Aug. 24, 1943. J. W. MYERS 2,327,925

ELECTRICAL SYSTEM

Original Filed May 16, 1940 2 Sheets-Sheet 1

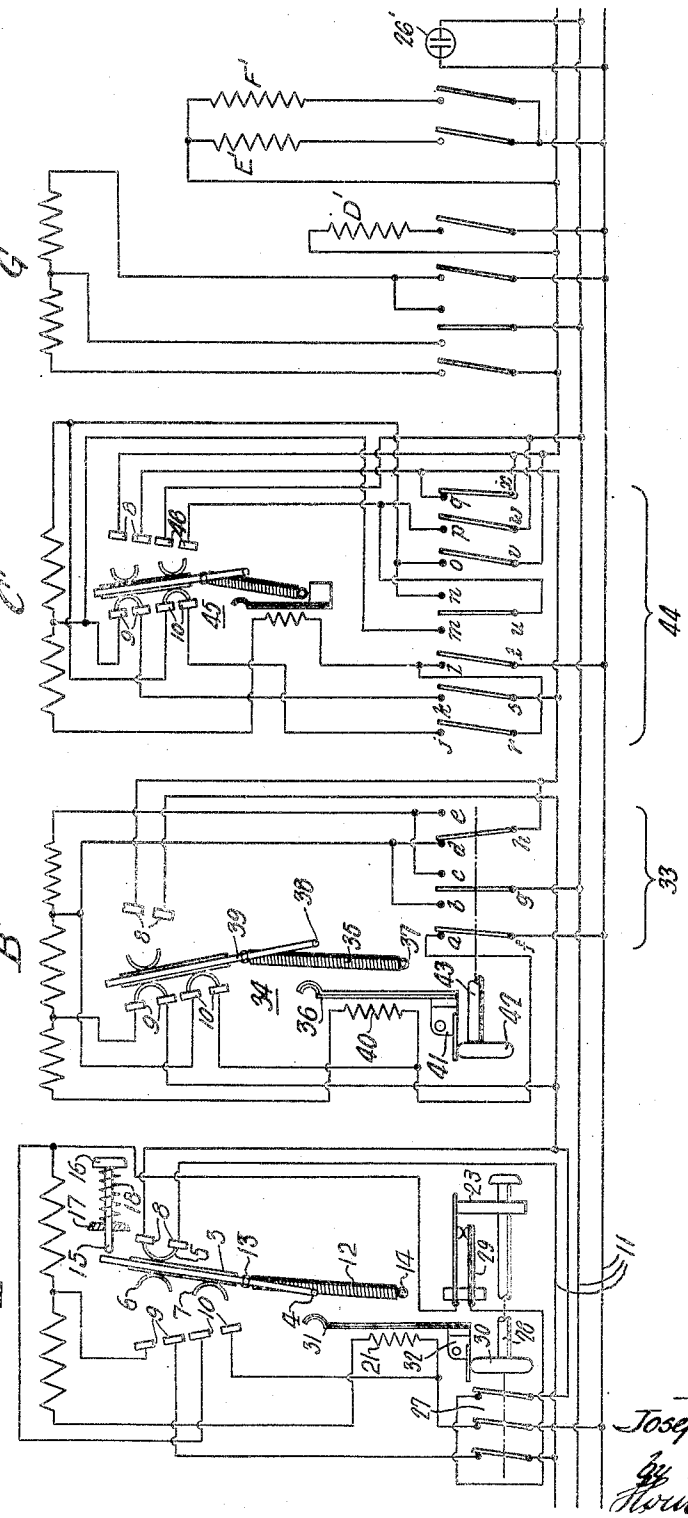

Fig. 1.

