Nov. 13, 1962 C. R. TURNER 3,064,091

POSITION SELECTION MEANS

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FIG. 1.

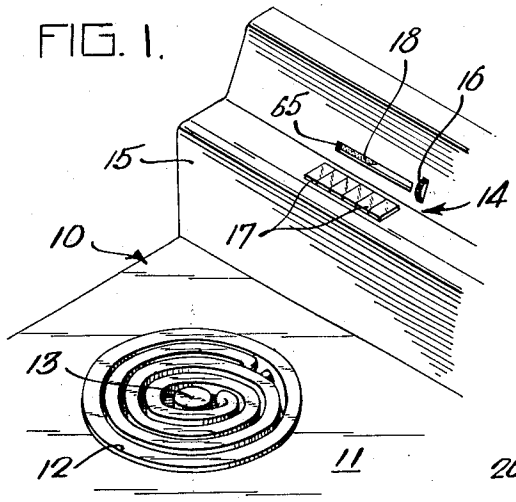

FIG. 2.

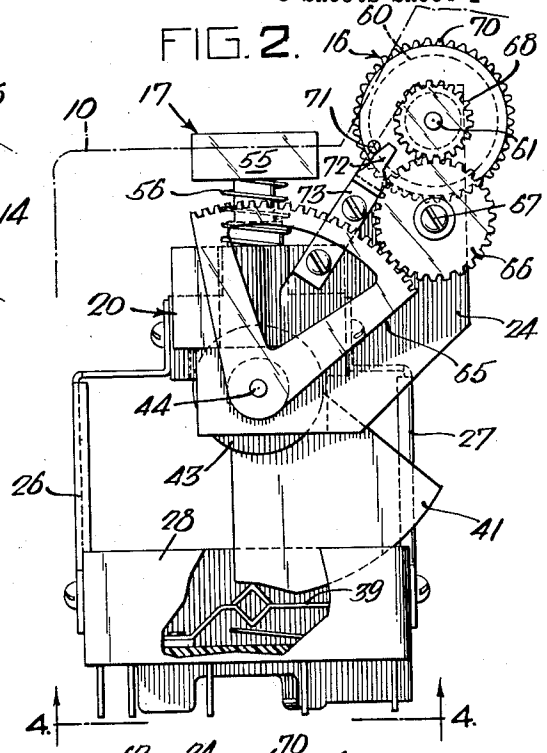

FIG. 3.

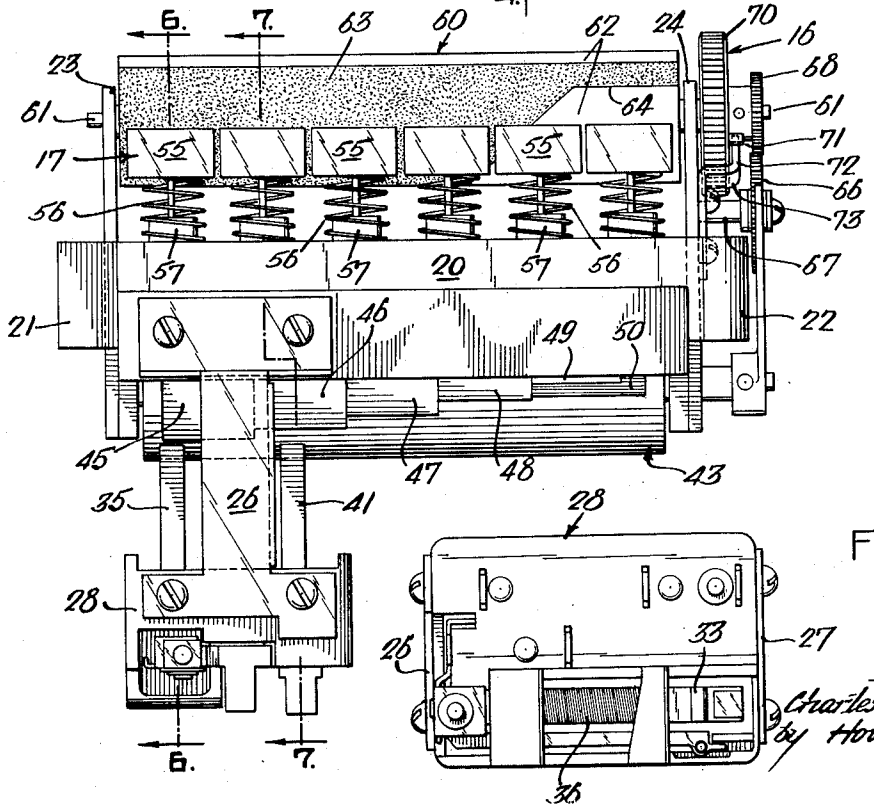

FIG. 4.

