

Feb. 7, 1950

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2,496,889

SWITCH FOR DOMESTIC APPLIANCES

Filed Feb. 13, 1946

4 Sheets-Sheet 1

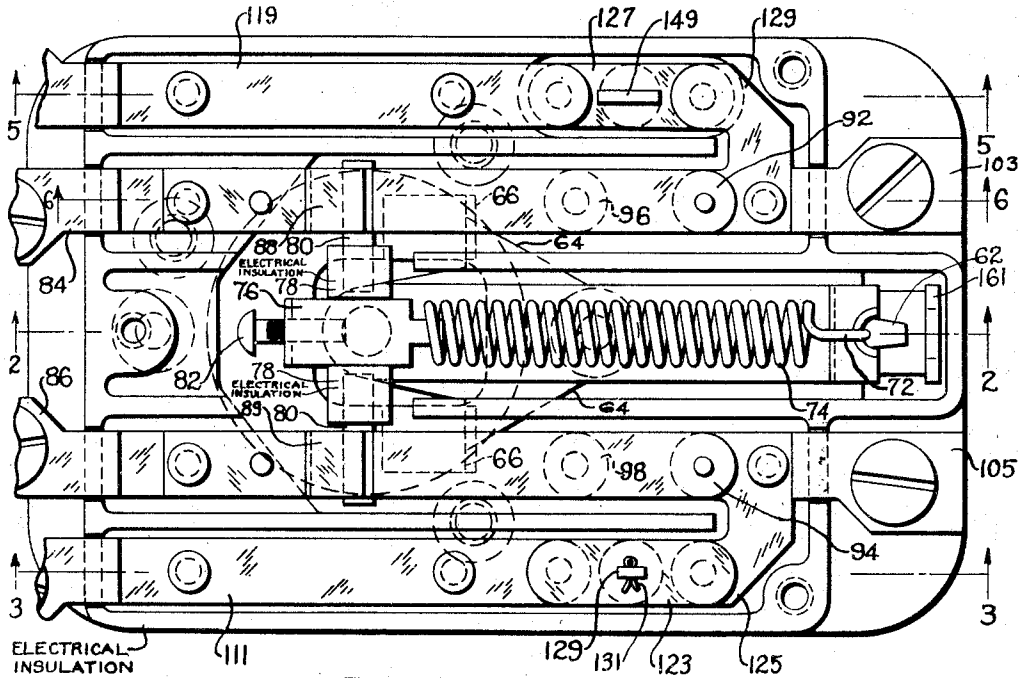


FIG. 1

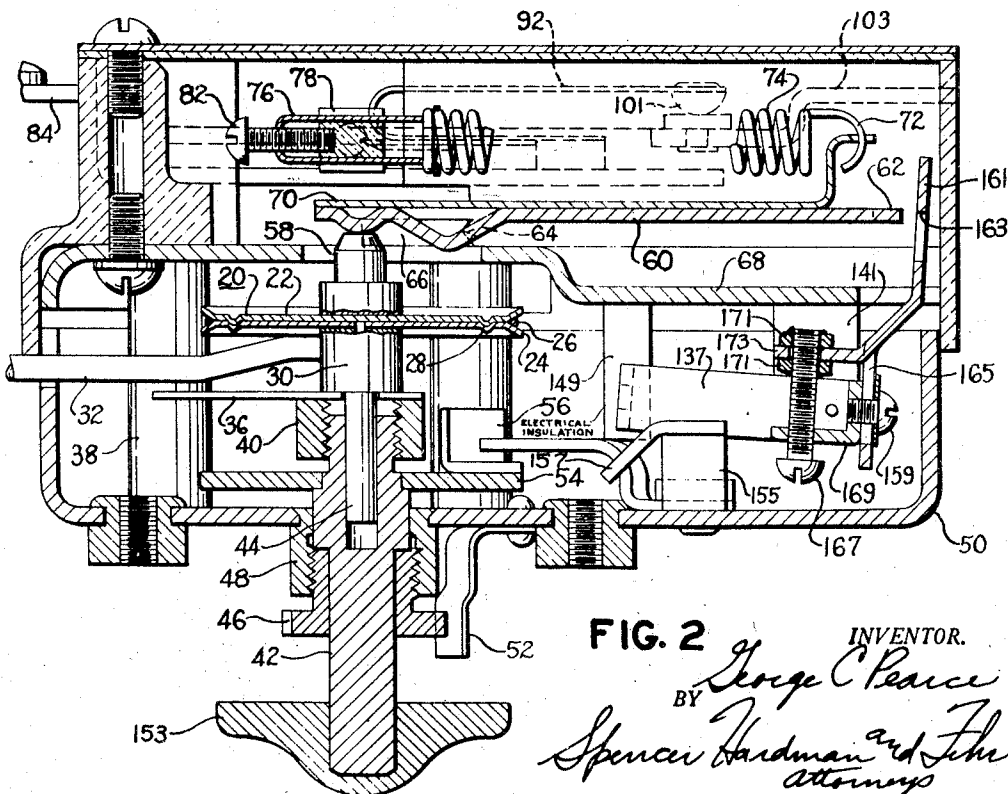


