

Nov. 14, 1939.

M. H. GRAHAM

2,180,233

TIMED COOKER

Filed Feb. 4, 1935

11 Sheets-Sheet 1

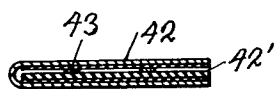
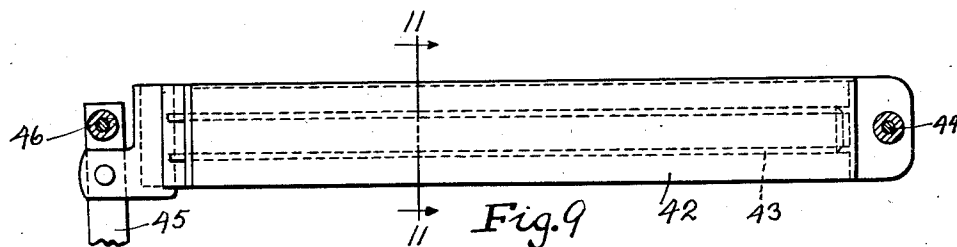
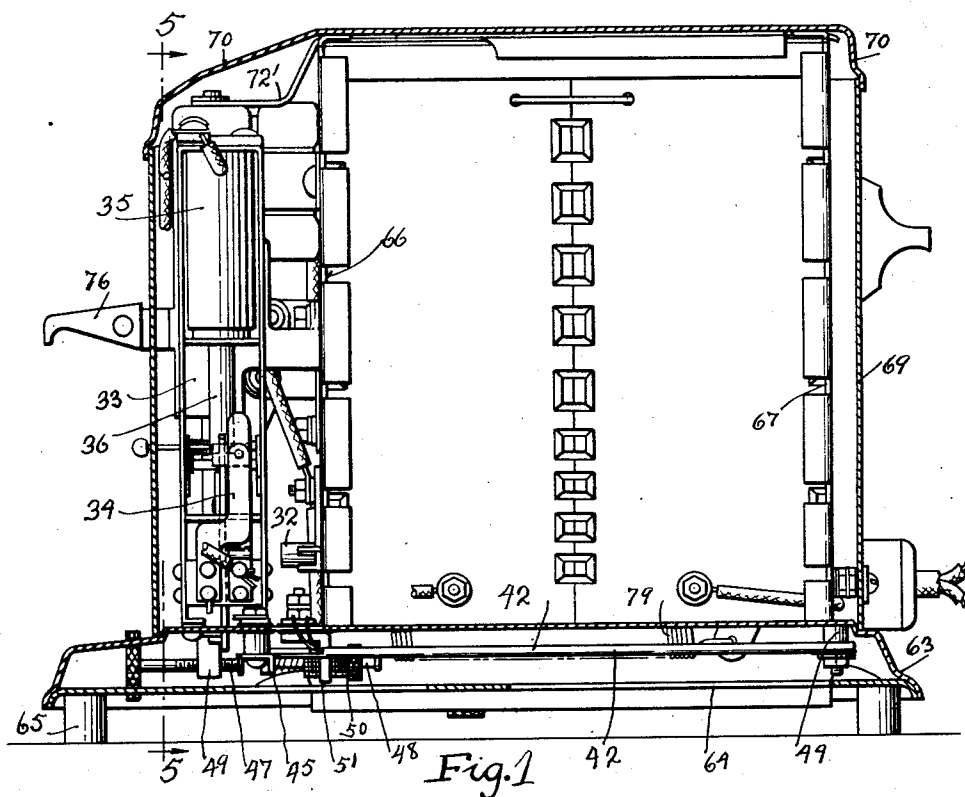


Fig. 11

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11 Sheets-Sheet 2

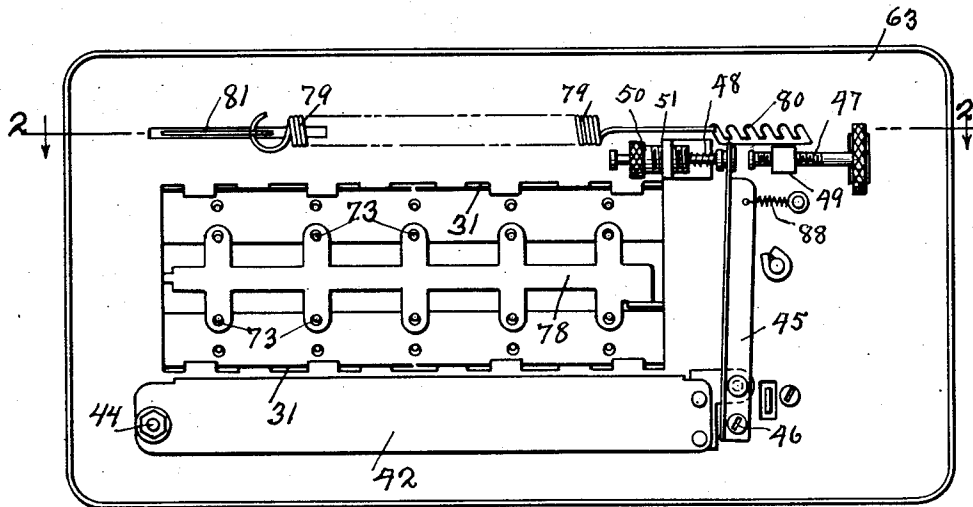
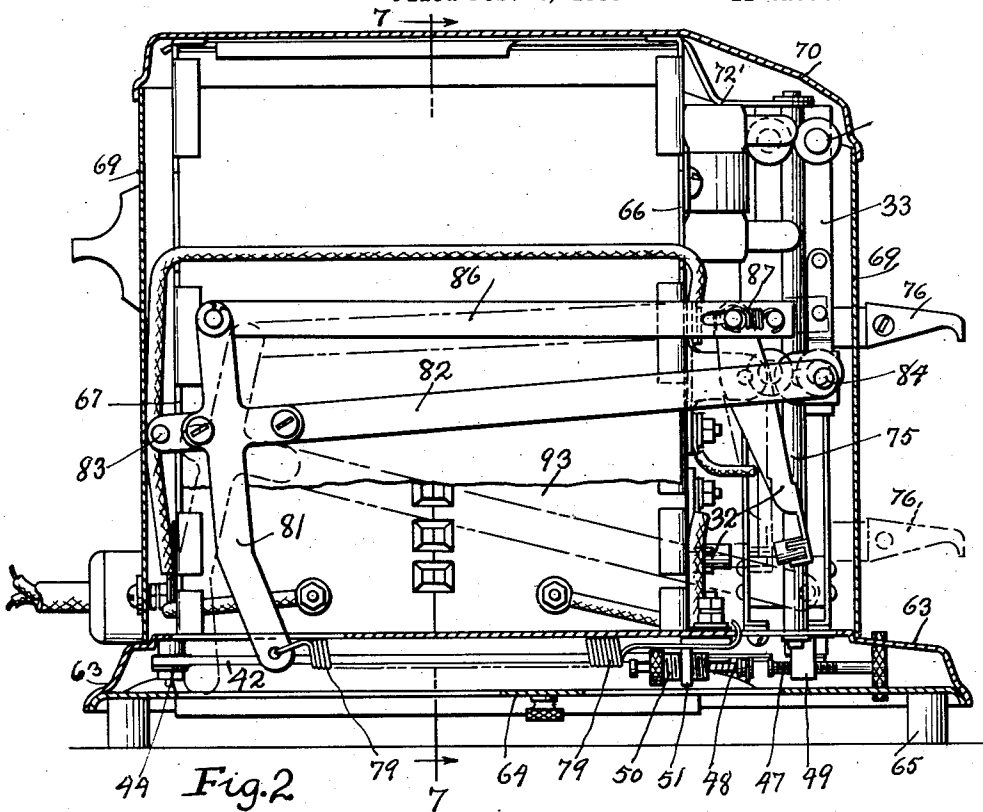


Fig. 3

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11 Sheets-Sheet 3

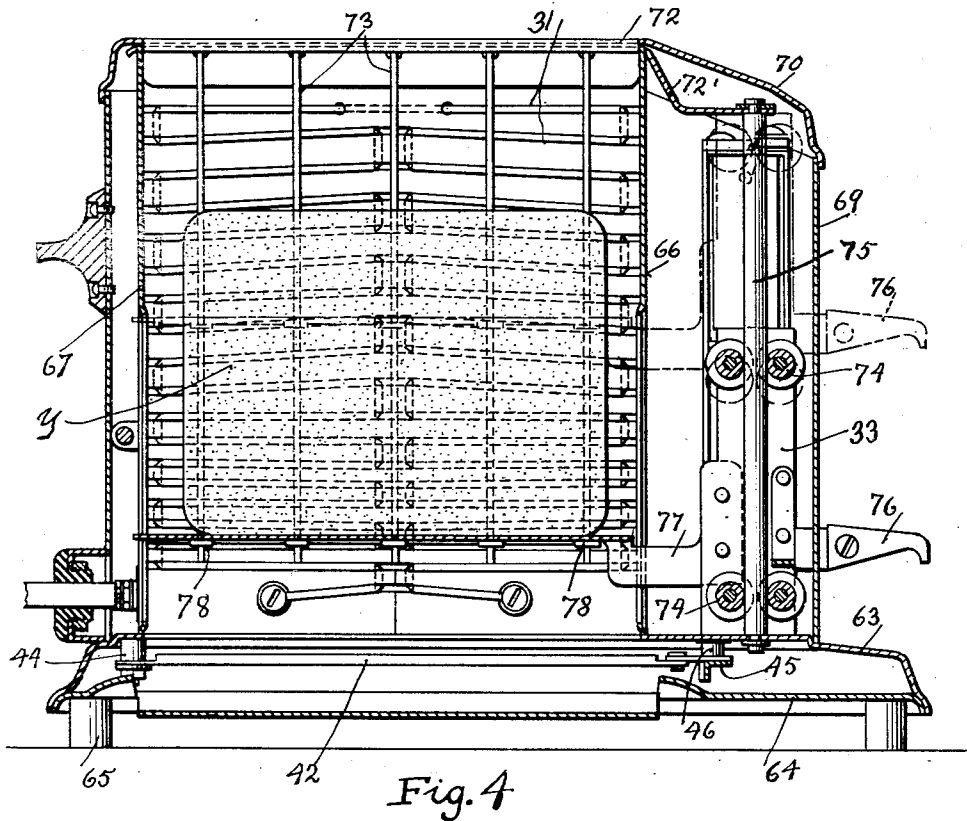


Fig. 4

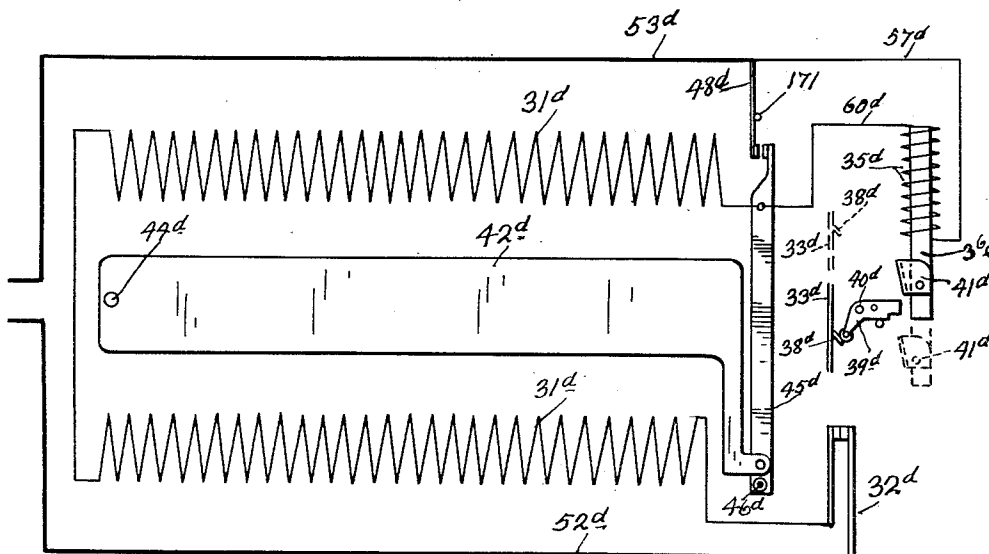


Fig. 29.