Inventor:
Charles Roger Turner
by Howson & Howson
Attys.

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FIG. 5.

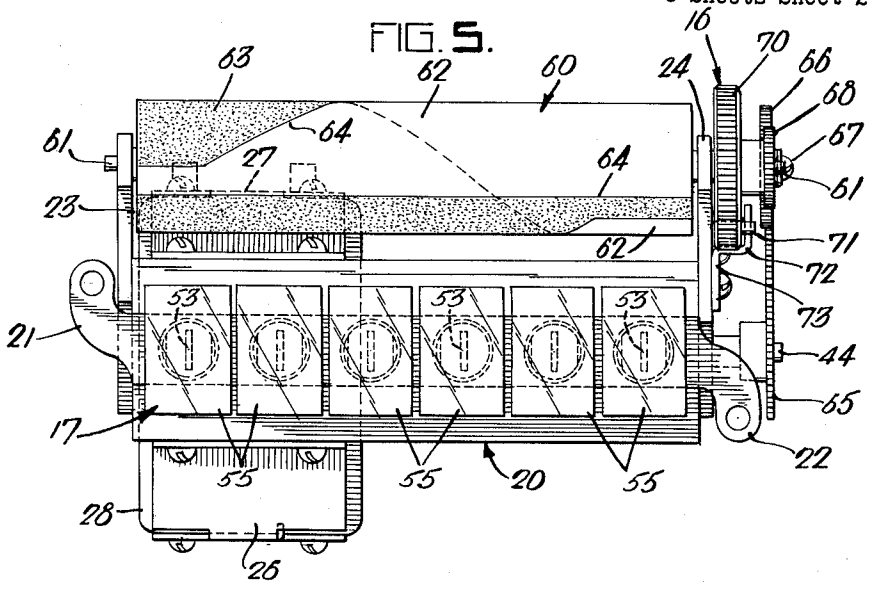


FIG. 6.

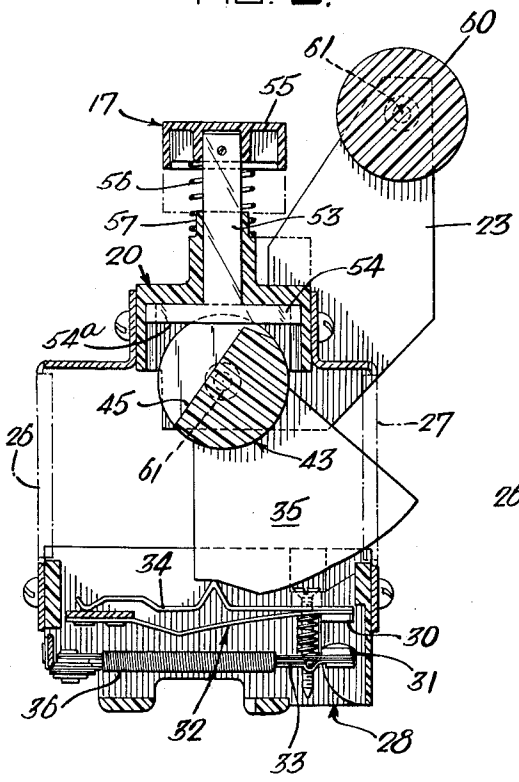
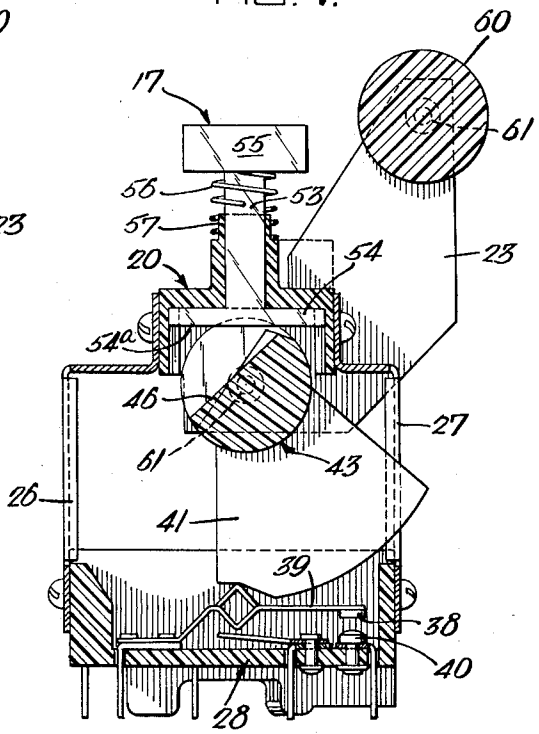


FIG. 7.