FIG. 2

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4 Sheets-Sheet 2

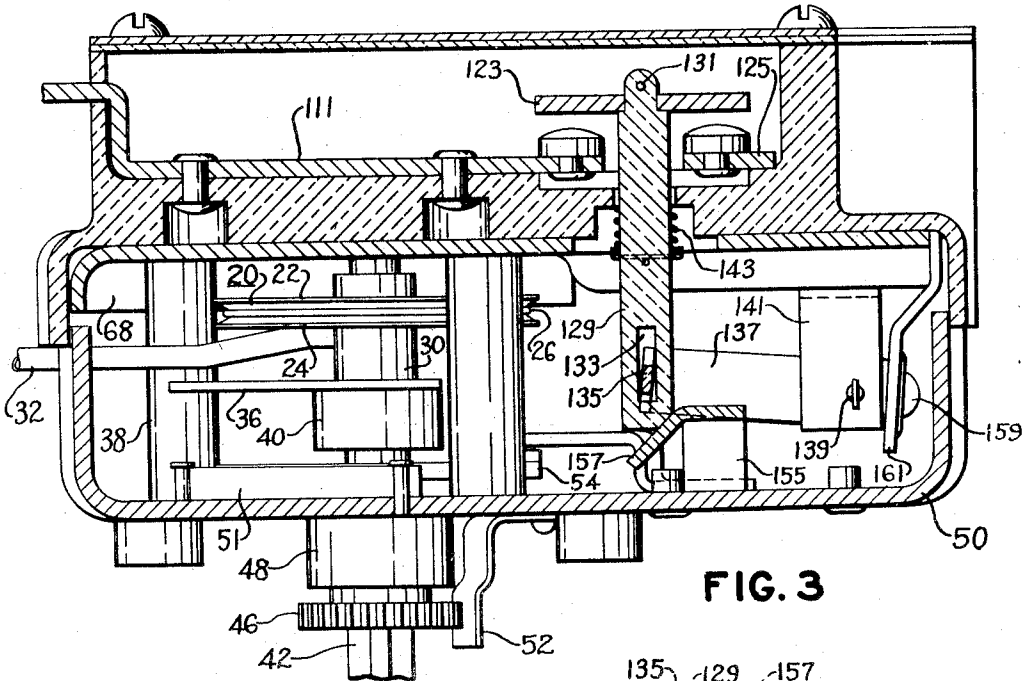


FIG. 3

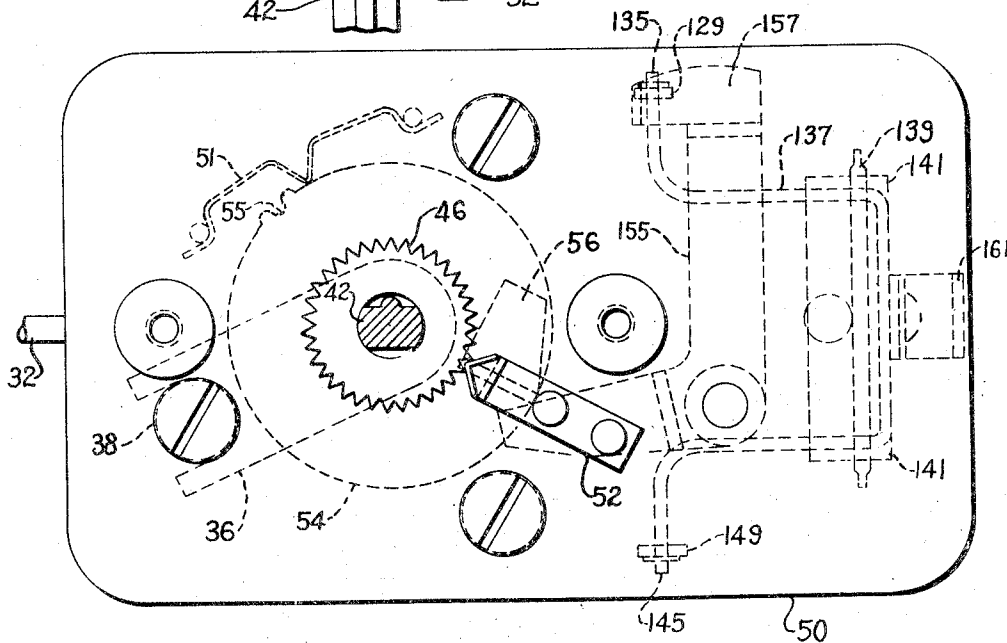


FIG. 4

