Feb. 7, 1956 H. N. BLISS 2,733,764

TIMER

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FIG. 1

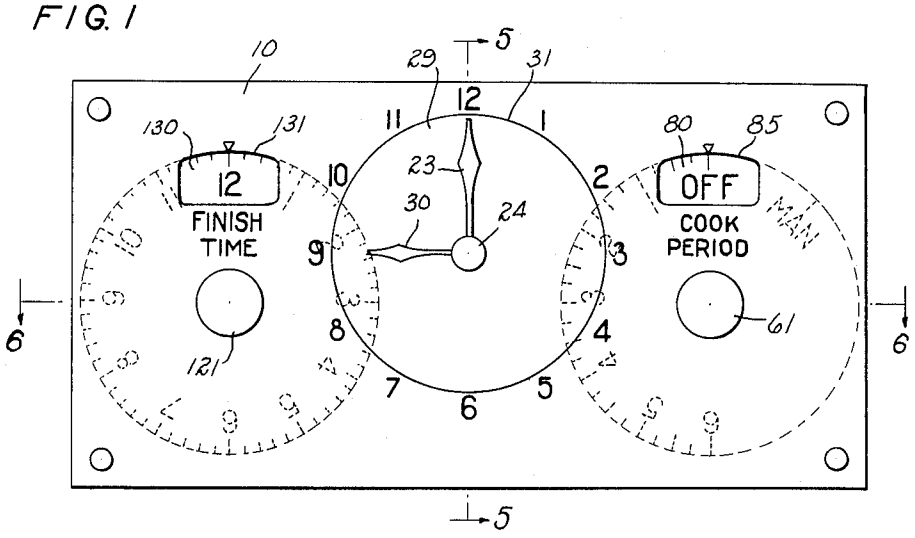


FIG. 2

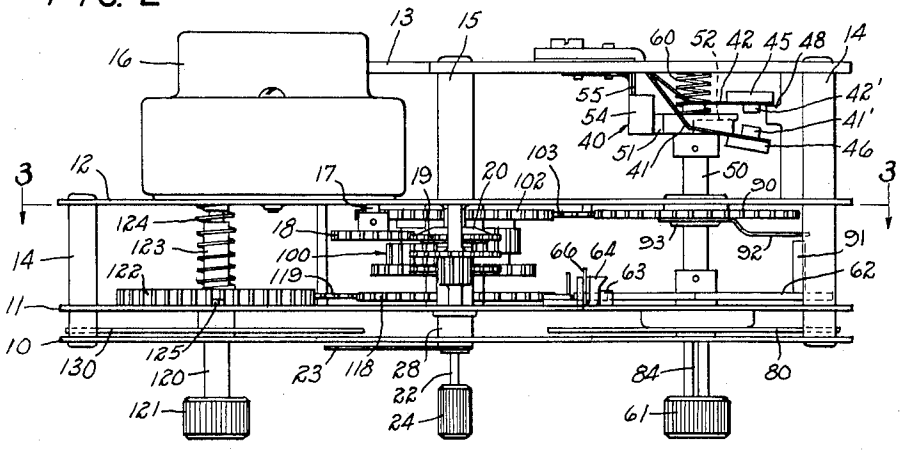
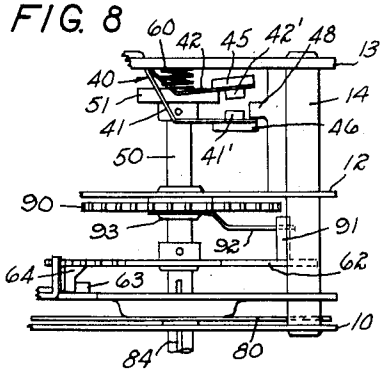