Inventor:
Charles Roger Turner
by Howson & Howson
Attys.

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FIG. 8.

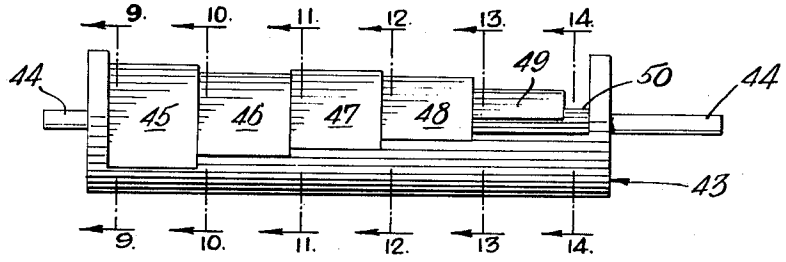


FIG. 9. FIG. 10. FIG. 11. FIG. 12. FIG. 13. FIG. 14.

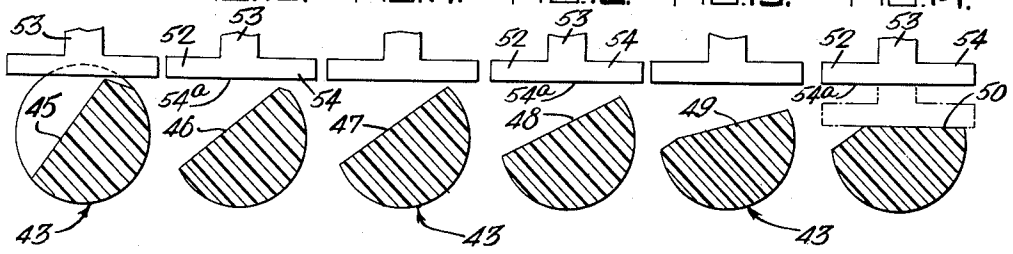
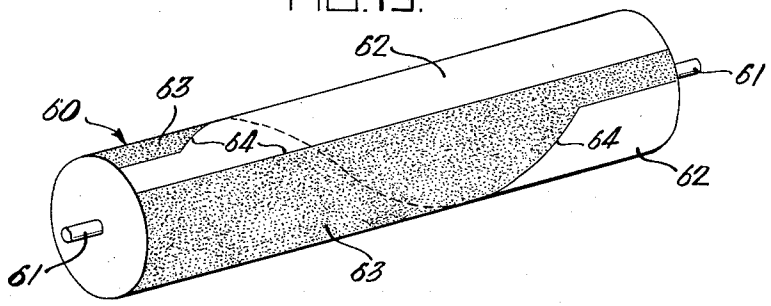


FIG. 15.



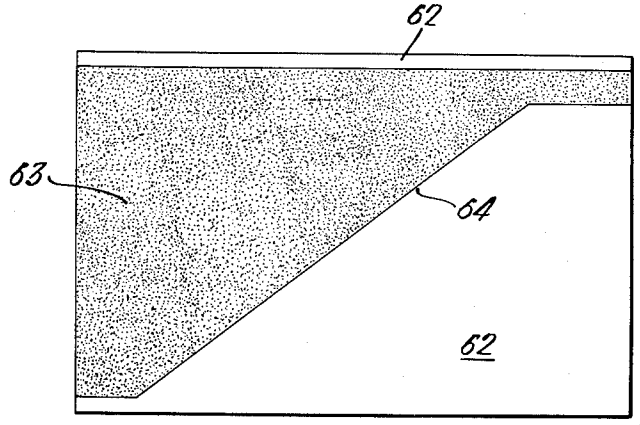


FIG. 16.

Inventor:
Charles Roger Turner
by Howson & Howson
Attys.