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4 Sheets-Sheet 3

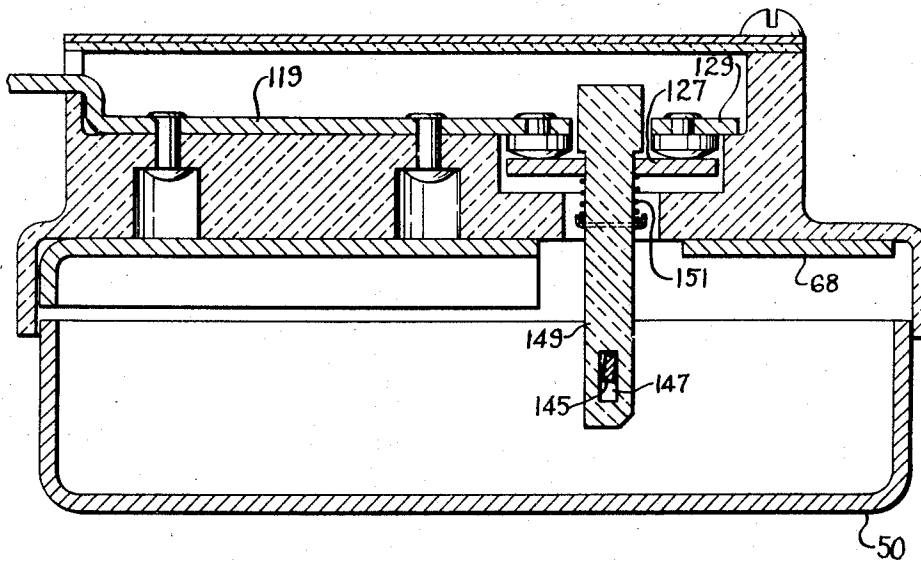


FIG. 5

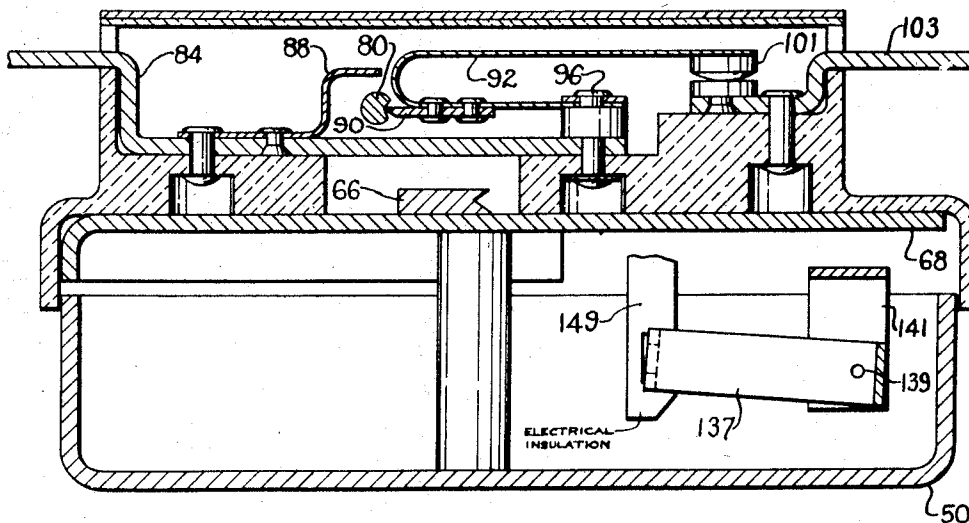


FIG. 6

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SWITCH FOR DOMESTIC APPLIANCES