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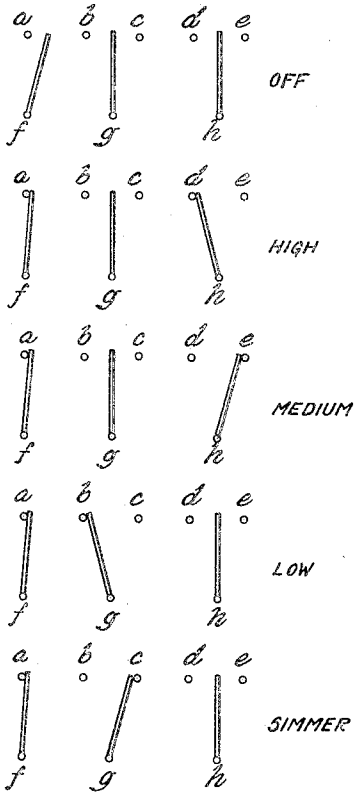
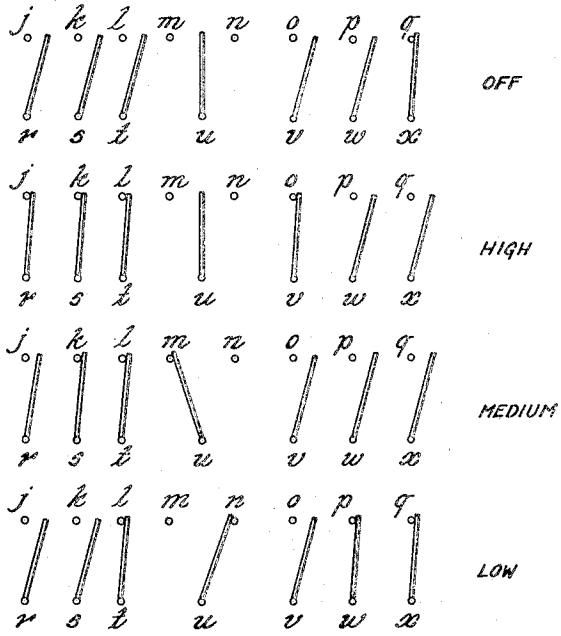
Fig. 2.



FLASH AT HIGH ONLY.

Fig. 3.



FLASH OF ENTIRE UNIT AT HIGH ONLY.

FLASH OF ONE-HALF OF UNIT AT MEDIUM.

NO FLASH AT OTHER POSITIONS.

Inventor:-
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UNITED STATES PATENT OFFICE

2,327,925

ELECTRICAL SYSTEM

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Original application May 16, 1940, Serial No. 335,584. Divided and this application January 23, 1941, Serial No. 375,700

12 Claims. (Cl. 219—20)

This invention relates to control systems for electric range cooking units and the like, and more particularly to novel means for effecting rapid heating of such units by increasing their energization to above normal, while limiting the total connected load of the entire apparatus to prevent overload on the supply line. The present application is a division of my copending application Serial No. 335,584, filed May 16, 1940.

The abnormal energization of a cooking unit to effect rapid heating thereof may be aptly termed "flashing" of the unit, and this term will be used herein for convenience. This invention is concerned particularly with flash control devices having provision for opening at least one of the supply conductors whenever a particular unit is flashed, thereby to drop any subsequent load connected to such conductor.

The principal object of the present invention is to provide novel devices of the character above mentioned, having incorporated therein means for preventing the disconnection or dropping of subsequent load except when a flashing operation is actually in progress. The desirability of this feature will be apparent later.

Another object of the invention is to provide novel forms of flash control mechanisms embodying the features hereinafter pointed out.

The invention may be clearly understood by reference to the accompanying drawings, in which

Fig. 1 is a diagrammatic illustration of an electric range embodying the features of the invention; and

Figs. 2 and 3 are illustrations of different switch positions of certain devices of Fig. 1.

Referring to Fig. 1 of the drawings, there are provided three flashable surface cooking units designated, respectively, A', B' and C'. Additionally, there are provided a non-flashable unit D', which may be a well-type unit, non-flashable units E' and F', which may be the usual oven and broiler units, respectively, and a non-flashable surface unit G. In this system, the energy supply will be from the left-hand side, the supply line being a conventional three-conductor line with say 230 volts between the outer conductors and 115 volts between an outer conductor and the central conductor.