United States Patent Office 3,064,091 Patented Nov. 13, 1962

3,064,091

POSITION SELECTION MEANS

Charles Roger Turner, Philadelphia, Pa., assignor to The Proctor-Silex Corporation, a corporation of Pennsylvania

Filed June 12, 1959, Ser. No. 820,042
15 Claims. (Cl. 200—5)

This invention relates to a position selection means particularly adapted for use with switch means of the type known as an "infinite switch," which has an infinite number of positions representing an infinite number of operational modes within its range of operation. In particular, the present invention relates to a discrete position selection means and to an indicator which is particularly useful in combination with this selection means but may have application apart from it.

Control of cooking by means accurately determining pan temperature and regulating heating effect regardless of the temperature of a surface resistance heating element is becoming an accepted technique. This type of effect, and particularly those involving so-called "expanded boil" ranges wherein different degrees of ebullition are achieved with different surface unit temperatures are due in large part to the use of infinite switches. These switches have an infinite number of contact positions or conditions within the range of operation corresponding to different pan heating levels. The appeal of such devices is in the wide range of cooking effects which have an analog in some position of the switch and which enable the cook to have much closer control over the cooking process than before. Frenquently, however, it is desirable to reproduce quickly and easily certain commonly used heating levels. The present invention is adapted to serve both of these needs. It provides a push button system by which rapid and accurate reproduction of a much used cooking condition may be achieved but it also provides an auxiliary means for precise and rapid reproduction of heating effects not even possible without the infinite switch and expanded boil technique.

The position selection means of the present invention consists of a primary selection means such as a manually adjusted dial capable of selecting any of the infinite number of positions and a secondary selection means consisting of a push button array which permits the selection of much used heating effects by simply pressing one of a plurality of buttons. Because an infinite switch is part of the system, the positions may include more than one position within the expanded boil region. The buttons may be labeled with the effect to be produced. Moreover, in order for the user to know which level has been selected, the system in addition has an indicating means which cooperates with the push button control. A preferred form of indicating means is one which will effectively indicate that the selected setting has been accomplished. One effective way of doing this is to arrange a viewer or window parallel with the row of push buttons and to provide an indicator means movable relative to the window and divided into fields, which may be differently marked as by the use of different colors, so that as the indicator moves past the window the boundary of the fields will become visible above the push button which has been depressed or between adjacent push buttons whose discrete positions bracket the actual position selected. Alternatively, of course, this type of indicator can be used with calibrations on the window or frame with, or without, the push buttons. It is preferred that the movable portion of the indicator be cylindrical since this arrangement lends itself to combination with a cylindrical dial or knob which may have its knurled surface exposed to rotation by the thumb or fingers of an operator for positioning in an infinite number of operating positions.

More specifically, the present invention is directed to a position selection system including a switch having an infinite number of overclosed positions. A position selection knob acts through coupling means through which may also act a push button selection means, alternatively acting to select certain much used discrete positions. In addition to the push buttons, an indicating means may be employed having a surface area divided into a pair of fields such that the boundary between the fields moves across a viewer which may be calibrated in terms of cooking levels or effects. Preferably, however, the viewer and the push buttons are arranged in parallel rows and the indicator is so arranged that the boundary between its fields falls directly above the push button which is used to secure the discrete position of the device represented by the indicator.

For a better understanding of the present invention reference is made to the following drawings in which:

FIG. 1 illustrates in perspective the surface element of an electric range with its associated switch position selection device arranged on the back of the range;

FIG. 2 is an elevational view from one end of the position selection system and switch employed in the range of FIG. 1 from one end, showing the structure partially in section in the region of the actuation of the switch;

FIG. 3 is a front elevational view of the structure shown in FIG. 2;

FIG. 4 is a view taken along line **4—4** of FIG. 2 showing the bottom of the switch supporting structure;

FIG. 5 is a plan view from above the device shown in FIGS. 2 and 3;

FIG. 6 is a sectional view taken along line **6—6** of FIG. 3;

FIG. 7 is a sectional view taken along line **7—7** of FIG. 3;

FIG. 8 is a view of the position selection cylinder of the device shown in FIGS. 2–7;

FIG. 9 is a sectional view taken along line **9—9** of FIG. 8;

FIG. 10 is a sectional view taken along line **10—10** of FIG. 8;

FIG. 11 is a sectional view taken along line **11—11** of FIG. 8;

FIG. 12 is a sectional view taken along line **12—12** of FIG. 8;

FIG. 13 is a sectional view taken along line **13—13** of FIG. 8;

FIG. 14 is a sectional view taken along line **14—14** of FIG. 8;

FIG. 15 is a perspective view of the indicator cylinder of the structure of FIGS. 2–7, and

FIG. 16 is a developed view of the surface of the cylinder of FIG. 15.