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4 Sheets-Sheet 4

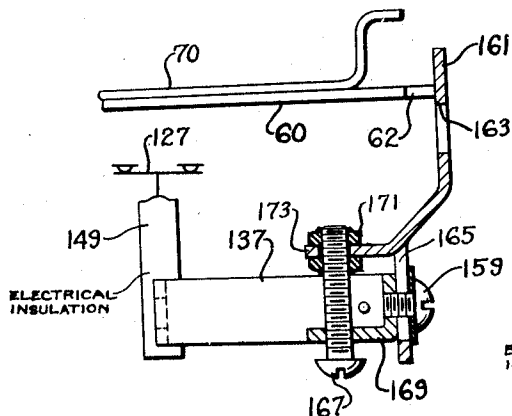


FIG. 7

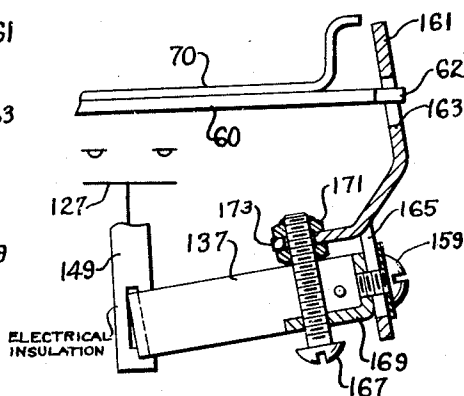


FIG. 8

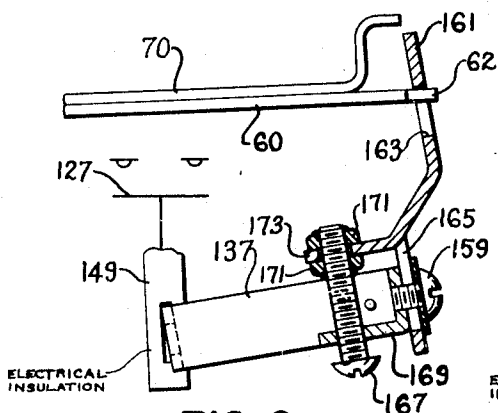


FIG. 9

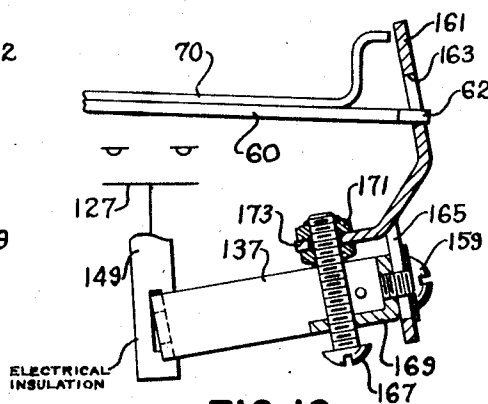


FIG. 10

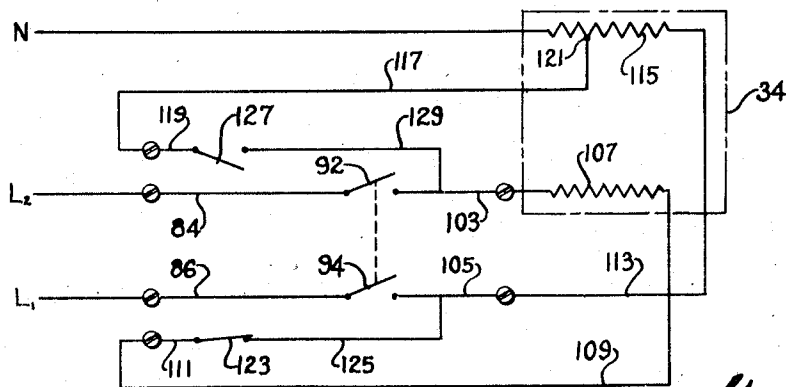


FIG. 11

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UNITED STATES PATENT OFFICE

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SWITCH FOR DOMESTIC APPLIANCES

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Application February 13, 1946, Serial No. 647,273

12 Claims. (Cl. 200—83)

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This invention relates to a domestic appliance and more particularly to controls for electric ranges and other applications.

Temperature controls for electric ovens must operate with accuracy over the wide range of temperatures preferably at a small differential. In addition there has been a demand for the combination of the preheat, bake and broil circuit switches with a temperature control arranged in such a way that the oven may be started in the preheat circuit if desired, and then circuits are automatically changed to the bake circuit arrangement when the selected baking temperature is reached. The devices of this type which have been used have the disadvantage that the automatic change from the preheat circuit to the bake circuit arrangement disturbs the operating temperatures of the temperature control during the first cycle and causes the over-shooting of the selected baking temperature.

It is an object of my invention to provide a simple accurate oven control with an automatic preheat-bake circuit changing device which will not cause the over-shooting of the selected temperature and which is controlled by a single knob.

It is another object of my invention to provide a simple accurate low differential oven control which breaks both sides of the supply conductors and requires no pig tail connections.

It is another object of my invention to provide a simple accurate oven control which can be readily adjusted by an ordinary serviceman.