Referring first to the flashable unit A', this unit may comprise two similar sections as illustrated, adapted to be connected either in series or parallel relation by means of the associated flash-control mechanism now to be described. There is provided an arm 3 pivoted at its lower end at 4 and carrying a contact bridge 5 on one side thereof and a pair of contact bridges 6 and 7 on the opposite side. The contact bridge 5 is adapted to engage the load-dropping contacts 8, while contact bridges 6 and 7 are adapted to engage the flash contacts 9 and 10, respectively. When the switch mechanism is in normal energization position, the sections of the associated heating unit A' are connected in series across the two outer conductors of the three-conductor supply line 11, the circuit being readily traceable. It will be noted that such circuit includes elements not heretofore mentioned, but which will be described in detail. When the switch mechanism is in its flash postion, the sections of the associated heating unit are connected in parallel relation with one another across the two outer supply conductors, and the upper supply conductor is opened at contacts 8, thereby dropping the subsequent load connected thereto.

A spring 12 has its upper end connected to arm 3 at 13 and its lower end anchored at point 14, which is substantially aligned vertically with the pivot 4. The arrangement is such that when the arm 3 is moved just beyond its center position, in either direction, the spring 12 moves the arm abruptly to one or the other of its positions and maintains it in that position. This may be clearly seen from the illustration, from which it will be noted that the spring is slightly to one side of the pivot 4. In order to move the arm from its normal energization position to its flash position, there is provided a manually-operable rod 15 having an actuating knob 16 and extending through a panel shown fragmentarily at 17. This rod is normally maintained in its outer inoperative position by the spring 18. The length of the rod is such that when it is moved inward to the full extent, the arm 3 is moved only to a point just beyond its center position toward the flash position of the switch. In other words, the manually-operable push rod 15 is capable of moving the arm 3 only to a point just beyond its center position. The reason for this will be apparent later. Except in certain instances to be mentioned hereinafter, this movement of the arm 3 enables the spring 12 to move the arm to its flash position. Thus, the normal series connection of the heating unit sections is interrupted and the sections are connected in parallel to effect flashing of the unit.

A thermostatic element 31 which may comprise a bimetallic strip mounted on support 32, is arranged adjacent the spring 12 for cooperative action therewith. Associated with the ther-

mostatic element 31 is a heater element 21 which is connected in circuit with the heating unit. In this manner, the thermostatic device, comprising elements 31 and 21, is arranged to "track" with the associated heating unit, as fully described and claimed in the Myers and Roesch Patent No. 2,207,634, issued July 9, 1940. In other words, the thermostatic element 31 is always conditioned according to the temperature of the associated heating unit. Assuming that the heating unit is at a temperature lower than its normal high operating temperature, when the unit is flashed the thermostatic element 31 flexes toward the spring 12 and engages the same; and when the heating unit reaches substantially its normal high operating temperature, the element 31 deflects the spring 12 sufficiently to move the arm 3 back to its normal energization position. This, of course, interrupts the flashing operation and restores the normal energization of the heating unit sections. If the heating unit is already at its normal high operating temperature when the flash control knob 16 is depressed, the element 31 will prevent the arm 3 from moving to flash position since the spring 12 will be deflected by element 31 to the right of pivot 4. Moreover, the user will be unable to effect flashing of the unit, since the rod 15 can move arm 3 only to a position just beyond the center position. Thus, it is impossible for the user to damage the unit, either unintentionally or intentionally, by excessive flashing.