Referring first to FIG. 1, an electric range, generally designated **10**, is illustrated in part, showing a top surface **11** in which is located an electric heating unit **12** having a centrally disposed pan control **13**. The actual pan control, for example, may be of a type illustrated in the copending application of Daniel E. Clapp, Ser. No. 574,287, filed March 27, 1956, and assigned to the common assignee of this application, or similar types of pan controls which permit adjustment at a location remote from the pan control by a so-called "infinite switch" which is capable of being adjusted to produce an infinite number of energy levels within the range of its operation.

It is characteristic of this type of switch to employ a pair of contacts, at least one of which is movable, and usually both of which are movable. A movable contact is mechanically urged into different degrees of over-

closure by different amounts of pressures applied to it or its supporting structure. Consequently, as the other contact is moved, usually in response to the movement of its bimetal which is heated by a heater whose output is proportional to the current or heating effect of the main heater 12, it will take different periods for the switch to initially open. The greater the overclosure of the contacts, the longer will be the time it takes to open initially, and the sooner the switch will reclose. The effect adjusted in this way may be described as modification of the ratio of on to off time. The greater the proportion of total operating time the switch is closed the greater will be its heating effect.

The infinite switch in this instance is associated with the position selection means, generally designated 14, located in the backboard 15 of the range. As will later be explained in greater detail, a primary position selection means in this case consists of infinite selection means 16, and a secondary position selection means consists of discrete selection means 17. An indicator 18 provides visual means of determining the heating level set by either the primary or secondary selection means. The discrete position selection means is effective to accurately select, without painstaking manipulation, certain predetermined switch positions which may represent particularly desirable heating levels for normal cooking operations. The indicator means is preferably arranged so that it is associated with the discrete position selection means whereby it may be immediately recognized which push button of the discrete position selection means has been chosen to effect the setting of the switch. Fine readjustment can be accomplished by the infinite position selection means 16 after rough adjustment by push buttons 17, in addition to the conventional function of adjusting the switch through its full range.

Referring now to FIGS. 2, 3, 4 and 5, it will be seen that the structure is supported on a frame centered around a guide and central support member 20, preferably of high strength insulating material, such as a phenolic condensate product, which is made to support the push buttons 17, as will be later described, and which has an inverted channel shaped portion at its bottom, which channel portion extends beyond the actual guide portion in a transverse direction. Formed as an integral part of the guide member 20 are brackets 21 and 22 which enable mounting of the system in a range or elsewhere. Member 20, in turn, supports the metallic end plates 23 and 24 which serve as bearing means and gear supports, etc. Fixed to the front and rear portions of guide member 20 are brackets 26 and 27 which suspend a hollow insulating switch casing 28, which may also be phenolic material, below the main support structure.

Within the casing 28 are a pair of switch members: one, an infinite switch which is seen in the section shown in FIG. 6 and, the other, a simple on-off switch which is shown in section taken in FIG. 7. The infinite switch shown in FIG. 6 has a pair of contacts 30 and 31 which are mounted on suitable support members 32 and 33, respectively, which are fixed to the casing 28 in a suitable manner, such as by riveting. Also associated with switch contact 30 is a pressure applying member 34 which is acted upon by a cam 35, the support for which will be later described. Cam 35 is so shaped that when rotated it acts first to close the contacts 30 and 31 and then gradually overcloses them by exerting greater and greater mechanical pressure of the cam on member 34, thereby urging contact 30 into a position where it will follow contact 31 as it moves. The support 33 for contact 31 is a bimetallic member which is adapted to move in a direction to open the contacts when heated by a heater coil 36 which may be in a pilot circuit as taught in the copending application of Daniel E. Clapp, Ser. No. 574,287, filed March 27, 1956, and assigned to the common assignee of this application. The effect of this arrangement is to produce a heating effect proportional to that of the heating unit 12 which causes bimetal 33 to gradually flex. In flexing, contact 31 is moved away from contact 30. Pressure on contact 30, however, will cause it to continue to bear against and effectively follow movement of contact 31. The greater the pressure of contact 30 upon contact 31, the further it will tend to follow contact 31, and the longer the contacts will remain closed. It is the pressure which causes contact 30 to follow contact 31 which has been referred to as "overclosure." This has the effect of requiring a greater amount of heating to open the contacts, which then upon the cooling of bimetal member 33, close more readily because of the advanced position of contact 30. The advantages of such an arrangement are taught in many prior applications, including the abovementioned application of Daniel E. Clapp.