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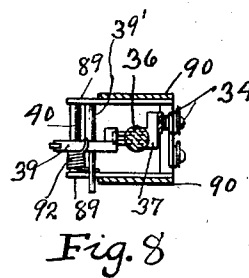
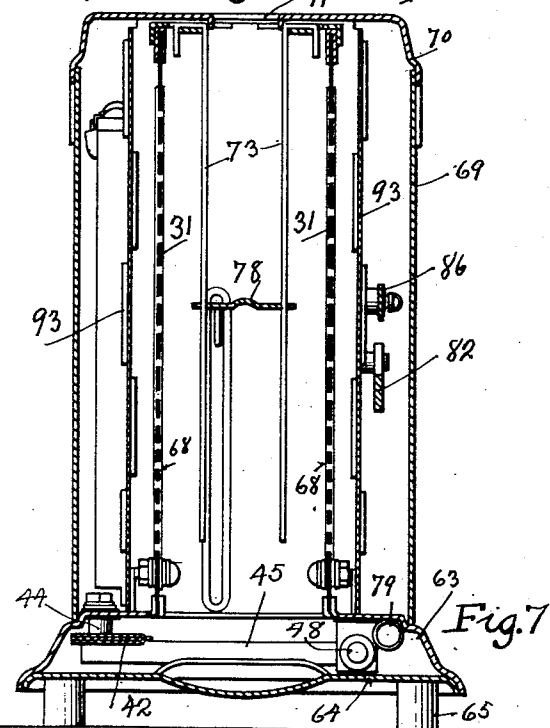
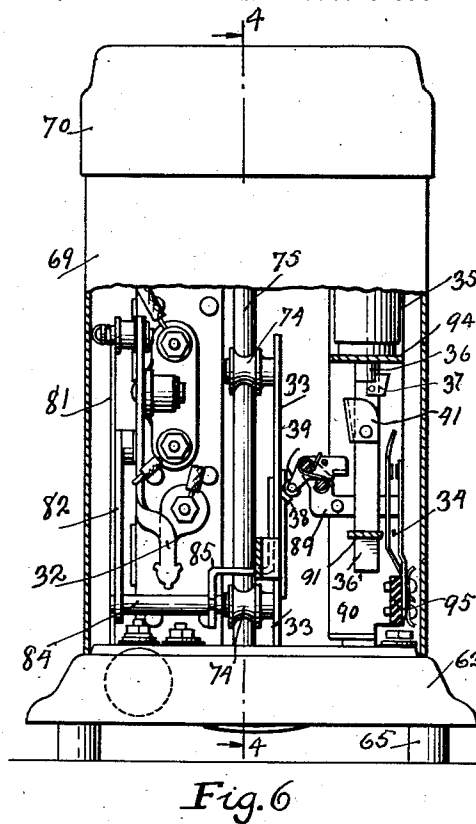
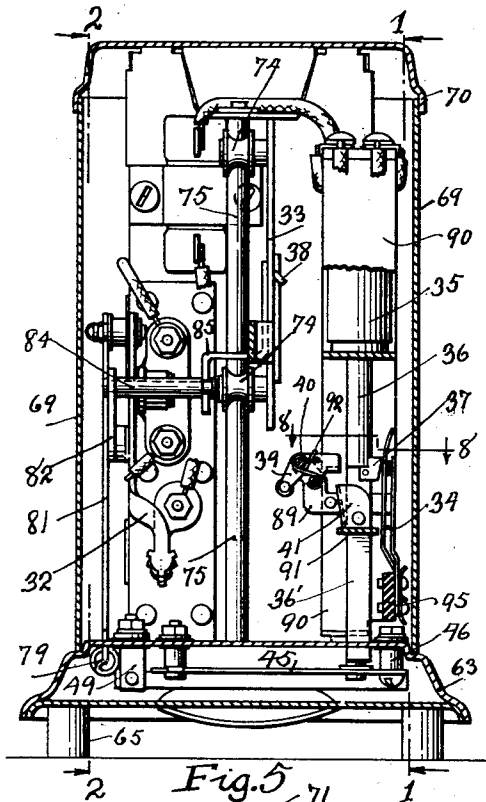
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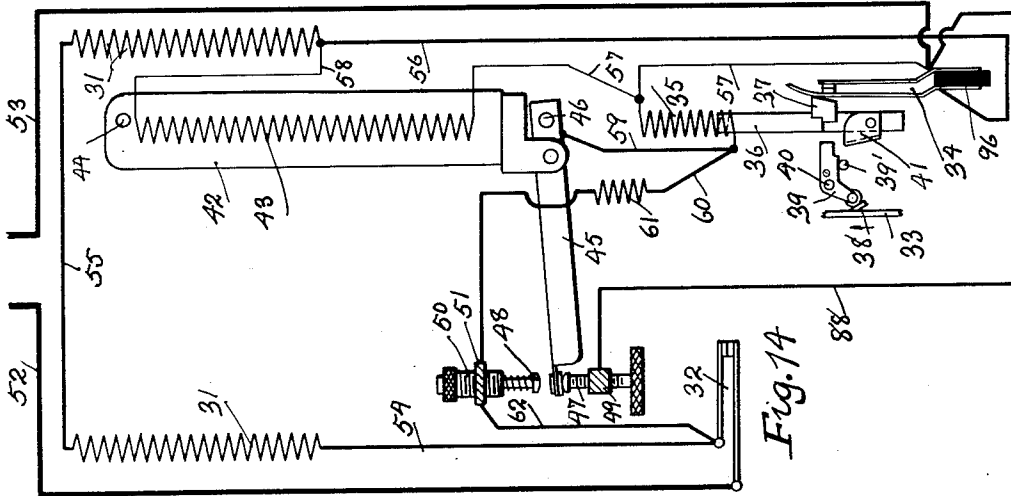


Fig. 14

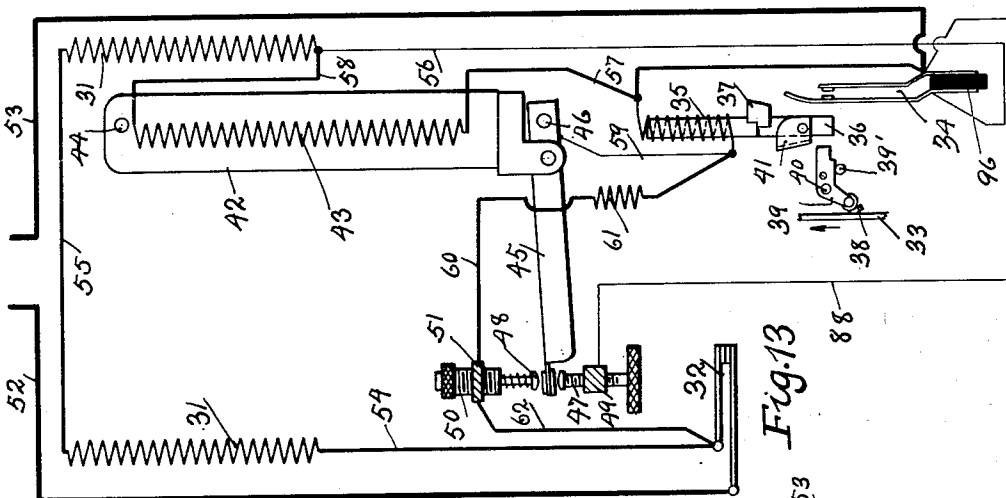


Fig. 13

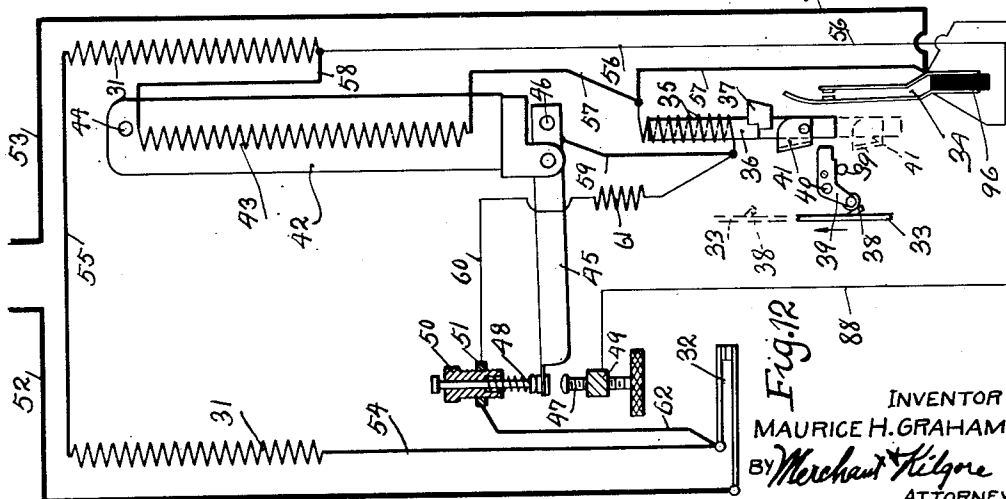


Fig. 12

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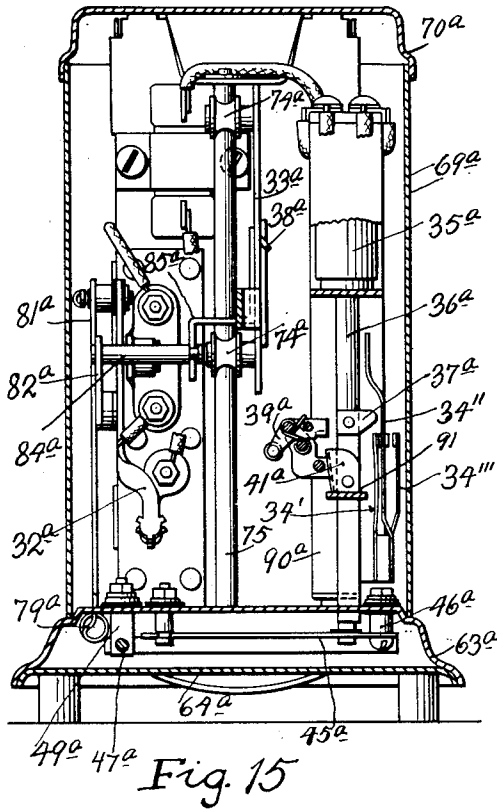