It is another object of my invention to provide an oven control with a less expensive actuating means.

Briefly, to attain these objects I have provided an oven control with an adjustable disk-type diaphragm which, through a primary lever and toggle arrangement and an insulating tie bar, operates a dual toggle mechanism which opens and closes both sides of the supply conductors. The primary lever is provided with a projection cooperating with a recess in an arm of an auxiliary lever member, by which the auxiliary lever member is normally held in the bake position. A knob adjusts the position of the diaphragm to obtain various baking temperatures and in addition operates a cam arrangement whereby the auxiliary lever may be operated to preheat position and the projection disengaged from the recess. When the oven approaches the proper temperature the projection will re-enter the recess thereby allowing the lever to return to the bake position. The control is made accurate through the use of knife edges and cooperating notches

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in the pivots of greatest movement of the main switch mechanism.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a top view with the cover removed of an oven control embodying my invention;

Fig. 2 is a sectional view taken along the lines 2—2 of Fig. 1;

Fig. 3 is a sectional view taken along the lines 3—3 of Fig. 1;

Fig. 4 is a bottom view of the control with the knob removed;

Fig. 5 is a sectional view taken along the lines 5—5 of Fig. 1;

Fig. 6 is a sectional view taken along the lines 6—6 of Fig. 1;

Fig. 7 is a fragmentary view showing the preheat-broil control mechanism in preheating position;

Fig. 8 is a similar view showing the mechanism in the bake "off" cycle position;

Fig. 9 is a similar view showing the mechanism in the bake "on" cycle position;

Fig. 10 is a similar view showing the mechanism in the "off" position; and

Fig. 11 is a wiring diagram of the oven and control.

Referring now to the drawings, and more particularly to Fig. 2, there is shown an actuating diaphragm 20 formed of an upper disk 22 having an upwardly flared rim and a lower disk 24 having a downwardly flared rim. These two disks 22 and 24 are soldered together at the base of their flared rim by a ring of solder 26 to form a sealed chamber between the disks. An annular bead 28 is provided in the lower disk adjacent its rim for improving the flexibility in expansion of the diaphragm. The downwardly turned annular bead in the upper disk 22 rests in the groove resulting from the formation of the bead 28. The lower disk 24 is provided with a small central aperture and is bonded to a supporting member 30 having passages therein connecting this aperture with the tubing 32 which in turn connects to a suitable thermostat bulb suitably located within the oven 34 (see Fig. 11).

The bulb, the tubing 32, the member 30 and the interior of the diaphragm 20 constitute a hydraulic assembly preferably filled with some suitable form of liquid which expands and contracts substantially uniformly throughout the range of

oven temperatures without any change in its characteristics. The supporting member 30 has a pin 44 extending into a concentric aperture in the end of the control knob shaft 42. The supporting member 30 rests against an arm 36, the outer edge of which is notched to engage the supporting post 38 so as to prevent rotation of the nut 40 to which it is fastened. The nut 40 is in threaded engagement with the threaded end of the control knob shaft 42. The knob shaft 42 is provided with a shoulder which bears against an adjustable gland nut 46 which is threaded into the pocket 48 riveted to the lower switch casing 50. The gland nut 46 has its outer periphery notched so that it is prevented from free movement by a spring latch 52. Also rigidly fastened to the knob shaft 42 is a disk 54 carrying a cam member 56.

The upper diaphragm 22 has bonded to it an operating button 58 which bears against the adjacent end of a primary lever 60. The primary lever is formed of a strip of metal with a rounded end over the button 58 and a projection 62 at the opposite end. The lever 60 also has lateral projections 64 provided with knife edges engaging notches formed in the pair of blocks 66 which are supported on the sheet metal base 68. The lever 60 is stiffened by a thin metal member 70 which is turned up and notched to receive the hooked end 72 of a tension coil spring 74. The other end of the tension coil spring 74 is anchored to a U-shaped metal member 76 having outwardly extending prongs extending between the coils at the adjacent end of the spring 74. A tie 78 of electrical insulating material is provided with pins 80 having axially extending V-shaped notches. The tension of the spring 74 is adjusted by a set-screw 82 which extends through the yoke of the U-shaped member 76 and engages the middle of the tie 78. The movement of the pins 80 in the downward direction is interrupted by the conductor bars 84 and 86 and in the upward direction by the Z-shaped stop member 88 and 89. The notches in the pins 80 receive the knife edges formed on the separate knife edge members 90 which are riveted to the U-shaped contact strips 92 and 94 as shown in Fig. 6. The contact strip 92 is anchored to the post 96 as shown in Fig. 6, while contact strip 94 is similarly anchored to the post 98. The post 96 is mounted directly upon the end of the conductor 84. The knife edge members 90 are so beveled that the knife edge is at the face of the strip which is riveted to the contact member 92.