The on-off switch is a simple spring-supported contact 38 supported by movable spring support member 39 on housing 28 and movable against fixed contact 40 mounted on housing 28 by the rotation of cam 41 against the spring member 39. Cam 41 is designed so that, instead of gradually increasing pressure, when sufficient pressure is applied to close the switch contacts, it simply maintains pressure at a uniform value in any possible position of the device.

The cams 35 and 41 are, in turn, attached to a generally cylindrical member 43, shown in some detail in FIGS. 8–14. As seen in FIG. 8, cylindrical member 43 is provided with an axially arranged rod support or shaft 44 fixed relative to the cylinder and journaled in the brackets 23 and 24 to permit relative rotation of member 43. Also, as seen in FIG. 8, regions of the cylinder through ranges of length at successive axial levels are cut away along chords of the cylinder to provide flat surfaces at various angles to one another through elements of the cylinder. These faces, numbered 45 through 50, are at a particular angle selected to create that orientation of the cylinder which will give a desired discrete switch position in cooperation with the flat plates 54 fixed to the push buttons. It will be observed that while faces 47 and 48 are perfectly flat, faces 45 and 46 have one edge cut away, whereas faces 49 and 50 have another edge cut away. The purpose of cutting away these edges is to avoid contact of these edges with cooperating pressure faces of flat plates 54 which are supported above the cylinder 43 in guide member 20 and which are part of generally T-shaped members 53–54. These generally T-shaped members have a stem 53 slidably passing through block 20 through parallel guide holes so that the stems themselves are held mutually parallel. The flat plates 54 may also be maintained parallel at all times by the sidewalls of the channel shaped portion of member 20 which sidewalls guide the edges of plate portion 54. It is the bottom of the plates 54 which provide the planar surfaces 54*a* which are adapted to make contact with the flat surfaces 45 through 50, depending upon the location of the member. The T-shaped members are, of course, inverted and topped by push-button elements 55 which may be pinned or otherwise held in place. Each push button is urged upwardly by a spring member 56 which extends between the top of member 20 and the push button element 55. The springs may terminate around a boss extension 57 atop member 20.

It will be seen by depression of a particular push button, its corresponding plate member 54 will have its surface 54*a* pressed against the cylindrical member 43 at a point to one side or the other of the center of rotation so that the flat surface 45—50 opposite the plate will tend to be rotated until the chord and the flat surface of the plate are parallel to one another and in contact over most of their areas. Therefore, selection of one of the push buttons determines a particular rotational position of the cylinder 43, and since the cams 35 and 41 are fixed thereto it determines a specific position of cam 35 and hence a

certain overclosure of switch **30**. This same condition of overclosure is achieved each time that same push button is depressed. As can be seen in FIGS. 8 through 14, the adjacent flat surfaces are arranged so that pressure on successive push buttons in the order of their arrangement from left to right in FIGS. 3 and 5 will cause successively greater amounts of overclosure of the contacts **30**, **31**. The flats are so positioned that pressure on their push button results in a predetermined particular pressure being exerted by the cam on the switch which will result in a particular heat level being maintained, and the heat level may be one of several standard heat levels represented by the various push buttons. The buttons themselves may be labeled with these heating levels such as low-boil, high-boil, frey, etc.