Fig. 15

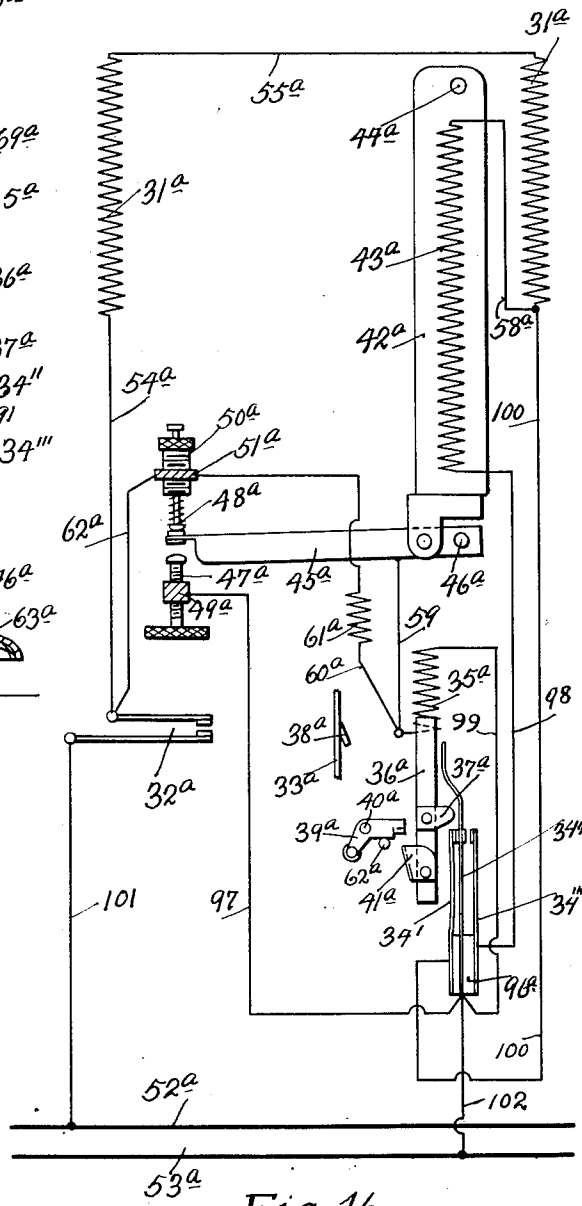


Fig. 16

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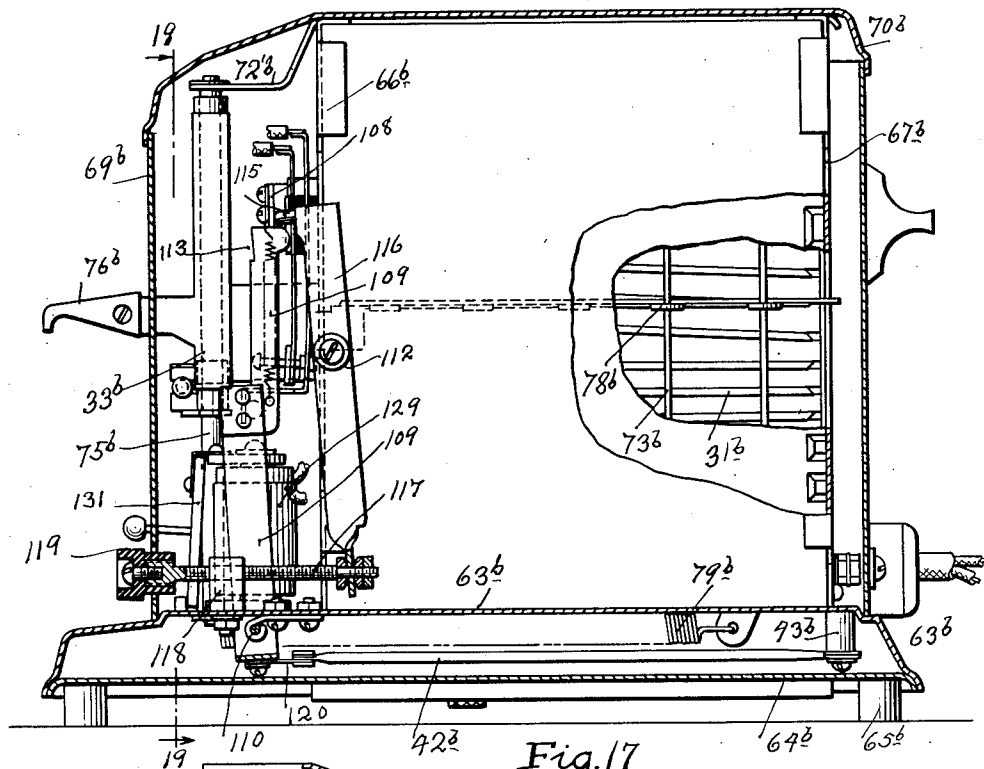


Fig. 17

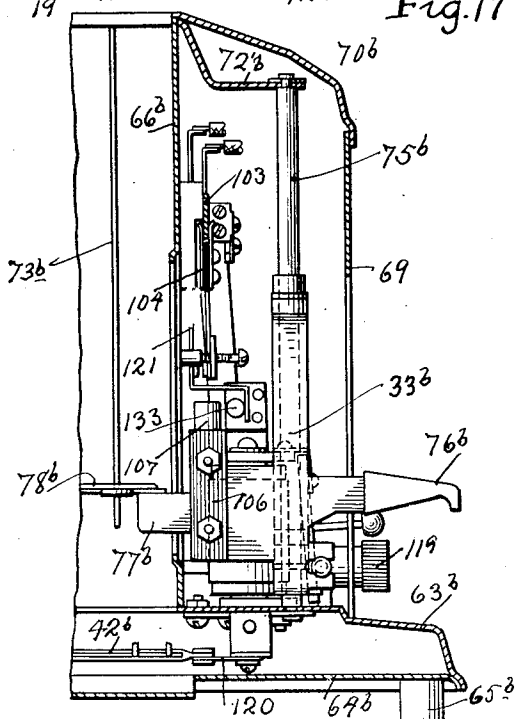


Fig. 18

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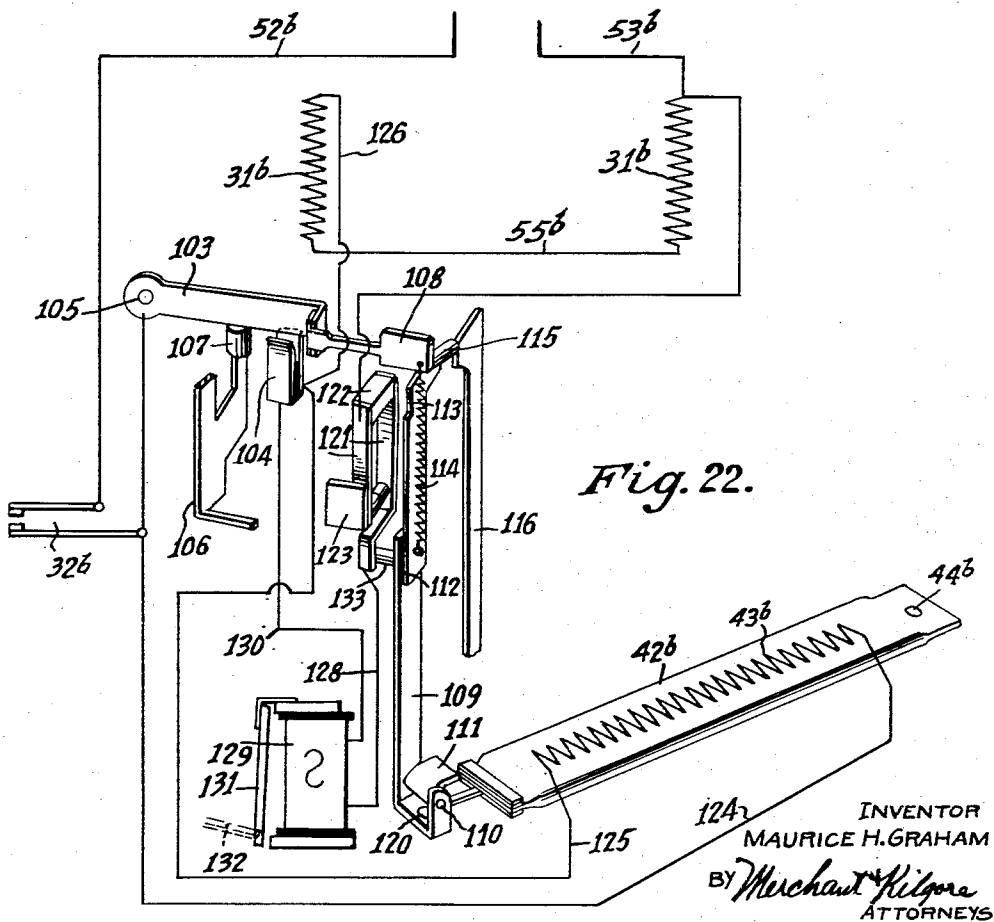
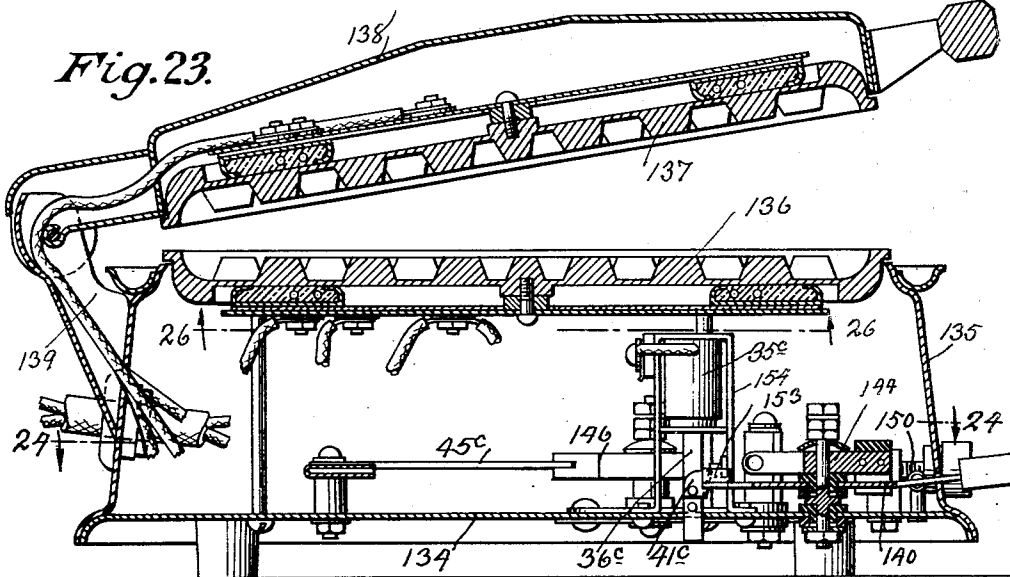
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11 Sheets-Sheet 11

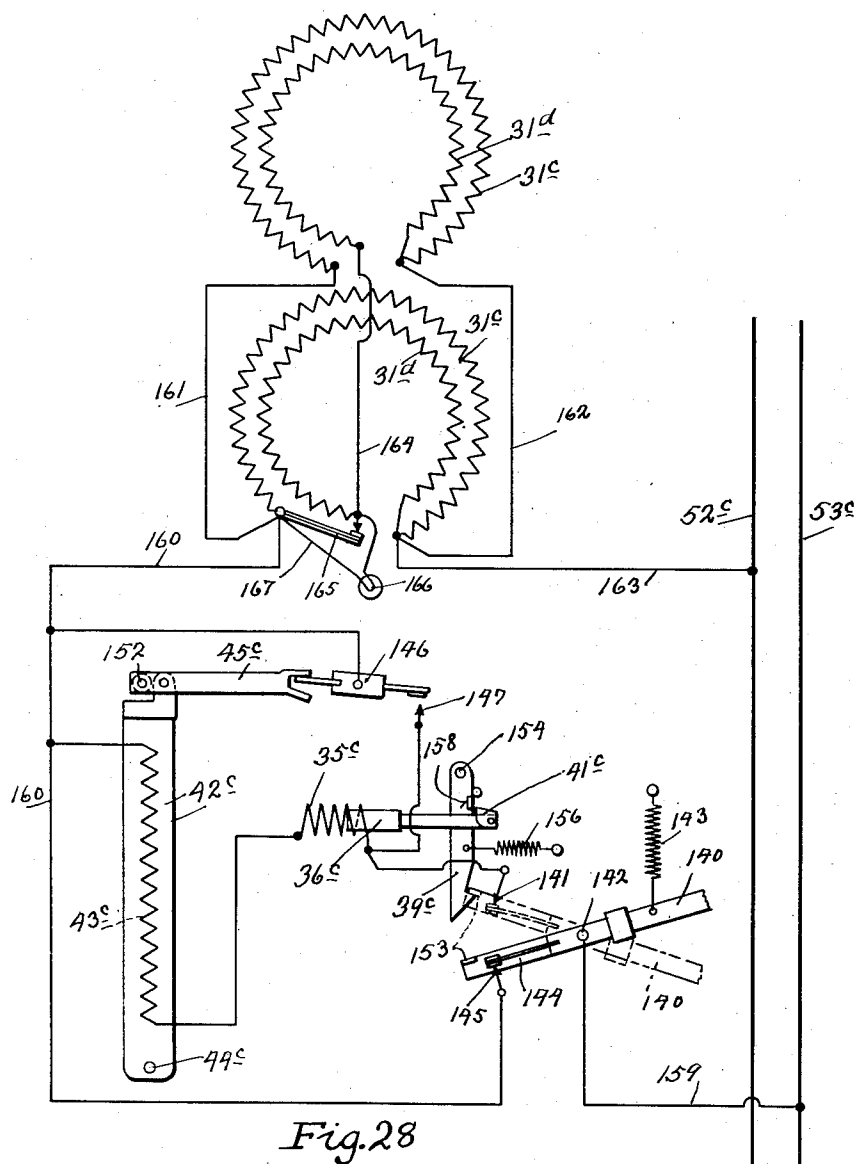


Fig. 28

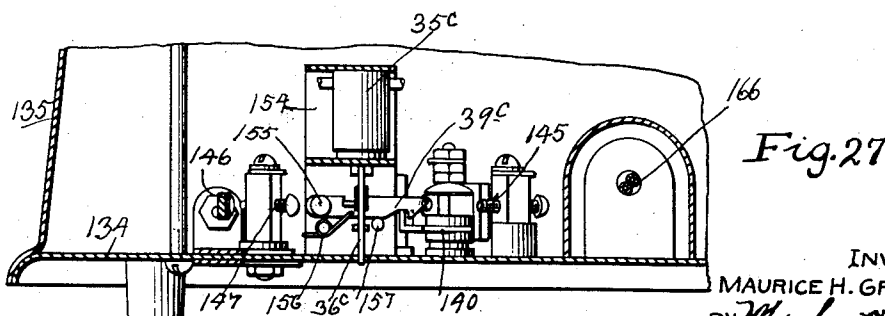


Fig. 27

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UNITED STATES PATENT OFFICE

2,180,233

TIMED COOKER

Maurice H. Graham, St. Louis Park, Minn., assignor to McGraw Electric Company, Chicago, Ill., a corporation of Delaware

Application February 4, 1935, Serial No. 4,899

36 Claims. (Cl. 219—19)

My invention relates to time-controlled cookers and more particularly to automatic electric toasters, waffle irons and like cooking apparatus, wherein the material to be toasted or cooked is combined with a container or holder therefor associated with primary electrical heating elements. Toasters, waffle irons and like electrical cooking apparatus require timing mechanism that will operate accurately under varying conditions of use and that will maintain accuracy of toasting or cooking control, irrespective of the varying temperatures of the apparatus, cooking oven or space, and which variations in temperature will occur at the initiation of the toasting or cooking actions, depending on the rapidity with which the successive actions are produced. These actions which I have demonstrated by long continued tests involving thousands of continuously repeated operations, I have accomplished in my present invention.