By this arrangement a direct column loading is applied to each of the thin metal strips forming the contact members 92 and 94 in the portion extending between the knife edge members 90 and the posts 96 and 98. Since the contact members 92 and 94 are very thin this column loading causes this portion of the strip to buckle and bend either upwardly or downwardly to the limits of movement of the pins 80. The contact strip 92 is folded back beyond post 96 and carries a contact 101 at the end, which cooperates with the contact at the end of the conductor strip 103. Likewise the folded-back end of the contact strip 94 carries a contact which cooperates with the contact directly beneath it on the contact strip 105.

For illustrating the connection of my control to an oven circuit, I have shown such a circuit diagram in Fig. 11. As shown in Fig. 11, the conductor strip 103 is connected to one end of the lower heating unit 107 while the other end

of the lower heating unit 107 is connected by the conductor 109 to the conductor strip 111. The conductor strip 105 is connected by the conductor 113 to one end of the upper heating unit 115, the other end of which is connected to the neutral conductor of an Edison three wire power supply. A tap 121 connecting to the heating unit 115 about one third the distance from the neutral end is connected by the conductor 117 to the conductor strip 119.

The conductor strip 111 is normally connected by the bridge contact 123 to the arm 125 of the contact strip 105 to establish the baking circuit arrangement. For preheating, the conductor strip 119 is connected by the bridge contact 127 to the arm 129 of the conductor strip 103. For broiling, the bridge contact 127 remains closed but the bridge contact 123 is opened.

According to my invention, for preheating both the switches 127 and 123 are closed so that two-thirds of the upper heating unit 115 and the entire lower heating unit 107 are energized at full line voltage with the switches 92 and 94 opening at the proper time to prevent the oven from being heated above the selected temperature and then reclosing when the temperature falls. The switch 127 is open while the switch 123 is closed to establish the normal baking circuit in which the lower heating unit 107 is connected directly across the supply conductors at full voltage while the upper heating unit 115 has both portions connected in series between the conductor 113 and the neutral supply conductor N to cause it to be heated at a fraction of the supply line voltage. For broiling, the switch 123 is kept open while the switch 127 is kept closed. The switches 92 and 94 remain closed throughout the broiling operation. This causes two-thirds of the upper heating unit 115 to be connected across the supply conductors at full voltage with the remaining third being connected across one of the supply conductors and the neutral conductor N, while the lower unit 107 is entirely disconnected.

To operate the contact bridge 123, there is provided a vertical link 129 of insulating material, the upper end of which is provided with a shoulder upon which the contact bridge 123 rests as well as an ear through which extends a cotter-pin 131 for locking the contact bridge 123 to the upper end of the link 129. The lower end of the link 129 is provided with an aperture 133 into which extends a projection 135 extending from one of the legs of a U-shaped member 137 pivoted upon the pivot pin 139 supported by a pair of arms 141 extending downwardly from the sheet metal base 68. The link 129 is normally pushed downwardly by a very light coil spring 143. The other end of the U-shaped lever 137 is provided with a projection 145 extending through the aperture 147 in the link 149 of insulating material which at its upper end carries the contact bridge 127. This link 149 is also provided with a light coil spring 151 which tends to urge the contact bridge 127 against a pair of shoulders plainly shown on the link 149.

The dial knob 153 upon the end of the knob shaft 42 through the disk 54 and the cam member 56 operates the bell crank lever 155 when the knob 153 is in the highest temperature point of its operating range. The opposite end of the bell crank lever 155 carries a cam 157 which in the extreme high temperature position of the knob 153 engages the bottom of the vertical link 129 to lift the contact bridge 123 for deenergizing the lower heating element 107. As shown in Fig. 5

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the U-shaped member 137 is lifted by its connection with the link 129 so that the projection at its opposite end lifts the link 149 to hold the bridge contacts 127 closed to connect the upper heating unit 115 directly into the circuit. In this position the control sets up the circuit for broiling purposes which, with the contacts 92, 94 and 127 closed and the contact 123 open, connects two-thirds of the upper heating unit 115 directly across both supply conductors and the other third between one of the supply conductors and the neutral conductor with the lower heating unit 107 being disconnected at one end from the supply conductor 86. Since the knob 153 is in its highest temperature position the switch contacts 92 and 94 will be held closed through the action of the toggle spring 74.