It will be noted that the heater element 21 is connected in series relation with the heating unit sections during the normal energization connection of the latter, but the heater element is included in one of the branch circuits with one of the heating unit sections when the latter are connected in parallel relation for flash operation. This arrangement maintains similar wattage ratios of the heater element and the heating unit, thus providing for accurate tracking of the thermostatic device with the heating unit. To explain this more fully, it will be seen that the current supplied to the heating unit during flashing is four times the normal current; and since the voltage remains the same, the power or energy supplied to the unit during flashing is four times the normal energy. Thus, the wattage ratio of the heating unit is four to one. Now by virtue of the heater element 21 being included in one of the branch circuits, during flashing, it receives twice as much current during the flashing operation as it does during normal operation; and since the energy consumed by this element is equal to the product of its resistance and the current squared, its wattage ratio is also four to one. It may be noted that if this heater element were serially connected during the flashing operation, it would receive four times its normal current and its wattage ratio would be sixteen to one, which is vastly different from the wattage ratio of the heating unit.

A manually-adjustable thermostatic switch 29 is connected as illustrated so as to control the operation of the unit during the normal energization thereof. It should be noted that the normal series connection extends through this switch from the load side of contacts 8, so that this switch has no control over the flashing operation, since it is excluded from the circuit when the flashing mechanism is in flash position. The switch 29 is preferably of the pan control type illustrated in the above-mentioned Patent No. 2,207,634. This switch may be controlled by means of a cam 23 carried by a rotatable rod or shaft 28. The energization of unit A' is controlled by an on-off switch 27 also controlled by rotatable shaft 28. Although this switch is diagrammatically shown, its contacts may be actuated by a cam or cams on shaft 28. Additionally there is provided on shaft 28 a cam 30 which, in the "off" position of switch 27, prevents the flashing mechanism from being operated. To this end, the support 32 for the flash control thermostat 31 is pivotally movable by cam 30. In the "off" position of switch 27, the cam 30 moves the thermostat 31 clockwise to a position such that it prevents the arm 3 from being moved to flash position. Were it not for this action by the cam 30, the flashing mechanism might be actuated and would remain in flash position, and the upper supply conductor would remain open thereby rendering inoperative the subsequent units connected to that conductor. While the arm 3 may still be moved from its normal energization position, it returns thereto when the knob 16 is released.

Referring now to unit B', this unit is a three section unit comprising two main sections and an auxiliary section, and the unit is controlled by mutually cooperative devices 33 and 34 which may form a unitary structure. The unit B' is adapted for multi-heat operation by means of the manual switch 33. This switch may take any suitable form, for example, it may comprise a rotatable shaft carrying cams for actuating the contact fingers. The various positions of the contact fingers for different positions of the switch are shown in Fig. 2, wherein the legends indicate the different operating conditions of the unit B'. The different heats or operating temperatures so indicated are effected by variously connecting the sections of unit B' to the supply conductors. The unit is flashed to its high temperature by connecting the two main sections in parallel across the two outer supply conductors.

In this instance, the flash mechanism 34 is automatic, i. e., it is biased by its spring 35 to flash position and is moved to normal energization position only when actuated by the thermal element 36. To this end, the point 37 at which the lower end of spring 35 is anchored is offset with respect to the pivot point 38 of arm 39. Hence, the spring tends at all times to urge the arm to flash position. When the element 36 flexes under the influence of its heater 40, it engages spring 35 and thus moves the arm 39 to normal energization position. However, the flash mechanism is also movable to normal energization position by manual operation to prevent flashing of unit B' at certain positions of switch 33. To this end, the element 36 is mounted on a pivoted bracket 41 which is actuated by a cam 42 on shaft 43. This shaft may be that of the switch 33, so that the cam is rotated to different positions for the different positions of the switch 33. The cam is so designed that it is ineffective at the "high" position of switch 33, but at other positions of the switch the cam actuates bracket 41 to move element 36 which in turn moves the flash control mechanism to normal energization position. Thus, the unit B' is automatically flashed when switch 33 is moved to its "high" position, the subsequent load being dropped during the flash period. At other positions of switch 33, however, flashing of unit B' is prevented and

the supply conductors are closed to the subsequent load.