To the above ends, generally stated, the invention consists of the novel devices, combinations of devices and arrangement of parts hereinafter described and defined in the claims.

Considering the matter particularly in respect to electric bread toasters, it is a well known fact that the time required to toast a slice of bread to a predetermined or desired degree, varies with the variations in the temperature condition of the toaster at the commencement of the particular toasting operation. The same statement is true to a greater or less degree in the cooking or baking of various other food articles or the like. In the case of an electrically operated toaster, it will take a relatively greater amount of time to toast a first slice of bread to a predetermined degree upon insertion into a cold toaster, than will be required to toast a subsequent bread slice inserted into the toaster after it has been operated a few times and been heated up.

For some years there has been marketed electrically operated toasters and other cookers provided with timing devices set to operate upon the completion of the cooking operation to automatically terminate the cooking operation. Such cookers, were, however, not capable of producing uniform results because of necessity for variable timing, due to the change in their temperature condition, upon the occurrence of successive operations. In order to remedy this defect, it has been proposed to provide means for varying the operation of the timing device, in accordance with the variations in temperature of the cooker, and thereby to compensate for the increase in

cooking temperature occasioned by frequent use. One of such means is a temperature responsive device subject to some heat condition of the cooker, such, for example, as a thermostat in the toaster disclosed in the Forbes Patent No. 1,665,735, of date April 10, 1928, which controls the operation of the timing mechanism for the toasting of the bread slice. Again, in the case where a thermostatic heating means is employed, for the automatic timing of the toasting or cooking interval, it has been proposed to provide means for preheating the timer means prior to use for controlling the cooking operation after the cooker has been initially operated and heated, as a means for compensating for the increased temperature of the cooker.

The simple type of thermostatic timer such as now generally used in oil burner control circuits commercially known as "warp strips" or bi-metallic strips, which consists of the thermally responsive elements, and the deforming of which is determined by the interval necessary to heat the same to a predetermined temperature, is not commercially applicable for use to control any device such as a toaster, waffle iron or the like, adapted to be operated in rapid succession. The obvious reason is that when the warp strip has been heated, the device cannot again serve as an efficient timer until the strip has again cooled down. In an effort to overcome this difficulty and enable the use of a thermostatic timing means, in a device such as a toaster or the like, adapted to be operated in rapid succession, it has been proposed to employ a plurality of thermostatic timers in an arrangement in which it is intended that one of the thermostatic elements will be allowed to cool off while the remaining timer is in operation; but this latter structure, so far as I am aware, has not been successfully operated.

My present invention provides a timer which is self-compensating for increases or other variations in cooking temperature occasioned by use, and which is therefore particularly adapted for use in automatic regulation of an electrically operated toaster or cooker, without the necessity of any other means for varying the operation of the same to compensate for changes in the cooking temperature.

It is a special object of my invention to provide a timer adapted to be set in operation upon the completion of the cooking interval of an electrically operated toaster or cooker and arranged to automatically terminate said intervals, and which timer inherently and in its normal oper-

ation, varies the cooking interval in accordance with or proportionate to the changes in the heat condition of the cooker, resulting from frequent repeated use, whereby the necessity of providing any additional or secondary means for changing the normal operation of the timer to compensate for cooking temperature changes, is entirely obviated.

Stated in another way, a broad purpose of the invention is the provision of a single thermostatic timer in which a heat-responsive controlling element in itself can be operated over and over again in rapid succession and which, when thus used, will automatically compensate for the variations in the cooking or heat-applying temperature due to various intervals or conditions between the repeated uses.

Again, it is a general object of the invention to provide a single thermostatic timer in an automatic electrically operated cooker or other device that can be operated in rapid succession and which is of such nature that in its normal operation, it inherently compensates for temperature changes of the cooker or device.

More particularly, the invention contemplates the utilization of the time consumed in allowing the thermally responsive device to cool, as well as the time required to heat it, in order to establish a cooking interval, and it is a further object of the invention to provide a thermostatic timer in which a cooking or heat applying interval is determined from the time required to heat a thermally responsive device to a predetermined temperature, and to permit it to cool to a second predetermined temperature.

As will hereinafter appear, in the operation of my improved timer as applied, for example, to an electrically operated commercial toaster or cooking device, each cooking interval involves two sub-intervals, to wit: (a) a variable sub-interval required to heat the device from an uncertain or variable cool or low temperature condition to a predetermined higher temperature; and (b) the invariable or constant sub-interval required to permit the timer to cool from the predetermined high temperature down to a predetermined cooled or relatively low temperature. By a suitable and simple adjusting device, the entire cooking interval made up of the above noted sub-intervals (a) and (b), can be varied, to thereby increase or decrease the degree or extent of the complete toasting or cooking interval; but with the timer set, the said intervals (a) and (b) will be as above stated, to wit: the sub-interval (a) variable, and the sub-interval (b) constant.

The above and numerous other objects of the invention will become more apparent upon consideration of the devices illustrated in the accompanying drawings.

Figs. 1 to 14, inclusive, illustrate my invention as embodied in a commercial bread toaster;

Figs. 15 to 20, inclusive, illustrate my invention as incorporated in a bread toaster of somewhat modified form;

Figs. 21 and 22 illustrate a still further modified form of the invention embodied in a toaster;

Figs. 23 to 28, inclusive, illustrate the invention as incorporated in a waffle iron; and

Fig. 29 is a diagrammatic view illustrating a still further modified form of the invention.

Referring to the above drawings, wherein like characters indicate like parts throughout the several views;

Fig. 1 is a vertical front to rear section taken on the line 1—1 of Fig. 3;

Fig. 2 is a vertical front to rear section taken on the lines 2—2 of Figs. 3 and 5;

Fig. 3 is a bottom plan view of the toaster shown in Fig. 1;

Fig. 4 is a vertical section taken on the line 4—4 of Fig. 6;

Fig. 5 is a transverse vertical section taken on the line 5—5 of Fig. 1;

Fig. 6 is a front elevation of the toaster shown in Fig. 1, some parts being sectioned on the same line as in Fig. 5 but illustrating different positions of the parts;

Fig. 7 is a transverse vertical section taken on the line 7—7 of Fig. 2;

Fig. 8 is a fragmentary section taken on the line 8—8 of Fig. 5;

Fig. 9 is a side elevation showing in detail the thermostatic element herein designated as a timer;

Fig. 10 is an edge or side elevation of the timer shown in Fig. 9;

Fig. 11 is a section taken on the line 11—11 of Fig. 9; and

Figs. 12, 13 and 14 are diagrammatic views illustrating the wiring of the electrically actuated or influenced elements of the toaster, and illustrating different positions of the removable parts under different conditions.

Figs. 15 and 16 illustrate a toaster very much like that described in connection with Figs. 1 to 14, inclusive, but involving a somewhat modified arrangement of the immediate circuit-actuating connections.

Fig. 15 is a view corresponding to Fig. 5 but illustrating the modified circuit-actuating connections; and

Fig. 16 is a diagrammatic view illustrating the circuits of the modified arrangement of the toaster illustrated in Fig. 15.

Fig. 17 shows a somewhat modified form of the toaster being a vertical front to rear section taken on the line 17—17 of Fig. 19;

Fig. 18 is a section with some parts broken away taken on the line 18—18 of Fig. 20;

Fig. 19 is a transverse vertical section taken on the line 19—19 of Fig. 17;

Fig. 20 is a view corresponding to Fig. 19 but with some parts shown in full and with certain of the parts moved to a different position;

Fig. 21 is a fragmentary section taken on the line 21—21 of Fig. 19, some parts being removed; and

Fig. 22 is a diagrammatic view with some parts in perspective, illustrating the wiring of the electrically influenced parts of the toaster shown in Figs. 17—22, inclusive.

Figs. 23 to 28, inclusive, illustrate the invention as involved in the construction of a waffle iron;

Fig. 23 is a vertical section taken from front to rear centrally through the waffle iron;

Fig. 24 is a horizontal section taken on the line 24—24 of Fig. 23;

Fig. 25 is a section taken on the line 25—25 of Fig. 24, some parts being broken away;

Fig. 26 is a bottom plan view of the lower waffle grid looking upward from the line marked 26—26 on Fig. 23;

Fig. 27 is a fragmentary section taken on the irregular line 27—27 of Fig. 24, some parts being broken away;

Fig. 28 is a diagrammatic view illustrating the

circuits and circuit-actuating connections of the waffle iron shown in Fig. 23; and

Fig. 29 is a diagrammatic view illustrating a still further modified form of the invention.

Diagram views, Figs. 12, 13 and 14

Before describing in full the various drawings which illustrate several different embodiments of the invention, attention will first be directed to Figs. 12, 13 and 14. These views diagrammatically illustrate an embodiment of my invention which has been primarily designed for incorporation in an automatic electrically operated bread toaster, but which either in the identical form or slight modification, will serve as an automatic timer for numerous other devices. It is thought that by first considering the action of the system or scheme involved in these views, the later described application thereof in a toaster or the like will be more readily understood. The scheme illustrated in these views includes, (in addition to the circuit connections) heating coils or other heat radiators, a master switch, a master switch actuator, a shunting switch, an electro-magnetic tripping device for tripping the master switch actuator, and a thermally responsive timer, which latter includes an expansible and contractable thermally responsive element and a timer switch.

Referring more in detail to these diagram views, 31 indicates heat-radiating elements or coils such, for example, as would be used in a toaster. 32 indicates a normally open master switch. 33 indicates a master switch actuator. 34 indicates a shunting switch that is under strain to open. 35 indicates a tripper coil or solenoid, which, when energized, lifts a core or plunger 36 that is under normal strain to drop when relieved from the action of said solenoid or coil 35. This plunger 36 carries a lug or projection 37 which, when the plunger is dropped, closes the shunting switch 34. The master switch actuator 33 is shown as provided with a latch lug or projection 38 which is arranged to be engaged by a latch dog 39 that is intermediately pivoted at 40. Plunger 36 carries also a pivoted dog-releasing lug or element 41.

The timer includes as its main element, an expansible and contractable timer bar 42, preferably made of metal such as aluminum (which has a high co-efficient of expansion), and which is in close heat exchange association with a heating coil 43. One end of this timer bar 42 is pivotally anchored at 44 and the free end thereof is pivotally connected to the intermediate portion of a timer switch lever 45 that is pivoted at 46 and at its free end works between switch contacts 47 and 48. Lever 45 is made of metal and is an electrical conductor. Contact 47 is shown as threaded through a fixed bearing 49, and is a fixed contact except for adjustments required to vary the entire toasting or heat-applying interval designated above as made up of sub-intervals (a) and (b). Contact 48 is a yielding contact and, as shown, is in the form of a metal stem that works through a fixed bearing and is spring-pressed toward the contact 47, the extreme movement in that direction being limited by a head on the rear end of said stem. In the particular application illustrated, contact 48 works freely through a threaded bearing sleeve 50 which, in turn, is adjustable in a fixed bearing 51. For the purpose of the present illustration, contact 47 will be treated as a fixed contact, and contact 48 as a yielding contact.

The main leads or supply wires are indicated by the numerals 52 and 53. Lead 52 is connected to one side of master switch 32, the other side of which switch is shown as connected to one of the heating coils 31 by a wire 54. The first noted heating coil 31 is connected to the second heating coil by a wire 55, and the latter is connected by a wire 56 to one side of the shunting switch 34. The other lead 53 is shown as directly connected to that side of the shunting switch that is opposite to the connection just noted made by wire 56 to the other side of said switch, and this same side of switch 34 is connected to one end of solenoid coil 35 and to one end of the timer heating coil 43 by a wire 57. The other end of said coil 43 is connected by a wire 58 to the wire 56. The other end of solenoid coil 35 is electrically connected to the switch lever 45 by a wire 59 and to a bearing 51 and hence to the yielding contact 48 by a wire 60. In the wire or conductor 60 is interposed a high resistance coil 61 which, in this particular instance, may be assumed to have a resistance of 1400 ohms. The said bearing 51 and hence the movable contact 48 is electrically connected by a wire 62 to the same side of the master switch 32 to which wire 54 is connected. Wire 63 connects bearing 49 and hence contact 47 to that side of the switch 34 to which the wires 53 and 57 are connected.