The U-shaped member 137 has fastened to it, by the set screw 159, a projecting member 161 provided with an aperture 163 which normally receives the projection 62 at the end of the primary lever as shown in Figs. 8 and 9. This projecting member is provided with a vertical slot 165 through which the screw 159 extends into the yoke of the U-shaped member 137 to clamp this projecting member 161 to it. This screw 159 may be loosened and the vertical position of the projecting member 161 and its aperture 163 may be adjusted by the screw 167 which threads through the angle section 169 of the U-shaped member 137 and carries a pair of nuts 171 loosely positioned one on either side of the ear 173 extending from the projecting member 161 to hold its position relative to the U-shaped member 137. These nuts 171 are fastened in place on the screw by solder. The projecting member 161, when the projection 62 is in the aperture 163, limits the extreme movements of the primary lever 60.

When, however, the knob 153 is turned to the "broil" position the U-shaped member 137 is moved to its extreme position shown in Fig. 2 whereby the projecting member 161 is carried to the right as shown in Fig. 2 to disengage the projection 62 from the aperture 163. Since the knob 153 must be turned to its extreme high temperature position to cause the U-shaped member 137 to be cammed to this "broil" position, the threaded end portion of the knob shaft 42 must have pulled the nut 40 as well as the diaphragm assembly and the button 58 downwardly thereby allowing the toggle spring 74 to pull the long end of the primary lever 60 to its upper extreme position as shown in Fig. 7, in which the main contact members 92 and 94 are closed.

After this is done the knob 153 may be turned back to any of the baking positions, such as 400° F. for example, and the projection 62 will be contacted by the upper end of the projecting member 161 directly above the recess 163 thereby holding the U-shaped member in an intermediate position as shown in Fig. 7. In this intermediate position, the link 129 is lowered sufficiently to permit the contact bridge 123 to move to closed position and though the link 149 is likewise lowered, the spring 151 keeps the bridge contact 127 pushed up into its closed position. The primary lever 60 remains in this upper position keeping the contact members 92 and 94 in the closed position until the selected temperature is reached for which the knob 153 is set. Thus all the switches are closed, connecting the circuits in the preheat arrangement with both the upper and the lower units 115 and 107 connected for maximum heating.

When the oven 34 approaches the proper tem-

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perature, the button 58 will engage the short end of the primary lever 60 to move the projection 62 downwardly until it registers with and enters the aperture 163, after which under the continuing increase in heat the primary lever 60 and its projection 62 moves downwardly until the tripping point of the toggle mechanism is reached as illustrated in Fig. 8 to open the main contact members 92 and 94 to deenergize the entire circuit. When the projection 62 enters the aperture 163, the U-shaped member 137 will move to the position shown in Fig. 9 thereby lowering both links 129 and 149. Since the contact bridge 123 is already resting upon the contacts in closed position, the projection 135 at that end of the U-shaped member 137 will merely move from the top to the bottom of the slot 133. The projection 145, however, will pull the link 149 down far enough that the shoulders at the upper end of the link will carry the bridge contact 127 downwardly to open position. This will connect the circuit shown in Fig. 11 in the baking arrangement with the upper heating unit portions 115 connected in series with the neutral conductor at a fraction of maximum heat output and the lower heating unit 107 operating at maximum voltage and maximum heat output to provide uniform heating of the oven for baking purposes.

In baking position, the diaphragm member 20 will contract to cause the projection 62 to rise to the position shown in Fig. 9 causing the contact members 92 and 94 to be tripped to closed position. After sufficient heating in the baking circuit arrangement, the temperature rise will be sufficient to cause the diaphragm member 20 to expand to lower the projection 62 and the long end of the main lever to operate the toggle mechanism and the contacts 92 and 94 to the open position. The control will cycle in this manner throughout the baking period.

When the control is turned to the "off" position, the button 58 will be moved high enough to force the long end of the lever 60 downwardly so that the projection 62 will be forced to the bottom of the aperture 163. This will cause the contact members 92 and 94 to be moved to the open position thereby breaking both sides of the supply conductors. To give a positive feeling at the "off" position, the disk 54 is provided with a notch 55 between two projections which is adapted to receive the hump of the leaf spring 51 supported by a pair of pins extending into the switch casing 50.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. A control including an actuating means, an anchorage, a plurality of thin metal strips arranged substantially parallel and each being tightly fastened at one point to said anchorage, a tie transversely connecting the strips at a distance from the fastening point, said thin metal strips having an extension extending beyond the fastening point and provided with switch contacts, said contacts and fastening point being located adjacent opposite ends of the strips with the tie being located adjacent intermediate points of the strips, and spring means extending between said actuating means and said tie for applying a column load and for actuating said strips to operate said switch contacts.