In the specific illustration the switch 33 is shown in its "high" position and the flashing operation is taking place. The various circuits which are established by the switch 33 in its different positions may be traced with the aid of Fig. 2.

Thus, the cam 42, like the cam 30, permits operation of subsequent units when the associated unit is deenergized, and cam 42 also serves to prevent flashing of unit B' in certain operative positions of the multi-heat control switch 33.

Referring now to unit C', this unit also has an automatic flash control mechanism, and it is operable at different heats or temperature levels by means of the multi-heat control switch 44 comprising contacts or terminals lettered *j* to *x* and the associated contact fingers. The various positions of the switch contact fingers at the different positions of the switch are shown in Fig. 3. This switch may take the form above-mentioned, i. e., it may comprise cams on a rotatable shaft for actuating the contact fingers.

As indicated in Fig. 3, the entire unit is flashable at the "high" position of switch 44, while one-half of the unit is flashable at the "medium" position of the switch. In addition to controlling the connections of the unit C', the switch 44 embodies the electrical counterpart of cams 30 and 42 and performs the functions described hereinafter.

It will be noted that in this instance the flash contactor 45 has an additional pair of normal contacts 46. Moreover, the switch contacts *q*—*x* are arranged to short out the contacts 8, while contacts *p*—*w* are arranged to short out the contacts 46.

In the "off" position of switch 44, all of the contacts are open except contacts *q*—*x* which serve to energize the subsequent load. Were it not for these contacts the subsequent load would be deenergized, since the flash contactor is biased to flash position.

In the "high" position of switch 44, the sections of unit C' are connected in parallel across the outer supply conductors by means of contacts *j*—*r*, *k*—*s*, and *l*—*t* of the switch 44 and the flash contacts 9 and 10 of the flash contactor 45. The circuits are readily traceable. At this time, the contacts *q*—*x* are open so that the subsequent load is dropped during flashing. When the unit reaches its high temperature, the contactor is operated and the sections of the unit are connected in series through contacts *l*—*t*, *o*—*v*, and normal energization contacts 8. The latter also serve to energize the subsequent load. The contacts 46 are also closed but have no effect.

In the "medium" position of switch 44, the left hand section of unit C' is connected across the outer supply conductors by means of contacts *k*—*s* and *l*—*t* of the switch 44 and flash contacts 9. Thus, one-half of the unit is flashed. The contacts *q*—*x* are open so that the load dropping contacts 8 are effective to drop the subsequent load during the flash operation. When the flash contactor is actuated, the left hand section of unit C' is connected between the lowermost supply conductor and the central conductor through contacts *l*—*t*, *m*—*u*, and normal contacts 46. The contacts 8 are also closed to energize the subsequent load.

In the "low" position of switch 44, there is no flashing operation. The contacts *q*—*x* are closed thereby shorting out the load-dropping contacts 8 and supplying energy to the subsequent load. The sections of unit C' are serially connected between the lowermost and central supply conductors through contacts *l*—*t*, *n*—*u*, and *p*—*w*. Thus, the low voltage between the said conductors is applied to the serially connected sections giving low heat operation.

It will be understood that one purpose of Fig. 1 is to show different types of flash control mechanisms which may be employed in a system of this type. Obviously, a system may have all of its flashable units similar and such units may take any of the three forms shown in Fig. 1. Of course, a combination of these units may be used if desired, such as illustrated in Fig. 1.

It will be clear that in any such system, the flashing of the successive units may be "ordered" and will take place successively, and the flashing of any unit ahead of one being flashed will interrupt the flashing of the latter unit which will be resumed after the flashing of the prior unit is completed.

The invention is, of course, capable of modifications such as will occur to persons skilled in the art without departing from the scope of the appended claims.