It will be observed that the spring loading of push buttons **56** tends to return push buttons to their common level after pressure is released once the position of cylinder **43** has been selected. Consequently, no indication remains thereafter of which push button had been selected, and hence of what the heat level is, or will be. It is to this end that the indicator cylinder **60** is employed. Cylinder **60** has an axial rod or shaft **61** fixed relative thereto, said axial rod being journaled in plates **23** and **24** to permit its rotation. The cylinder **60** may be seen by reference to FIG. 15. It will be seen in a view developing the surface in FIG. 16 that its surface is divided into two principal areas by an essentially straight boundary line which is a helix on the cylinder. These areas are marked or identified in some special fashion, such as by color coding in one instance. Area **62** has been color-coded red, and area **63** color-coded black. Thus it will be seen that, if cylinder **62** is made to rotate about its axis and viewed through a narrow slot or viewer which runs parallel to the buttons, the boundary line between the red and black areas will appear to the viewer to shift. The slot **65** is preferably arranged parallel to the row of push buttons and close thereto, and the push buttons are so arranged that the rotation of cylinder **43** caused by them produces a synchronized rotation of cylinder **60** such that the border **61** between the red and the black areas appears to move to the left in FIG. 1 or FIG. 3, as may be seen in the viewer lying above the push button which has been actuated. As seen in FIG. 3, the gears employed between cylinders **44** and **60** cause cylinder **60** to make a complete revolution while cylinder **44** moves but a small angle. The gear train includes a gear segment rack **65** on shaft **44** mating with a spur gear **66** rotatably supported by plate **24** on stub shaft **67**. Spur gear **66**, in turn, mates with spur gear **68** on shaft **61** of the roller **60**, and the gear ratio is such that cylinder **60** makes one full revolution for the arc between the extreme ranges of the cylinder **43**. Also mounted on shaft **61** is narrow cylindrical knob **70** which may be used for adjustment of the cam to any position of overclosure of the switch contacts so as to effect an infinite number of heating conditions.

To limit rotation of the indicator cylinder **60** and knob **70** to one revolution, a stop pin **71** is provided on one edge of knob **70**. This pin abuts one side of stop **72** at one end of its range and the other side of stop **72** at the other end of its range. Stop **72** is at one end of bracket **73** supported on plate **24**.

It will be observed that the movement of the line boundary **64** along the slot viewer or window indicates heating effect and the window itself may be calibrated such that the position of the border line **64** at the top or bottom of the opening indicates any specific heating level or pan temperature.

It will be obvious to those skilled in the art that the indicator arrangement within the scope of the invention may be considerably varied since it is the effective movement of a line relative to a frame or viewer which indicates the heating level. This, of course, could be accomplished by using a rotating means other than a cylinder. For example, it could be accomplished by a disk having a spiral, or part of a spiral, on its face. Likewise, it could also be accomplished by a linear movement wherein a slide member is caused to move from one end of a window to the other by means including a suitable translational device.

Other modifications to the structure described which would occur to one skilled in the art are intended to be within the scope and spirit of the present invention.

I claim:

1. A position selection system for a switch having a pair of contacts at least one of which is capable of being mechanically loaded to an infinite number of overclosed positions within its range of operation representing an infinite number of energy levels, manual selection means for selecting any of the possible infinite positions of the switch, a coupling mechanism coupling the manual selection means and the switch, including means adapted to gradually overclose the switch contact, indicator means connected to the coupling mechanism to be moved in response to movement of the selection means, said indicator means employing a surface movable relative to a fixed viewing frame, said surface having a line dividing the surface into adjacent areas, so arranged that as the surface is moved the portion of the dividing line viewed through the frame appears to move and the position of the line relative to the frame is indicative of the relative degree of overclosure of the switch within its operating range, and a plurality of push buttons providing selection means acting through the coupling mechanism to select discrete positions of overclosure of the switch contacts, each of the selection means being adapted to operate independently and regardless of previous operation of other selection means.

2. The position selection system of claim 1 in which the indicator is arranged relative to the push buttons so that the position of the dividing line appears adjacent to the push button which has been employed.

3. The position selection system of claim 2 in which the indicator and selection means are connected together and to the coupling mechanism whereby the switch contacts are able to be adjusted to an infinite number of positions within the range of operation so that the indicator will show gradations between the discrete settings of the push buttons.

4. The position selection system of claim 3 in which the indicator surface divided by a line into two areas is a cylinder journaled to rotate about its major axis relative to a fixed viewing position on the frame relative to which the dividing line seems to move as the cylinder rotates.

5. The position selection system of claim 4 in which the fixed viewing position on the frame is limited to a narrow slot through which the cylinder may be seen and in which the two areas on the surface of the cylinder are two colors so arranged that their boundary indicates relative heating effect and so arranged that at the off-position of the switch only one color is seen and at all on-positions of the switch the other color is seen in some degree.

6. The position selection means of claim 4 in which the position selecting means includes a modified cylindrical surface coaxial with the indicator cylinder and fixed thereto for simultaneous movement therewith.