At this time and until further detail description may be given, the reader is asked to assume that the master switch actuator 33 is under strain to move upward, that it has a connection, which when it moves upward, will open the master switch 32; and that when said actuator 33 is forced downward to the position indicated by full lines in the said views, Figs. 12, 13 and 14, it will close said master switch.

Operation

With these facts in mind, the operation of the scheme shown in the said Figs. 12, 13 and 14 will be as follows: Normally switch actuator 33 will be in the raised position indicated by broken lines in Fig. 12, and the tripping plunger or member 36 will be in its lowered position indicated by broken lines in said Fig. 12. When the said elements 33 and 36 are in their broken line positions Fig. 12, master switch 32 will be in open position and there will be no flow of current through any of the conductors or elements of the device. When it is desired to render the system operative, the operator will depress the switch actuator 33, thereby permitting or causing said master switch 32 to be closed, so that current will then flow not only through the heating coils 31, but also through the tripping solenoid 35 energizing the same and causing opening of shunting switch 34, permitting current to flow through timer heating coil 43, thereby causing both coils 31 and 43 to generate heat.

In the drawings, the flow of current under the several conditions is intended to be indicated by the heavy wire-indicating lines. Thus, as indicated in Fig. 12, the flow will be from lead 52 through closed master switch 32, wire 62, contact 48, lever 45, wire 59, coil 35, and wire 57 to lead 53, and at the same time there will be a flow of current through wires 54 and 55, heating coils 31, wire 58, timer coil 43 and wire 57 to lead 53. This is the condition illustrated in Fig. 12, at which time lever 45 is engaged with yielding contact 48 and at which time, because of the path of least resistance, the current will flow through tripping coil 35, through said lever and

wire 59, rather than through the high resistance coil 61.

When the master switch actuator was manually depressed as above described, its lug 38 passed below the engaging end of latch dog 39 in position to be latched down by said dog, but at the same instant and while said actuator was held depressed, master switch 32 was closed (as described), causing energization of tripping coil 35 and the latter being energized instantly raised the plunger 36 to its uppermost position shown by full lines in Fig. 12. As the said plunger was raised, its pivoted lug 41 engaged the adjacent end of latch dog 39, moving the same into position to release said actuator 33, but the action was so quick that said dog resumed its latching position before there was any upward movement of said actuator 33. When plunger 36 is moved upward as just described, shunting switch 34 was opened, but the importance of this action will be discussed later on.

When the condition of the system is that shown in Fig. 12, current will flow through the coils 31 and 43 and 35, as just stated, until under the action of heat from coil 43, timer bar or element 42 has been expanded so as to disengage lever 45 from contact 48, as shown in Fig. 13. The only immediate effect of this action is to break the circuit leading to the tripping coil 35 through the low resistance circuit (including the lever 45) and to cause the current to then flow through high resistance coil 61 and from thence through said tripping coil. The current then flowing through solenoid coil 35 will be sufficient to hold plunger 36 raised, but not sufficient to cause it to be raised from its lower to its uppermost position. Under the conditions illustrated in Fig. 13, current will still flow through the heating elements 31 and through the timer coil 43, so that the bar 42 will continue to expand until the free end of lever 45 has been engaged with fixed contact 47, as shown in Fig. 14.

Under the conditions existing in Fig. 14, tripper coil 35 will be shunted out by the circuit through lever 45, and through wires 59, 57 and 88, thereby permitting plunger 36 to drop to its lower position, in which position its lug or projection 37 closes the shunting switch 34. Under dropping movement of the plunger, pivoted latch dog releasing lug 41 freely passes the adjacent end of latch dog 39 without any action thereon, since the downward movement of the adjacent end of said dog is limited by a suitable stop 39'.

When shunting switch 34 is closed, as shown in Fig. 14, by dropping of the plunger 36, the circuit will be closed between the opposite sides of said switch, thereby shunting out the circuit through the timer heating coil 43, but leaving the circuit through the heating coils 31 still closed for the full flow of current therethrough. When the circuit through the timer heating coil 43 is thus shunted out, the timer bar or element 42 will immediately commence to cool off and to contract, starting the movement of the free end of the lever 45 from engagement with fixed contact 47 toward engagement with a movable contact 48. While lever 45 is thus being moved toward engagement with contact 48, current will continue to flow through the heating elements 31, but not, of course, through the timer heating coil 43; plunger 36 will remain in its lowered position holding shunting switch 34 closed, and master switch 32 will be held closed by the actuator 33, which is still latched down by dog 39. When, however, lever 45, by continued contraction of

bar 42, is again engaged with contact 48, the circuit through tripper coil 35 will be then again closed through lever 45, as shown in Fig. 12, thus causing said coil 35 to be energized with sufficient force to pull plunger 36 from its lowered position shown in Fig. 14, back to its raised position shown in Fig. 12.

The upward movement of said plunger 36 thus produced, accomplishes two results, to wit: it opens or permits the shunting switch 34 to open, and by engagement of pivoted lug 41 (which has a limited outward swinging movement) with the adjacent end of latch dog 39, releases the master switch actuator 33, thereby permitting the latter to move upward and in its upward movement open the master switch, thereby cutting off all supply of current to the system or device. When this happens, tripper plunger 36 drops back to position shown by broken lines in Fig. 12, ready to repeat its above described function in the next cycle of operation.

From the foregoing, it is evident that the time of the complete toasting or cooking action is the time required for the lever 45 to move out of engagement with contact 48 and into engagement with contact 47 (which is the variable sub-interval (a) above referred to), plus the time required for the said lever to move from engagement with contact 47 back into engagement with contact 48 (which is the constant or unvarying sub-interval above referred to as sub-interval (b)). The extent to which movable contact 48 will be depressed or moved against its spring tension under the action of lever 45, will vary with the extent to which the thermally responsive bar or element 42 is permitted to cool.

With the so-called fixed contact 47 set in a definite position, the heating elements will be operated so as to produce always substantially the same cooking or heating actions, regardless of the temperature of the apparatus or its parts (including, of course, the element 42), at the instant that the apparatus is set in action to toast bread or produce other cooking or heating action.

As illustrated in the drawings, the stem of contact 47 has threaded engagement with its bearing 49 and hence is capable of being set in different adjustments, and of course, the setting thereof into different adjustments will vary the total time interval and the intensity of the repeated toasting, cooking or heating actions, which actions, however, will be constant in respect to the result, for any particular setting of the relatively fixed contact.

In Figs. 1 to 11, inclusive, I have illustrated a commercial toaster in which the scheme and structure diagrammatically illustrated in Figs. 12, 13 and 14 is applied.

Referring now particularly to these views, it may be stated that in this embodiment of the invention, the toaster has very much the appearance of that of the well-known "Toastermaster" toaster, but differs therefrom very materially in its vital structural features and the operation thereof. As here illustrated, the base portion of the toaster is made up of a raised base plate 63 and a bottom base plate 64 supported by foot blocks 65. Rigidly secured on and rising from the base plate 63 is a frame made up of upright front and rear plates 66 and 67, that support laterally spaced insulating sheets 68, preferably mica, on which latter the heating coils 31 are applied. Detachably mounted on the base plate 63 and surrounding and enclosing the mica sheets 68 and various other parts, is a casing 69, pref-

erably of light sheet metal and on the top of which a crown sheet or top plate 70 is applied. This crown sheet 70 is provided with a centrally located bread discharge passage 71 through which, as will presently appear, the bread slices may be passed into and out of the oven or toasting chamber formed between the coils 31.

Detachably mounted on top of the end plate 66 is a rectangular marginal rim 72, the opening in which is larger than the bread passage 71 so that it does not interfere with the passage of the bread through the latter into and out of the toasting chamber. Guide rods 73 are secured to and depend from the rim 72 and will serve to hold the bread out of contact with the heating coils 31. In Fig. 4, a slice of bread is indicated by the character *y*. By reference particularly to Figs. 2, 4, 5 and 6, it will now be noted that the vertically movable element 33, heretofore described as a master switch actuator, is provided with grooved rollers 74 that run on a vertical guide post 75 rigidly secured at its lower end to the base plate 63 and at its upper end to a projection 72' of the rim 72. This plate or member 33 affords a vertically movable carriage and to facilitate the manipulation thereof, it is shown as provided with a projecting handle 78 that works through a vertical clearance slot in the front of the casing 69. This master switch actuator 33 is provided with a projecting arm 77 to which is rigidly secured a skeletonized bread-supporting table or support 78 that is movable vertically between the heating coils or elements 31. Table 78 has lateral projections through which the lower ends of the guide rods 73 are freely passed. Arm 77 works through a vertical slot in the frame plate 66 and holds carriage plate 33 against rotation on post 75.

The carriage made up of the plate 33 and associated parts is put under tension to move to its uppermost position shown by dotted lines in Fig. 4, by a coiled spring 79, one end of which is adjustably anchored to a notched flange 80, formed in the base plate 63 and the other end of which is connected to the lower end of a vertically disposed arm 81 that is rigidly secured to a long lever 82. This lever 82 is pivoted at 83 to a lug on the rear frame plate 67 and at its free end it is provided with a laterally projecting stud 84, the inner end of which in the structure illustrated, is embraced by a pronged end of a bracket 85, see Figs. 2, 5 and 6, which, in turn, is rigidly secured to the carriage-forming actuator plate 33. The upwardly projected end of the arm 81 is pivoted to a switch-actuating link 86, the front end of which is connected to the upper end of the movable element of the master switch 32 by a yielding connection made up of a short coiled tension spring 87 that connects studs on the switch member and on said link.

By reference to Figs. 9, 10 and 11, it will be noted that the timer bar 42, as preferably designed, is made up of a sheet of expansible metal, to wit: preferably aluminum, bent into flat U-shaped cross-sectional formation to enclose between its folds, the timer coil 43 contained in insulating material 42'. In the present application of the timer bar, its anchor stud 44 is shown as rigidly secured to the bottom of the base plate 63 and the pivot 46 of the switch lever 45 is also applied to the bottom of said plate 63, see particularly Figs. 1, 2 and 3. Also as shown in Fig. 3, the free end of the lever 45 is under light tension from coiled spring 88 to move toward switch contact 47. This spring will simply

take up slack, but does not, however, control the movements of said lever, the latter being under the complete control of timer bar 42, as already described.

The pivot 40 of the latch dog 39 described in connection with the diagram views, Figs. 12, 13 and 14, in the present instance, is shown as a rod supported by lugs 89 of a pair of upright parallel bars 90 that are rigidly secured to one of the front corner portions of the base plate 63 (see Fig. 5). The stop pin 39' is also applied to these lugs 89, see Figs. 5, 6 and 8. Also, in this application of the invention, the tripping plunger 36 is provided with a flat depending portion 36' which works through a slot in the base plate 63 and through a slot in a stop bar 91 that is rigidly secured to the upright bars 90. Thus plunger 36 which carries the tripping and switch-closing elements is held against rotation on its axis. Lock dog 39 can be gravity held in its locking position shown in Figs. 5, 6, 12 and 14, but for this purpose, it is shown as additionally held by a light torsion spring 92, best shown in Figs. 5, 6, and 8. As best shown in Fig. 7, louvered plates 93 are applied between the coil-supporting plates and the outer sides of the casing 69.

The tripping coil 35 is shown as supported on a shelf 94 secured to the bars 90, see Figs. 5 and 6, by reference to which bars it will also be noted that the normally separated contacts or members of the tripping switch 34 are secured and insulated from each other by an insulating block 95 secured to the lower portions of the bars 90. A manner of applying the invention broadly illustrated in the diagram views, Figs. 12, 13 and 14, to the commercial toaster illustrated in Figs. 1 to 11, inclusive, has now been described, and the general operation has already been made clear by the description of the said diagram views. A short summary of the action of the commercial toaster with the invention thus applied, is as follows:

Summary of operation of invention applied as in Figs. 1 to 14, inclusive

Normally, or when the device has been out of use, the parts will be in positions shown by full lines in Figs. 1, 2 and 5, and by broken lines in Fig. 4, and the current will be entirely cut off to the toaster because master switch 32 will then be open. The bread slice is then inserted through the passage 71 and placed on the table 78. Then by taking hold of the handle 76, the carriage is depressed, thereby lowering the table 78, bringing the bread into toasting position between the heating elements or coils 31; and this same movement of the plate or carriage 33, operating through the lever 82 and arm 81, against tension of spring 79, closes the master switch, thereby turning the current onto the heating coils or elements 31 and timer coil 43. The toasting action will then be initiated and will continue as described in connection with diagram views, Figs. 12, 13 and 14, until the complete toasting action has been accomplished; whereupon, the tripper coil 35 will be energized, raising the plunger 36, causing latch dog 39 to release the carriage 33. When carriage 33 is thus released, spring 79 will quickly move carriage 33 upward, causing the table 78 to project the bread partially from the toaster and the master switch to be opened, restoring the toaster to normal or inoperative condition. The exact cycle of operation of the toaster and the important results thereof have been fully described in

connection with the diagram views and need not be here repeated.