I claim:

1. In an electrical cooking apparatus, a supply line, an electric cooking unit connected to said line, additional load devices comprising at least one other cooking unit connected to said line, switching means and connections controlled thereby for greatly increasing the energization of said first-mentioned unit to heat the same rapidly to a desired temperature level, contacts on said switching means to open at least one conductor of the supply line and thus drop at least a portion of the additional load during the increased energization of said first-mentioned unit, switching means for controlling the current supply to said first-mentioned unit, means for positively restoring the dropped load when said last-named switching means is in off position, and a common actuating means for said last-named switching means and said load restoring means.

2. In an electrical cooking apparatus, a supply line, an electric cooking unit connected to said line, additional load devices comprising at least one other cooking unit connected to said line, switching means and connections controlled thereby for greatly increasing the energization of said first-mentioned unit to heat the same rapidly to a desired temperature level, contacts on said switching means to open at least one conductor of the supply line and thus drop at least a portion of the additional load during the increased energization of said first-mentioned unit, multi-position switching means for controlling the current supply to said first-mentioned unit and for operating the unit at different temperature levels, means for positively restoring the dropped load when said last-named switching means is in certain positions, and a common actuating means for said last-named switching means and said load restoring means.

3. In an electrical cooking apparatus, a supply line, an electrical cooking unit connected to said line, additional load devices connected to said line subsequent to said cooking unit, switching means for said unit, connections controlled by said switching means in one position for supplying predetermined energizing current to said unit, other connections controlled by said switch-

ing means in another position for greatly increasing the energizing current to said unit, means operatively associated with said switching means to move it automatically to its first-mentioned position when said unit is heated by the increased current substantially to a predetermined temperature, contacts on said switching means to open at least one conductor of the supply line and thus drop at least a portion of the connected load when the switching means is disposed in its said other position, switching means for controlling the current supply to said unit, means for positively maintaining said first switching means in its first-mentioned position to restore the dropped load when said last-named switching means is in off position, and a common actuating means for said last-named switching means and said load restoring means.

4. In an electrical cooking apparatus, a supply line, an electrical cooking unit connected to said line, additional load devices connected to said line subsequent to said cooking unit, switching means for said unit, connections controlled by said switching means in one position for supplying predetermined energizing current to said unit, other connections controlled by said switching means in another position for greatly increasing the energizing current to said unit, means operatively associated with said switching means to move it automatically to its first-mentioned position when said unit is heated by the increased current substantially to a predetermined temperature, contacts on said switching means to open at least one conductor of the supply line and thus drop at least a portion of the connected load when the switching means is disposed in its said other position, multi-position switching means for controlling the current supply to said unit and for operating the unit at different temperature levels, means for positively maintaining said first switching means in its first-mentioned position to restore the dropped load when said last-named switching means is in certain positions, and a common actuating means for said last-named switching means and said load restoring means.

5. In an electrical cooking apparatus, a supply line, an electrical cooking unit connected to said line, additional load devices connected to said line subsequent to said cooking unit, a switch for said unit operable between two positions, connections controlled by said switch in one of its positions for supplying predetermined energizing current to said unit, other connections controlled by said switch in its other position for greatly increasing the energizing current to said unit, means normally biasing said switch to said other position, means operatively associated with said switch to move it automatically to its first-mentioned position when said unit is heated by the increased current substantially to a predetermined temperature, contacts on said switch to open at least one conductor of the supply line and thus drop at least a portion of the connected load when the switch is disposed in its said other position, switching means for controlling the current supply to said unit, means for restoring the dropped load when said switching means is in off position, and a common actuating means for said switching means and said last-named means.