7. A position selection system for a switch having a pair of contacts at least one of which is capable of being mechanically loaded to an infinite number of overclosed positions within its range of operation representing an infinite number of energy levels, manual selection means for selecting any of the possible infinite positions of the switch, a coupling mechanism coupling the manual selecton means and the switch, said coupling means including a rotatable cylinder having a number of flat surfaces along chords of the cylinder, and a plurality of push buttons connected to means terminating in flat surfaces which coact with the flat surfaces of the cylinder to select discrete positions of overclosure of the switch contacts.

8. A position selection system for a switch having a pair of contacts, at least one of which is capable of being mechanically loaded within its range of operation to an infinite number of overclosed positions representing an infinite number of energy levels, comprising a supporting frame, switch contacts mounted relative to the supporting frame, at least one of which is mounted on a support movable relative thereto, a cam adapted to bear against the support for the contact and thereby to overclose said contact, a rotatable coupling system supported on the frame and rotatably supporting the cam, a rotatable selection knob coupled to the coupling system for selecting any one of the infinite number of overclosed switch positions, a row of push buttons movably supported relative to the frame and adapted to cooperate with the coupling system to move the cam to discrete positions, and an indicator means having a movable part rotatably supported relative to the frame and a viewer on the frame arranged parallel to the row of push buttons so that the surface of the movable part seen through the viewer is divided into two differently identified areas by a boundary line which in different positions of the movable part is seen in different parts of the viewer such that the boundary occurs above the push button which has been actuated.

9. The position selection system of claim 8 in which the movable member of the indicator consists of a cylinder the surface of which is divided into two fields by a spiral boundary line, which is arranged to appear in the viewer adjacent the push button which is selected.

10. The position selection system of claim 9 in which a cylindrical knob coaxial with movable indicator member and fixed thereto is also provided for moving the switch to an infinite number of positions.

11. The position selection system of claim 10 in which the frame portion supporting the push buttons provides slide bearing surfaces for parallel slide members connected to the push buttons at one end and to generally perpendicular flat plates at the other, and the cylinder supporting the cam has flat areas along chords on the cylinder against which the flat plates bear and which are adapted to move the cylinder until the flat plate on the selected push button lies flat against its assoicated area on the cylinder.

12. The position selection system of claim 11 in which the cylinders supporting the cam and carrying the indicator fields are connected by gears which cause the indicator cylinder to rotate faster than the cam supporting cylinder.

13. A position selection system for use with a device which may assume an infinite number of positions within a range, comprising a frame, cam means adapted to permit said device to assume the infinite number of positions, a rotatable support for the cam which is adapted to cooperate one at a time with each of a plurality of push button elements arranged in a row and adapted to move the shaft to separate discrete positions when the various push buttons are pressed, a cylinder having two fields with a common boundary coupled to said shaft to rotate with it such that the boundary effectively shifts from one end of a window to the other, said window being parallel to the push buttons and so arranged that the boundary will overlie the particular push button which has been depressed to achieve the condition indicated.

14. A position selection system for a switch having a pair of contacts, at least one of which is capable of being mechanically loaded within its range of operation to an infinite number of overclosed positions representing an infinite number of energy levels, comprising a supporting frame, switch contacts mounted relative to said frame, at least one of which is mounted on a support movable relative thereto, a cam adapted to bear against the support for the contact and thereby to overclose said contact, a rotatable cylinder supported on the frame and rotatably supporting said cam, a plurality of push buttons movably supported relative to the frame arranged to cooperate with said cylinder to move the cam to selected discrete positions, the range between minimum and maximum overclosure representing only a portion of one revolution of said cylinder and said push buttons being operable to rotate the cylinder in whatever direction is required to represent the desired discrete position, and a rotatable selection knob coupled to said cylinder for selecting any one of an infinite number of overclosed positions.

15. A control system for a cooking range comprising a supporting frame, control means mounted relative to said frame adjustable to supply various cooking temperatures, cam means adapted to adjust said control means, a rotatable cylinder supported on the frame and rotatably supporting said cam, a plurality of push buttons movably supported relative to the frame arranged to cooperate with said cylinder to move the cam to selected discrete positions, the range between minimum and maximum adjustment representing only a portion of one revolution of said cylinder and said push buttons being operable to rotate the cylinder in whatever direction is required to represent the desired discrete position, and a rotatable selection knob coupled to said cylinder for selecting any one of an infinite number of adjustment positions between minimum and maximum.

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