2. A control including an actuating means, an

anchorage, a plurality of thin metal strips arranged substantially parallel and each being tightly fastened at one point to said anchorage, a tie transversely connecting the strips at a distance from the fastening point, said thin metal strips having an extension greater in length than the distance between the tie and the fastening point provided with switch contacts, said contacts and fastening point being located adjacent opposite ends of the strips with the tie being located adjacent intermediate points of the strips, and spring means extending from said tie beyond the fastening point to the actuating means for applying a column load and for actuating said strips.

3. A control including a movable actuating means, a pivoted cooperating device having an extending means extending substantially parallel to the movement of the actuating means, one of said means being provided with a projection and the other means being provided with a recess capable of receiving said projection and limiting the relative movement therebetween, means for operating said pivoted device to separate the projection from the recess to allow movement of the actuating means beyond the limit of movement provided by the projection within the recess, and a control device operated by the pivoted device.

4. A control including a movable actuating means, a pivoted cooperating device having an extending means extending substantially parallel to the movement of the actuating means, one of said means being provided with a projection and the other means being provided with a recess capable of receiving said projection and limiting the relative movement therebetween, means for operating said pivoted device to separate the projection from the recess to allow movement of the actuating means beyond the limit of movement provided by the projection within the recess, a control device operated by the pivoted device, and a second control device operated by said actuating means.

5. A control including a movable actuating means provided with a projection, a cooperating device having an extending means with a surface extending substantially transverse to the movement of the projection, the surface of said extending means being provided with a recess capable of receiving said projection and guiding said projection into said recess, means for moving said cooperating device away from said projection to disengage the recess from the projection and hold the cooperating device in a second position, and a control device operated by said cooperating device in its movement to and from said second position.

6. A control including a movable actuating means provided with a projection, a cooperating device having an extending means with a surface extending substantially transverse to the movement of the projection, the surface of said extending means being provided with a recess capable of receiving said projection and guiding said projection into said recess, means for moving said cooperating device away from said projection to disengage the recess from the projection and hold the cooperating device in a second position, a control device operated by said cooperating device in its movement to and from said second position, and a second control device operably connected to and operated by said actuating means.

7. A control including an actuating means, an anchorage, a plurality of thin metal strips extending in one direction from the anchorage,

means forming a plurality of knife edges upon said strips, a tie having a plurality of notches receiving said knife edges, and spring means extending between said tie and said actuating means substantially in alignment with said strips for imposing a column loading thereon and for holding said knife edges in said notches, and a control device operated by said strips.

8. A control including an actuating means, a plurality of thin metal strips, a tie connecting the strips, a U-shaped member receiving the tie and provided with a set screw extending through the yoke into contact with the tie, spring means extending between said U-shaped member and the actuating means, and a control device operated by said metal strips.

9. A control including an actuating means provided with a projection, a snap-acting control device operatively connected to the actuating means, a rotatable means for adjusting said actuating means, a second control device having a recess cooperating with said projection for normally limiting the movement thereof, said second control device having guiding means adjacent the recess for guiding said projection into the recess upon movement of the actuating means, and means cooperating with said adjusting means for disengaging said projection from said recess to operate said second control device from one position to another.

10. A control including a casing having a stuffing box in a wall portion thereof, an actuating means within the casing, a control device within the casing connected to and operated by said actuating means, an adjusting shaft means extending through the stuffing box and having a threaded connection with the actuating means for adjusting the position of the actuating means, said adjusting shaft being provided with a shoulder adjacent the stuffing box, said stuffing box being provided with an adjustable gland cooperating with the shoulder upon said adjusting shaft for controlling the location of the actuating means.

11. A control including an actuating means, an anchorage, a plurality of thin metal strips arranged substantially parallel, a tie transversely connecting the strips at an intermediate point, said strips being each tightly fastened to said anchorage at points spaced from said tie, said strips having extensions extending from said tie and provided with switch contacts, said contacts and fastening point being located adjacent opposite ends of the strips with the tie being located adjacent intermediate points of the strips, and spring means extending from said tie beyond the fastening points to the actuating means for applying a column load and for actuating said strips.

12. A control including a movable actuating means, a movable cooperating device having an extending means substantially parallel to the movement of the actuating means, one of said means being provided with a projection and the other means being provided with a recess capable of receiving said projection and limiting the relative movement therebetween, adjusting means for adjusting the operation of the actuating means, means operated by said adjusting means for operating said movable device to separate the projection from the recess to allow movement of the actuating means beyond the limit of movement provided by the projection within the re-

cess, and a control device operated by the movable device.

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