact arm 22 to move toward the right, thus maintaining the predetermined minimum temperature.

I claim:

1. A heat regulator comprising a support, a thermostat pivotally mounted on said support, a movable contact member, fixed contact members corresponding to different temperatures adapted to be separately engaged by said movable contact member, said thermostat when in one extreme position tending to hold said movable contact member at one side of said fixed contact members, a control arm adapted to automatically rock said thermostat toward its other extreme position and cause said movable contact member to move toward the other side of said fixed contact members, and time-controlled mechanism for causing said control arm to move into its two extreme positions alternately and at predetermined times.

2. A heat regulator comprising a support, a thermostat pivotally mounted on said support, a movable contact member, fixed contact members corresponding to different temperatures adapted to be separately engaged by said movable contact member, a spring operatively connected with said movable contact member and tending to hold the latter at one side of said fixed contact members, a second spring stiffer than said first mentioned spring and tending to rock said thermostat for holding said movable contact member at the other side of said fixed contact members, and a control device adapted to automatically rock said thermostat in opposition to the tension of said second spring.

3. A heat regulator comprising a support, a thermostat pivotally mounted on said support, a movable contact member, fixed contact members corresponding to different temperatures adapted to be separately engaged by said movable contact member, a spring operatively connected to said movable contact member and tending to hold the latter at one side of said fixed contact members, a second spring stiffer than said first mentioned spring and tending to rock said thermostat for holding said movable contact member at the other side of said fixed contact members, a control arm adapted to automatically rock said thermostat in opposition to the tension of said second spring, and time-controlled mechanism for causing said control arm to thus operate at predetermined times.

4. A heat regulator comprising a thermostat, a movable contact member, operating connections between said thermostat and said contact member, fixed contact members corresponding to different temperatures adapted to be separately engaged by said movable contact member, a control arm adapted to occupy two extreme positions for determining the position of said movable contact member, time-controlled mechanism, a device adapted to move said control arm into one of its extreme positions, a second device adapted to move said control arm into its other extreme position, and means set in operation by said time-controlled mechanism for causing said two devices to operate alternately and at predetermined times.

5. A heat regulator comprising a thermostat, a movable contact member, operating connections between said thermostat and said contact member, fixed contact members corresponding to different temperatures adapted to be separately engaged by said movable contact member, a control arm adapted to occupy two extreme positions for determining the position of said movable contact member, time controlled mechanism, a spring-pressed arm adapted to move said control arm into one extreme position, a second spring-pressed arm adapted to move said control arm into its other extreme position, latching devices for retaining said spring-pressed arms in inoperative position, unlatching devices for releasing said spring-pressed arms, resetting devices for restoring said spring-pressed arms into latched condition, and means set in operation by said time-controlled mechanism for causing said unlatching devices and said resetting devices to operate alternately and at predetermined times.

6. A heat regulator comprising a thermostatic member, a movable contact arm operated by said thermostatic member, fixed contact members corresponding to different temperatures adapted to be separately engaged by said movable contact member, a comparatively weak stressing device tending to move said contact arm into engagement with an end member of said fixed contact members, a comparatively strong stressing device tending to move said contact arm into engagement with the other end member of said fixed contact members, and a control device which at predetermined times prevents the normal operation of said stronger stressing device.

7. A heat regulator comprising a thermostatic member, a movable contact member adapted to be operated by said thermostatic member, fixed contact members corresponding to different temperatures adapted to be separately engaged by said movable contact member, actuating mechanism adapted to move said movable contact member into its two extreme positions, latching devices for retaining said actuating mechanism in inoperative condition, unlatching devices for releasing said actuating mechanism, re-setting devices for restoring said actuating mechanism into latched condition, time-controlled mechanism, and means set in operation by said time-controlled mechanism for causing said unlatching devices and said resetting devices to operate alternately and at predetermined times.

8. A heat regulator comprising a thermostatic member, a movable contact member adapted to be operated by said thermostatic member, fixed contact members corresponding to different temperatures adapted to be separately engaged by said movable contact member, actuating mechanism adapted to move said movable contact member into its two extreme positions, latching arms for retaining said actuating mechanism in inoperative condition, a rotatable timing disk, projections carried by said timing disk for engaging said latching arms respectively to move them into unlatching position, and a dog carried by said timing disk for restoring said actuating mechanism to latched position.

9. A heat regulator comprising a thermostatic member, a movable contact member adapted to be operated by said thermostatic member, fixed contact members corresponding to different temperatures adapted to be separately engaged by said movable contact member, a control arm adapted to occupy two extreme positions for determining the position of said movable contact member, a spring-pressed arm adapted to move said control arm into one extreme position, a second spring-pressed arm adapted to move said control arm into its other extreme position, latching arms for retaining said spring-pressed arms in inoperative position, a rotatable timing disk, projections carried by said timing disk for engaging said latching arms respectively to move them into unlatching position, and a dog carried by said timing disk for restoring said spring-pressed arms to latched position.

In testimony whereof I hereunto affix my signature.

EVERETT H. WHITE.