6. In an electrical cooking apparatus, a supply line, an electrical cooking unit connected to said line, additional load devices connected to said line subsequent to said cooking unit, a switch for said unit operable between two positions, connections controlled by said switch in one of its positions for supplying predetermined energizing current to said unit, other connections controlled by said switch in its other position for greatly increasing the energizing current to said unit, means normally biasing said switch to said other position, means operatively associated with said switch to move it auttomatically to its first-mentioned position when said unit is heated by the increased current substantially to a predetermined temperature, contacts on said switch to open at least one conductor of the supply line and thus drop off the connected load when the switch is disposed in its said other position, multi-position switching means for controlling the current supply to said unit and for operating the unit at different temperature levels, means for restoring the dropped load when said switching means is in certain positions, and a common actuating means for said switching means and said last-named means.

7. In an electrical cooking apparatus, a supply line, an electric cooking unit connected to said line, additional load devices comprising at least one other cooking unit connected to said line, switching means and connections controlled thereby for greatly increasing the energization of said first-mentioned unit to heat the same rapidly to a desired temperature level, contacts on said switching means to open at least one conductor of the supply line and thus drop at least a portion of the additional load during the increased energization of said first-mentioned unit, switching means for controlling the current supply to said first-mentioned unit, means for short circuiting said load-dropping contacts to restore the dropped load when said last-named switching means is in off position, and a common actuating means for said last-named switching means and said short-circuiting means.

8. In an electrical cooking apparatus, a supply line, an electric cooking unit connected to said line, additional load devices comprising at least one other cooking unit connected to said line, switching means and connections controlled thereby for greatly increasing the energization of said first-mentioned unit to heat the same rapidly to a desired temperature level, contacts on said switching means to open at least one conductor of the supply line and thus drop at least a portion of the additional load during the increased energization of said first-mentioned unit, multi-position switching means for controlling the current supply to said first-mentioned unit and for operating the unit at different temperature levels, means for short circuiting said load-dropping contacts to restore the dropped load when said last-named switching means is in certain positions, and a common actuating means for said last-named switching means and said short-circuiting means.

9. In an electrical cooking apparatus, a supply line, a cooking unit comprising a plurality of portions connected to said line, a multi-position manual switch for controlling said unit, means controlled by said switch in one position for greatly increasing the energizing current to a portion only of said unit, means controlled by said switch in another of its positions for greatly increasing the energizing current to more than one portion of said unit, means for automatically interrupting the increased energization when said unit is heated substantially to a predetermined temperature, other units connected

to said line subsequent to said first-mentioned unit, and means for dropping at least part of the load constituted by said other units during said increased energization.

10. In an electrical cooking apparatus, a supply line, a cooking unit comprising a plurality of portions connected to said line, a multi-position manual switch for controlling said unit, means controlled by said switch in one position for greatly increasing the energizing current to a portion only of said unit, means controlled by said switch in another of its positions for greatly increasing the energizing current to more than one portion of said unit, and means for automatically interrupting the increased energization when said unit is heated substantially to a predetermined temperature.

11. In an electrical cooking apparatus, a supply line, an electric cooking unit comprising a plurality of portions connected to said line, additional load devices connected to said line, multi-position switching means for controlling the current supply to said unit and for operating the unit at different temperature levels, means controlled by said switching means in one position for greatly increasing the energizing current to a portion only of said unit, means controlled by said switching means in another position for greatly increasing the energizing current to more than one portion of said unit, whereby said unit is heated rapidly to the temperature levels corresponding to said positions, means for dropping at least a portion of the additional load during the increased energization of said unit, means for restoring the dropped load when said switching means is in certain positions, and a common actuating means for said switching means and said load restoring means.

12. In an electrical cooking apparatus, a supply line, an electric cooking unit connected to said line, additional load devices connected to said line, switch means movable to a flash position for greatly increasing the energization of said unit temporarily to effect rapid heating thereof, means for dropping at least a portion of the adidtional load when said switch means is in flash position, a manually rotatable cam-carrying control shaft associated with said unit, switch means controlled by cams on said shaft to energize and deenergize said unit, said unit being deenergized when the shaft is in an off position, a load-restoring cam on said shaft, and means operable by said load-restoring cam to actuate said first switch means to load-restoring position whenever said shaft is moved to its off position.

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