From the foregoing it will be observed that in the particular arrangement described, the automatic means for tripping the master switch actuator, causing opening of the master switch and movement of the bread from the toasting zone or oven, in addition to the several important functions performed, serves as a means for indicating the completion of the timed toasting, cooking or heating interval. From this it further follows that the so-called means for indicating the completion of the timed interval can be audible, visual or purely functional. The particular means described in connection with the views, Figs. 1 to 14, inclusive, is visual because of the clearly observable movements of the parts, is audible because of the sound produced by the release of mechanism and is functional in that it projects or ejects the bread and opens the master switch, automatically cutting off current supply to the toaster.

Figs. 15 and 16

The structure illustrated in Figs. 15 and 16, except for some of the circuit connections and the construction of the shunting switch, is like that fully described in connection with Figs. 1 to 14, inclusive, and hence those parts that are identical with the structure of the said Figs. 1 to 14, are here indicated by the same characters with exponent *a* added thereto. The shunting switch of this structure which is employed instead of the heretofore described switch 34, involves three contact members 34', 34'' and 34''', which members are anchored to an insulating block 96a mounted on a fixed part of the framework of the toaster, such as the bars 90a. Contact 34'' is under tension normally to maintain electrical engagement with contact 34' but out of engagement with contact 34''', and its upper end is bent so that it will be forced out of engagement with contact 34' and into engagement with contact 34''' by lug 37a when plunger 36a is raised.

By reference to Fig. 16, it will be noted that in this arrangement, bearing 49a and hence fixed contact 47a is electrically connected to contact 34''' by a wire 97; that the timer heating coil 43a is connected to said contact 34''' by a wire 98; that one terminal of tripper coil 35a is connected to contact 34'' by a wire 99; and that one terminal of one of the heating element coils 31a is connected to contact 34' by a wire 100; that the main lead 52a is connected to one side of master switch 32a by a wire 101; and that the main lead 53a is connected to contact 34'' by a wire 102.

Diagram view, Fig. 16, indicates the normal condition of the toaster illustrated in Figs. 15 and 16, and the operation thereof will be exactly that described in connection with Figs. 1 to 14, inclusive, except that at the time when lever 45a engages fixed contact 47a at the completion of the above described sub-interval (*a*), the circuit leading to timer coil 43a will be absolutely opened, whereas, in the previously described arrangement, said circuit leading to said timer coil is simply shunted out of action. More specifically described, the said action will be as follows:

When master switch 32a is closed by depression of actuator 33a, the current will first flow through trip coil 35a, causing plunger 36a to be raised and its lug 37a to move contact 34'' out of engagement with contact 34' and into en-

gagement with contact 34''', thereby closing the circuit through the heating coils 31a and timer heating coil 43a. Then when, under expansion of member 42a, lever 45a is engaged with contact 47a, current will take the path of least resistance from master switch through wire 62a, wire 60a, resistance 61a, wire 59a, lever 48a, contact 47a and wires 97 and 102, thereby shunting out the tripping coil 35a and permitting plunger 36a to drop back to its position shown in Fig. 16. When this takes place, shunting switch contact 34'' will again engage with contact 34', thereby absolutely opening the circuit through timer heating coil 43a, permitting the element 42a to commence to cool; but at this time, the current will still flow through the heating coils 31a by way of wire 100, contacts 34' and 34'', and wire 102.

From the description just given of Figs. 15 and 16, it will be understood that the timer coil can be "cut out" of action either by shunting it out or by opening or breaking its circuit. The term "timer cut out" is, therefore, herein used in a sense broad enough to cover either or both of the said actions or manners of rendering inoperative the coil or device which supplies heat to the thermally responsive timer.

Attention should have been called to the fact that contact 34'' makes contact with 34''' before it breaks contact with contact 34'.

Figs. 17 to 22, inclusive

The structure illustrated in these views in many respects is like that illustrated in Figs. 1 to 14, inclusive, but differs therefrom in the circuit connection and in some of the details of mechanism. Those parts of the structure illustrated in these last noted views, that are identical with those illustrated in Figs. 1 to 14, inclusive, are indicated by the same numerals with the exponent *b* added thereto.

In this modified structure, the master switch 32b is connected to the vertically movable carriage 33b by the same connections, and is subject to the same spring that is fully described in connection with Figs. 1 to 14. In this arrangement, however, the so-called shunting switch and the tripping switch are of modified form. The shunting switch shown comprises a circuit-closing lever 103 and co-operating contacts 104. Lever 103 is pivoted to front plate 66b at 105 and contacts 104 are also supported from said plate 66b but insulated therefrom and from each other. The carriage 33b carries an extension 106 which has a finger 107 that underlies the intermediate portion of said lever and holds the same raised, as shown in Fig. 22, when the carriage is in its normal raised position. Lever 103 has a laterally yielding spring extension 108 that normally rests on the extreme upper end of a long lever 109, and which is pivoted near its lower end at 110 to a bracket 111 that is rigidly secured on the base plate 63b. Lever 109 is shown as made up of two sections that are rigidly connected but insulated the one from the other at 112.

At its extreme upper end, lever 109 is formed with a notch 113 into which the end of lever extension 108 will drop under certain conditions. A light coiled spring 114 attached to the end of lever extension 108 and to the intermediate portion of lever 109 yieldingly pulls 103—108 downward and holds the latter normally on the flat upper end of said lever 109. In a rearward direction, movement of the free end of the flexible arm extension 108 is limited by a relatively fixed

stop 115 which, as shown, is carried at the upper end of a stop lever 116 that is intermediately pivoted to a suitable bearing on a fixed part, such as the front plate 66b. The lower end of this lever is shown as swivelled to an adjusting screw 117 that works through a nut block 118 on the base 63b and is provided at its front end with an operating knob 119. The free end of the thermally influenced timer bar 42b is shown as connected by a short thrust link 120 to the extreme lower end of the lever 109.

The tripping switch is shown as made up of two metallic spring strips 121, the upper ends of which are rigidly connected but insulated from each other by a block 122. One of the members 121 is anchored to a block or element 123 rigidly secured to the front plate 66b. One side of the master switch 32b is connected to main lead 52b and the other side of said switch is connected by a wire 124 to one terminal of the timer coil 42b, the other terminal of said coil being connected by a wire 125 to one of the switch contacts 104, this same contact being connected by a wire 126 to one of the heating coils 31b. One of the said coils 31b is connected by a wire 127 to the relatively fixed member of the tripper switch contacts 121. The other or movable switch contact 121 is connected by a wire 128 to one terminal of a tripper magnet coil 129, the other terminal of which is connected by a wire 130 to the switch contact 104 to which the wire 125 is not connected.

Tripper magnet 129 has a movable armature 131, the free end of which is under yielding strain to engage a latch detent or lug 132 that is carried by a lower front portion of the carriage 33b. Lever 109 at its intermediate portion, see particularly Fig. 22, is provided with a lateral pin or projection 133 that is engageable with the depending end of the movable contact 121.

Operation of structure of Figs. 17 to 22, inclusive

The normal position of the various parts is illustrated in Figs. 17, 19 and 22, under which conditions the carriage 33b and bread carrier 78b are raised and master switch 32b is open. When a slice of bread has been inserted on the bread carrier 78b, the carriage 33b may be depressed by engaging and depressing the handle 76b. This downward movement of the carriage (which as before noted, serves also as a master switch actuator), closes the master switch and causes the carriage to be latched in its lower switch-closing position with the bread in position for toasting, by engagement of the armature 131 with the latch lug 132. When this takes place, the current will flow from lead 52b through master switch 32b, wire 124, timer coil 42b, wire 125, and heating coils 31b to lead 53b. When timer bar 42b is subject to the heat from timer heating coil 43b, it will commence to expand and will move the upper end of lever 109 rearward or toward the right in respect to Fig. 22, and will carry the pin 133 away from the free end of the movable contact 121, thereby causing the tripper switch to open. However, even before this tripper switch is opened, no current can flow through the tripper magnet 129.

Under expansion of timer bar 42b, the yielding lever extension 108 will be forced against the relatively fixed stop 115, but when said timer bar is expanded to a certain predetermined extent, its extreme upper end will be carried beyond the end of lever extension 108, and thereupon, spring 114 will cause switch lever 103 with its extension

108 to drop, thereby closing the circuit between the shunt switch contacts 104.

At this time, it will be understood that the carrier extension 106 and its lifting finger or lug 107 will be in the lowered position due to the lowering of the carriage 33b. When the circuit is thus closed between contacts 104, the flow of the current will be from lead 52b through switch 32b, arm 103, contacts 104, and heating coils 31b to lead 53b; but the circuit through timer coil 43 will then be shunted out so that timer bar 42b will be permitted to cool and will contract. When said bar 42b is contracted far enough to permit the points of tripper switch contacts 121 to engage, the circuit will then be closed through tripping coil 129 by way of wires 130, 128, switch contacts 121 and wire 126.

When tripper coil 129 is energized, its armature 131 will be attracted, thereby disengaging the latch lug 132 and permitting the carriage 33b to be immediately raised under the action of its spring 79b. When the carriage is thus moved back to its raised or normal position, master switch 32b will be opened, cutting off the entire supply of current and lever 103 will be again raised out of engagement with contacts 104 and the spring arm 108 will, under its own spring tension, snap back to the position shown in Fig. 22 over the upper end of lever 109.

With the stop 115 set in a definite position, the toasting actions will be uniform, that is, will be toasted to a certain degree. The degree to which the bread will be toasted may be increased or decreased, however, by adjustments of the lever 116 and its stop 115.

Waffle iron, Figs. 23 to 28, inclusive

These figures illustrate the invention incorporated in a waffle iron, which comprises a suitable base 134 which supports an upstanding casing 135. The numeral 136 and 137 indicate, respectively, the fixed and movable grids of the waffle iron, the former of which is supported on the upper edge or rim of the casing 135 and the latter of which is contained in a cap-like cover plate 138 which, in turn, is hinged to a lug 139 on the casing 135. The heating coils are applied to the respective grids in proper heat exchange relation in respect thereto. Preferably, and as best illustrated in diagram view, Fig. 28, each grid is provided with two heating coils 31c and 31d that are connected in multiple by a circuit presently to be described.

The thermally influenced timer bar 42c which is similar to the earlier described timer bar 42, is provided with a heating coil 43c. This bar 42c is shown as located just above the base 134 and is anchored thereto at 44c. The main or master switch of this arrangement is shown as in the form of a metallic lever 140 and a fixed contact 141. Lever 140 is shown as pivoted to the base 134 at 142 and is subject to a spring 143. Lever 140 has a yielding contact 144 that is directly engageable with contact 141 and with a spaced contact 145. Contacts 141 and 145 may take various forms, but as shown, they are in the form of screws that are adjustable through lugs on the base plate 134.

The shunting switch of this structure, as shown, comprises a lever 146 and a fixed contact 147. Lever 146 is intermediately pivoted at 148 to a carrier plate 149 that is slidably mounted on the base plate 134 under the action of an adjusting screw 150 that is swivelled to a lug on said plate 149 and works with threaded engagement through

a nut block 151 fixed on the base 134. The purpose of this adjustment will later appear.

The free end of the timer bar 42c is pivotally connected to a shunt switch-actuating lever 45c which, in turn, is pivoted to the base plate 134 at 152. At its free end, the arm 45 is provided with diverging prongs between which the adjacent end of the switch lever 146 is arranged to work in a manner hereinafter described.

The master switch lever 140 at its free end, is shown as provided with a latch lug 153 which, when the said lever is moved to the broken line position, Figs. 24 and 28, will be engaged and held by a free end of a latch dog 39c. Latch dog 39c is pivoted at 155 to a bracket 154 secured on the base 134 and is subject to a light spring 156 that normally holds the same against a fixed stop 157 on said bracket. At its intermediate portion, said dog is shown as provided with an offset tripping lug 158.

A tripping magnet or solenoid 35c is mounted on a bracket 154 and acts upon a vertically movable core or tripping plunger 36c. At its lower end, plunger 36c is provided with a dog-releasing lug or element 41c that is pivoted thereto for slight inward swinging movements, but limited in its outward swinging movement. Main lead 53c is connected to the master switch lever 144 by a wire 159 and contact 145 is connected to one terminal of timer coil 43c and to one terminal of one of the coils 31c by a wire 160. Terminal of wire 160 is connected by a wire 161 to the other heating coil 31c; and the terminals of the two upper coils 31c and 31d are connected to the corresponding terminals of the other set of coils 31c—31d by a wire 162, and from the latter point, a wire 163 leads to the main lead 52c. A wire 164 connects one terminal of the upper coil 36d to the corresponding terminal of the lower coil 31d and thence through a switch 165 to a wire 160. This switch 165, as shown, includes a bi-metallic strip or warp bar which normally closes the circuit through wire 164 but will open when the temperature of the waffle iron reaches a certain predetermined high point suitable for cooking. A signal light bulb 166 is shunted around the switch 165, as best shown in Fig. 28, by means of a shunt wire 167.

In Fig. 24, the numeral 168 indicates a gong or bell that is arranged to be struck by the end of a clapper-acting lever 169. Bell 168 is shown as mounted on the base 134 and lever 169 is shown as pivoted on the latter and is subject to a light retracting spring 170. The extended end of lever 169 is in position to be struck by the lug 153 on the end of switch lever 140 when the latter is released and is given quick return from its broken line to its full line position of Figs. 24 and 28.

Operation of the waffle iron, Figs. 23 to 28

In Fig. 28, full lines indicate the condition of the apparatus or device in what may be treated as normal, that is, when the leads 52c and 53c are connected to a source of current supply by suitable means, such as a socket, but in which the master switch lever 140 is in its normal or released position. At this time, current will flow from lead 53c through lever 140, wires 160 and 161, to heating coils of the waffle iron and the wire 163 to lead 52c. If the waffle iron is then idle, that is, not performing a waffle baking action, the warp switch 165 will be of such temperature that it will break the circuit through the inner heating coils 41d, but will leave the circuit closed through the coils 31c. This condition of the cir-

cuit will maintain the plates of the waffle iron in baking condition. In this arrangement, the completion of the proper baking or cooking period is indicated by the ringing of the bell or gong.

When the waffle iron is to be thrown into baking action, the master switch lever 140 will be moved into its dotted line position, Fig. 28, where it will be latched and held by latch dog 39c. Current will then flow from lead 53c, through lever 140 through coils 35c and 43c, through the heating elements of the waffle plates and through wire 163 to lead 52c. This will start the waffle baking action and the heating of the timer element 42c. Under expansion of element 42c, lever 45c will be moved first until its oblique prong engages the adjacent end of lever 146, and then until lever 146 is engaged with contact 147; and when this occurs, tripping coil 35c and the timer coil or element 43c will be shunted out of action because the current will then take the path of least resistance and flow through lever 146 through the coils of the waffle plates and through wire 163 to lead 52c. When timer element 43c is thus shunted out of action, thermally responsive member 42c will commence to cool and contract; but lever 146 will maintain engagement with contact 147 until it has been again engaged by the straight or upper prong of lever 45c, whereupon the circuit will be broken at contact 147. When contact is broken at 147, the current will then be forced through tripping coil or solenoid 35c and the latter being energized, will raise or attract the plunger 36c, causing lug 41c by engagement with lug 158, to move latch dog 39c and release lever 140, which latter, being released, will again resume the full line position, Fig. 28, cutting out of action all of the parts of the apparatus, restoring the device or apparatus to the condition first noted.

In the operation of the waffle device just described, the heretofore described variable sub-interval is the time required for lever 45c, under expansion of element 42c, to move lever 146 from any one of several different possible positions into engagement with contact 147; and the constant sub-interval is the time required under contraction of member 42c to move its oblique lower prong out of engagement and its straight or upper prong into engagement with the adjacent end of lever 146, thereby disengaging said lever 146 from contact 147. Inasmuch as the prongs of lever 45c are divergent, this last noted time can be varied by adjustments of lever 146 toward and from the pivot 152 of lever 45c; and the means for accomplishing this has already been described.

From the foregoing, it is evident that the expressions such as cut-out and cut-off, referring to the supply of electric current or heating medium, is used in a broad and liberal sense and intended to cover such actions whether the heating medium or current be completely cut off or so materially cut off as to modify or greatly reduce the cooking or baking action.

It is further evident that in the operation of all of the devices above described, at the termination of the described second or constant sub-interval, various actions are produced which indicate the termination of the timed or heat-supplying interval. For instance, the sound produced by the tripping of the mechanism would give such indication, or the ejecting movement of the bread in a toaster, or the observed movement of the parts would give indication of the termination of the timed interval.

Obviously, the invention herein disclosed is

capable of a wide range of modification within the scope of the invention and within the scope of the claims hereof.

Fig. 29 illustrates a structure or arrangement capable of incorporation in a toaster such as that illustrated in Figs. 1 to 14, inclusive, and wherein certain of the parts that correspond to those of the earlier structure are indicated by the same numerals with the added exponent *d*. In this structure, the thermally responsive expansible and contractable element 42*d* is not provided with an individual heating element but is placed between the main heating elements 31*d* directly in the line of radiant heat therefrom and in the line of the upwardly moving currents of air induced by convection. This structure will be made clear from the following brief description of the operation, to wit: When the toaster is in normal or cooled condition, and out of operation, master switch 32*d* will be open, plunger 36*d* will be down as shown by broken lines in Fig. 29, switch actuator 33*d* will be up as indicated by broken lines, and lever 45*d* will be engaged with switch contact 48*d* and will have pressed the same toward the left away from stop 171 a greater or less distance depending on the low temperature of the bar or member 42*d*. When the toaster is to be thrown into action, actuator 33*d* is pressed down to the full line position and will there be latched by the dog 39*d*. Downward movement of the actuator 39*d* operating through the mechanism earlier described, will close the master switch 32*d*. When master switch is thus closed, while lever 45*d* is engaged with contact 48*d*, trip magnet 35*d* will be shunted out and full current will then flow through the heating elements 31*d* and will continue to thus flow until the element 42*d*, under the action of the radiant heat from elements 39*d*, is expanded to such an extent as to first permit spring contact 48*d* to move against stop 171 and then to move lever 45*d* out of engagement with contact 48*d*, and when this occurs, the current will be caused to flow through trip magnet 35*d*, thereby raising plunger 36*d*, releasing the actuator 33*d* and permitting the same to be moved upward under the action of its spring, earlier described, thereby opening master switch 32*d* and terminating the toasting action. When master switch is opened, plunger 36 will have dropped back to its lower or dotted line position.

For the next toasting action, it will be assumed that the next toasting action is started by depressing actuator 33*d* while lever 45*d* is out of engagement with contact 48*d*. When this happens, trip magnet 35*d* will be energized, raising the plunger 36*d* while actuator is still depressed, thereby permitting dog 39*d* to again engage and latch the actuator down with the master switch 32*d* closed. When this second or repeat action is started, the flow of current through the heating elements 31*d* will be sufficient to hold plunger 36*d* raised, but will not be sufficient to produce any material heating of the elements 31*d*. Hence the heating elements 31*d* will not be again brought into action until element 42*d* has cooled to a sufficient extent to again engage lever 45*d* with contact 48*d*, whereupon, the full current will flow through the heating elements 31*d* (through lever 45*d* and contact 48*d*) and trip magnet 35*d* will be shunted out, permitting plunger 36*d* to drop to broken line position. When, however, under the radiant heat from the elements 39*d* element 42*d* is again expanded so as to disengage lever 49*d* from contact 48*d*, trip magnet 35*d* will be again energized, raising plunger 36*d*, tripping

switch actuator 33*d*, and causing the master switch 32*d* to be again opened, thereby terminating this last noted heating or cooking action.

What I claim is:

1. The combination with cooking means including a primary heater and an associated holder for the article to be cooked, of a timer for establishing intervals of time action of said primary heater, said timer including a thermally responsive member, heating means operative on said timer member only until the latter has reached a predetermined high temperature, thereby permitting said member to cool while said first noted heater is still in action, and means for interrupting the action of said first noted heater when and only when said timer member has cooled to a predetermined extent.

2. The combination with electrical cooking means including a primary electrical heater and an associated holder for the article to be cooked, of a thermostatic timer for establishing intervals of the time action of said primary heater, said timer including a thermally responsive member and an associated secondary electrical heater, a shunting switch actuated by said thermally responsive member, circuit connections and associated means operatively arranged to cut said secondary heater out of action when said expansible timer member is heated to a predetermined high temperature, and means for interrupting the action of said primary heater when and only when said timer member has cooled to a predetermined relatively low temperature.

3. The combination with electrical heating means, of a timer for establishing intervals of time action of said heating means, said timer including a thermally responsive member and an electrical heat-radiating element associated therewith, a shunting switch actuated by said thermally responsive timer member, circuit connections including said electric heating means and the electrical element of said timer, a normally open master switch in said circuit connections, a master switch actuator normally opening said master switch, a latch for holding said master switch actuator in a position to cause closing of said master switch, and an electromagnetic trip for releasing said latch, said trip including a coil in said circuit connections, the heating element of said timer being in a shunt across the main circuit and said shunt switch being arranged to shunt said heating element out of action when the thermally responsive member of said timer is heated to a predetermined high temperature, and to cause the said tripping magnet to actuate said trip and release said master switch actuator, thereby opening the main switch and cutting off the supply of current to said heating means, when the thermally responsive member of said timer cools to a predetermined low temperature.

4. The combination with electrical cooking means, including a primary electrical heater and associated holder for the article to be cooked, of a timer for establishing intervals of time action of said primary heater, said timer including a thermally responsive member and a secondary heat-radiating element associated therewith, circuit connections for supplying current to said primary electrical heater and to the electrical heat-radiating element of said timer, and a timer switch actuated by the thermally responsive member of said timer and arranged to control said circuit connections so as to cut the heating element of said timer out of action, when

said timer member is heated to a predetermined temperature, and cause the flow of current to said first mentioned heating means to be interrupted, when and only when said timer member has cooled to a predetermined extent.

5 5. The combination with electrical cooking means, including a primary electrical heater and associated holder for the material to be cooked of a timer for establishing intervals of time action of said primary heater, said timer including a thermally responsive member and a secondary heat-radiating element associated therewith, circuit connections for supplying current to said primary electrical heater and to the electrical
10 heat-radiating element of said timer, and a timer switch actuated by the thermally responsive member of said timer and arranged to control said circuit connections so as to cut the heating element of said timer out of action, when said
15 timer member is heated to a predetermined temperature, a manually closable master switch in the main circuit for initiating the cooking action, and means for opening said master switch when and only when the thermally responsive member of
20 said timer has cooled to a predetermined extent.

6. The combination with cooking means including a primary heater and an associated holder for the article to be cooked, of a thermostatic timer for establishing intervals of time, comprising a thermally responsive member, means for heating said thermally responsive member simultaneously with said primary heater, means operative as a result of the heating of said thermally
30 responsive member for rendering the heating means inoperative on said thermally responsive member, and means operative as a result of subsequent cooling of said thermally responsive member for indicating the termination of the cooking interval by an observable manipulation of the device.
40

7. The combination with electrical cooking means and means for supporting an article to be cooked thereby, of a timer for establishing intervals of the time action of the said cooking means, said timer including a thermally responsive member and an electrical heating element associated therewith, a timer actuated switch, a master switch, circuit connections including said electrical cooking means, timer heating element, timer actuated switch and master switch, and associated means whereby the heating element of said timer will be cut out of action when the thermally responsive member of said timer has reached a predetermined high temperature, and
55 said master switch will be opened to cut said heating means out of action and terminate the timed interval, when the thermally responsive member of said timer has cooled to a predetermined low temperature.
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8. The structure defined in claim 7 in further combination with a master switch actuator, a latch for holding said actuator in a position to close said master switch, and an electro-magnetic trip for releasing said master switch actuator to open said master switch when the thermally responsive element of said timer has cooled to the predetermined low temperature indicated.
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9. The structure defined in claim 7 in further combination with a master switch actuator, a latch for holding said actuator in a position to close said master switch, and an electro-magnetic trip for releasing said master switch actuator to open said master switch when the thermally responsive element of said timer has cooled to
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the predetermined low temperature, said electrical connections including also a tripping switch that is operated to cut the electrical heating element of said timer out of action when the thermally responsive element thereof has been heated to the predetermined high temperature indicated.
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10. In an electric toaster, the combination with electrical heating elements, a supply circuit therefor including a normally open master switch, and a master switch actuator, of a thermostatic timer for establishing the intervals of the time action of a supply of current to the electrical heating elements of said toaster, said timer including a thermally responsive member and an associated electrical heating element, means under the control of said timer, for cutting off the supply of current to the electrical heating element thereof when said member has been heated to a predetermined temperature, and for automatically actuating said switch actuator to open said master switch to cut off the supply of current to the heating elements of said toaster, when the thermally responsive member of said timer has cooled to a predetermined low temperature.
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11. In an electric toaster, the combination with electrical primary heating elements, a supply circuit therefor including a normally open master switch, and a master switch actuator, of a thermostatic timer for establishing the intervals of the time action of a supply of current to the electrical heating elements of said toaster, said timer including a thermally responsive member and an associated electrical heating element, means under the control of said timer, for cutting off the supply of current to the electrical heating element thereof when said member has been heated to a predetermined temperature, and for automatically actuating said switch actuator to open said master switch to cut off the supply of current to the heating elements of said toaster, when the thermally responsive member of said timer has cooled to a predetermined low temperature, and further in which the means for cutting off the supply of current to the heating element of said timer is a switch that has electrical connections to and is arranged to be actuated by said timer at the above noted time when the thermally responsive member of said timer has been heated to the predetermined high temperature.
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12. In a waffle iron, a batter container, primary heating means applied to said container, a thermally responsive timer member, means for heating said timer member and means for rendering said last said means inoperative on said timer member when the latter has reached a predetermined high temperature and without interrupting the heating action of said primary heating means on said container, and means for terminating the timed cooking interval of said primary heating means on said container, when and only when said thermally responsive timer member has cooled to a predetermined extent.
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13. The combination with cooking means including a primary electrical heat radiator and an associated holder for the article to be cooked, of a thermally responsive timer member, a secondary electrical heat radiator associated with said timer member, circuit connections to said electrical heat radiators including a manually closed master switch and a switch subject to the action of said thermally responsive member and thereby operative to cut said secondary electrical heat radiator out of action on said timer member when the latter has been heated to a predetermined temperature, and operative to open
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said master switch and terminate the cooking interval when and only when said thermally responsive member is cooled to a predetermined extent.

14. The combination with cooking means, of a timer for establishing intervals of the cooking action, including a thermally responsive member, heating means operative on said timer member only until the latter has reached a predetermined high temperature, thereby permitting said timer member to cool while the cooking action is continued, and means for interrupting the cooking action, when said thermally responsive timer member has cooled to a predetermined extent.

15. In a toaster, the combination with an electric heating element, a control switch therefor, a bread slice support, a single means for biasing the switch to open position and the bread support to non-toasting position and a latch for holding the switch in closed position and the bread support in toasting position, of a cyclically-operable thermally-actuable timing means including a thermally actuable element adapted to occupy substantially the same position at the beginning of each toasting operation, manually-actuable means for simultaneously closing the switch, moving the bread support to toasting position and causing thermal energization of the thermally actuable element and movement thereof in one direction, means engaged by the thermally actuable element during such movement to effect thermal deenergization of the thermally actuable element and cause return movement thereof, a latch-releasing means and means engaged by and cooperating with the thermally actuable element to energize the latch-releasing means.

16. A toaster comprising in combination, an electric heating element, a thermally actuable member, a heating circuit for the thermally actuable member, a switch for the heating element and the heating circuit spring-biased to open position, a normally open shunt for the heating circuit, manually actuable means to effect closing of the switch, a latch to hold the switch closed, a circuit comprising an electromagnetically-actuated latch-releasing means, means mechanically actuated by the thermally actuable member in its movement in a certain direction to effect closing of the shunt for the heating circuit and a return movement of the thermally actuable member and means engaged by the thermally actuable member during its return movement to effect energization of the circuit comprising the latch-releasing means and deenergization of the electric heating element.

17. In a bread toaster, the combination with cooking means including a primary heater and an associated holder for the article to be cooked, of a timer for establishing intervals of time action of said primary heater, said timer including a thermally responsive member, heating means operative on said timer member until the latter has reached a predetermined temperature, thereby permitting said member to cool while said primary heater continues the cooking action, and means operative as a result of subsequent cooling of said thermally responsive member for indicating the termination of the cooking interval by an observable manipulation of the device.

18. The structure defined in claim 17 in further combination with means for automatically moving the cooked article out of the cooking zone when the cooking interval is terminated.

19. In a bread toaster, primary electrical heating means, a timer for establishing intervals of

the toasting action including an expansible and contractable thermally responsive member, heating means operative on said timer member until the latter has reached a predetermined high temperature, means whereby when said timer member reaches the predetermined high temperature said timer member will be permitted to cool without terminating the application of heat to said primary heater, and means for interrupting the cooking action when said thermally responsive timer member has cooled to a predetermined extent.

20. In a bread toaster, primary electrical heating means, a bread holder movable to and from toasting position in respect to said primary heater, means for locking said bread holder in the toasting position and for simultaneously supplying current to said primary heater, a thermally responsive member, means for supplying heat to the latter when the bread holder is moved to toasting position, means for cutting off the supply of heat to said member when the latter has been heated to a predetermined temperature and permitting the same to cool while the toasting action continues, and means for terminating the toasting interval and moving said bread holder from the toasting position, when said member has cooled to a predetermined temperature.

21. In a bread toaster, a toasting compartment, a slice carrier movable to toasting and non-toasting positions relative to said compartment, means for retaining said carrier in toasting position, a thermally responsive member and releasing means for said carrier responsive to movement and return of said member by heating and cooling the same.

22. In a toaster, the combination with an electric heating element, a movable bread slice support, spring means operative to urge said slice support to non-toasting position, a latch for restraining the spring means so that the slice support may rest in toasting position, and manual means for moving the slice support into toasting position, which movement actuates the latch to restrain the spring means, of means including a thermally responsive member to effect release of the latch, means whereby actuation of the manual means effects thermal energization of the thermally responsive member and movement of one part thereof in one direction, means mechanically actuated by the thermally responsive member by its movement in one direction to effect thermal deenergization of the thermally responsive member and cause it to move in the opposite direction and means operatively engaged by the thermally responsive member during its movement in the opposite direction and cooperating therewith to effect release of the latch and return of the bread slice support to non-toasting position.

23. In combination, a toaster, and timing means for indicating the completion of operating time periods thereof, said timing means comprising a thermally responsive device, controllable heating means therefor, and means responsive to the cooling of the thermally responsive device after it has been heated by the heating means for indicating the completion of a time period provided by said timing means.

24. In combination, an electrically heated toaster, and timing means for indicating the completion of successive operating time periods of the toaster, said timing means comprising a thermally responsive device arranged to pass through a

similar cycle during each operating time period and having a portion movable to a given position in response to a temperature increase and movable away from said position upon cooling, controllable means for heating said thermally responsive device and allowing the same to cool, and means responsive to the cooling movement of said thermally responsive device to indicate the completion of a time period.

25. In combination, a bread toaster provided with electrical bread heating elements, and timing means for indicating the completion of successive toasting intervals of the toaster, said timing means comprising a temperature responsive device having a portion thereof free to move in response to temperature changes, an electrical heater energizable with the toaster heating elements at the initiation of a toasting interval for heating said temperature responsive device and causing the movable portion thereof to move in a first direction, a switch for effectively deenergizing said electrical heater to allow cooling of the temperature responsive device and resultant movement in a reverse direction without deenergizing the toaster heating element, and means responsive to cooling movement of the temperature responsive device to indicate the completion of a toasting interval.

26. In a bread toaster, a toasting compartment for receiving slices of bread to be toasted, heat responsive means including a thermally responsive device that changes its position and returns responsive to heating and cooling of the heat responsive means, means for rapidly heating said heat responsive means at the beginning of the toasting period, thereby causing movement of said heat responsive device in one direction to terminate the heating of the latter, and means for terminating the toasting period responsive to movement of the heat responsive device in the opposite direction when it cools.

27. The combination with cooking means including a primary heater and associated holder for the article to be cooked, of a thermostatic timer for establishing intervals of time action of said primary heater, comprising a thermally responsive member, means for heating said thermally responsive member simultaneously with the heating of the primary heater, means operative as a result of subsequent heating and movement of said thermally responsive member in one direction for rendering the heater inoperative on the thermally responsive member, and means operative as a result of subsequent cooling and movement in the opposite direction of said thermally responsive member, for indicating the termination of the cooking interval, by an observable manipulation of the device.

28. In combination a bread toaster provided with electrical heating elements, timing means comprising a thermally responsive device having a portion movable in response to temperature changes, an electrical heater energizable with the toaster heating elements at the initiation of a toasting interval for heating said thermally responsive device and causing the movable portion thereof to move in a given direction, and a switch operable on temperature rise of said thermally responsive device for effectively deenergizing said electrical heater thereby allowing the movable portion of the thermally responsive device to move in a reverse direction, and means responsive to such reverse movement of the thermally responsive device upon cooling for effectively deenergizing the toast heating elements and indi-

cating the completion of a toasting interval, said bread toaster being adapted to be operated in rapid succession and said timing means determining the timing intervals for successive toasting operations.

29. In a timer, a thermally actuable member secured at one end and having the other end free to move, means for moving and returning said free end by heating and cooling said member, and adjusting means for shifting up and down the temperature range to which the movement and return of said free end of said member is responsive.

30. In a cooking device having food-heating means, timing means for establishing intervals of the cooking action including a thermally responsive member, a heater operative on said member only until the latter has reached a predetermined high temperature, and means for interrupting the cooking action by said food-heating means in response to cooling of said thermally responsive member, said thermally responsive member being permitted to cool after said predetermined high temperature is reached and said food-heating means being operative during the cooling of said member.

31. In a cooking device of the type adapted to be used in carrying out a plurality of successive cooking actions, a timer for establishing intervals of the cooking action including a thermally responsive member, a heater for heating said member thereby to cause movement thereof, means for instituting operation of said heater upon institution of a cooking interval, and means responsive to heating movement of said thermally responsive device for rendering said heater inoperative thereby to permit the thermally responsive member to cool; and means responsive to cooling movement of said thermally responsive member after said heater is rendered inoperative for interrupting the cooking action of said device.

32. In a cooking device of the type adapted to be used in carrying out a plurality of successive cooking actions, a timer for establishing intervals of the cooking action including a longitudinally expandable and contractable non-warping thermally responsive member, a heater for heating said member thereby to cause movement thereof, means for instituting operation of said heater upon institution of a cooking interval, and means responsive to heating movement of said thermally responsive device for rendering said heater inoperative thereby to permit the thermally responsive member to cool; and means responsive to cooling movement of said thermally responsive member after said heater is rendered inoperative for interrupting the cooking action of said device.

33. In a bread toaster adapted to be used in carrying out a plurality of successive toasting operations and having a main electrical toast heating element energized only during toasting operations, a timer for establishing intervals of the toasting action including a thermally responsive member, an electrical heater for heating said member thereby to cause movement thereof, means for energizing said heater upon institution of a toasting interval, and means responsive to heating movement of said thermally responsive device for rendering said heater inoperative thereby to permit the thermally responsive member to cool; means for energizing said main heating element substantially simultaneously with energization of said heater, and means

responsive to cooling movement of said thermally responsive member after said heater is rendered inoperative for deenergizing said main heating element, said thermally responsive member being so constructed, arranged and positioned that the sum of the heat-up and cool-off intervals of the timer is substantially equal to the time required by said main toast heating element to toast a bread slice to the desired degree in any of successive toasting operations.

34. In a bread toaster, a toasting compartment, a thermally responsive device, means for terminating the toasting of a bread slice in said toaster responsive to movement and return of said thermally responsive device by heating and cooling the same.

35. The combination with an electric toaster having a main heating element, a bread slice support movable reciprocally into toasting and non-toasting positions relatively to said heating element and biased to non-toasting position, and

means for holding said support in its toasting position, of a thermally responsive element, and releasing means for said holding means prepared for operation by the thermally responsive element by heating thereof to a predetermined temperature and operated by the thermally responsive element to effect release of said holding means by cooling thereof to a lower substantially predetermined temperature to cause return of said support to non-toasting position.

36. In combination, heat treating apparatus comprising a source of heat, and a carrier for the article to be heat treated, a heat responsive element, an electrical heater for said element, a circuit for said heater closed concurrently with the movement of said carrier to operative position adjacent said heat source and opened responsive to heating of said element, and means for moving said carrier away from the heat source responsive to the cooling of said element.

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