FIG. 8



INVENTOR.
HARVEY N. BLISS
BY

Lindsey and Prutzman
ATTORNEYS

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FIG. 3

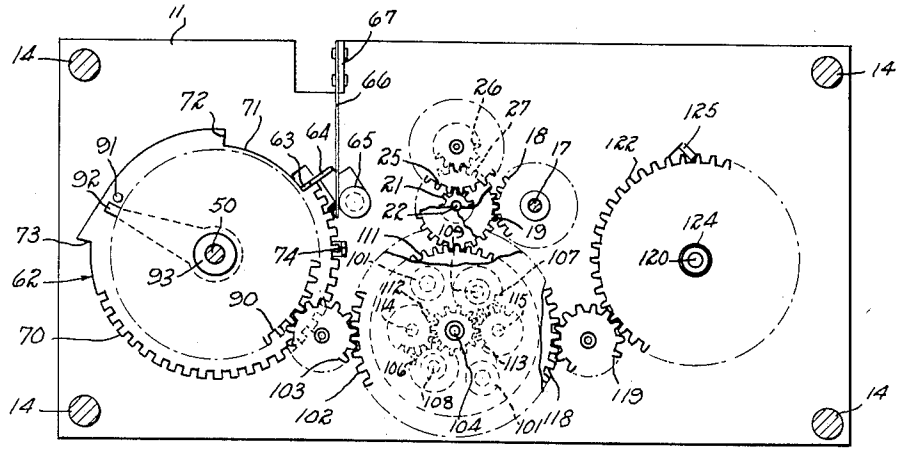


FIG. 4

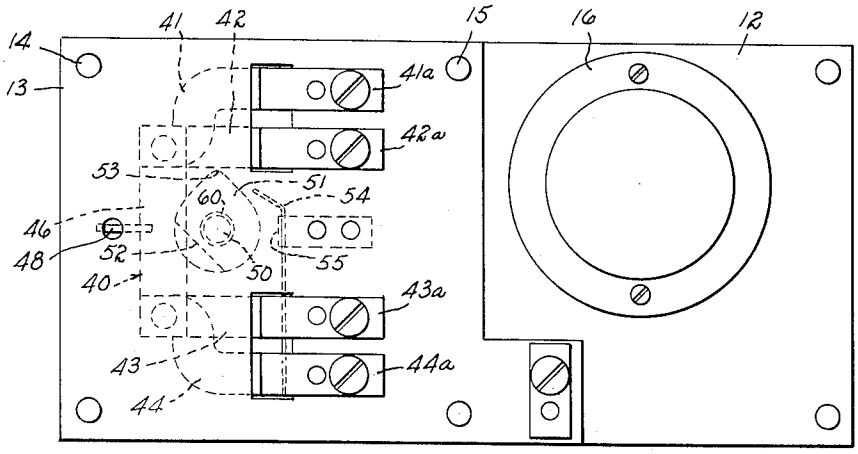
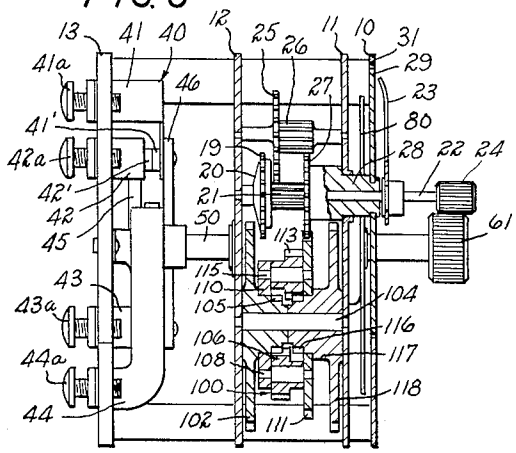


FIG. 5



INVENTOR.
HARVEY N. BLISS

BY

Lindsey and Prutzman
ATTORNEYS

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TIMER

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FIG. 6

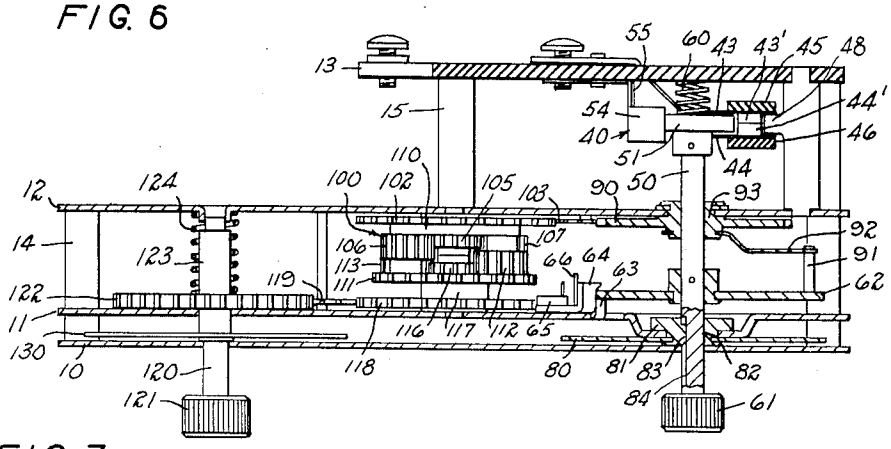
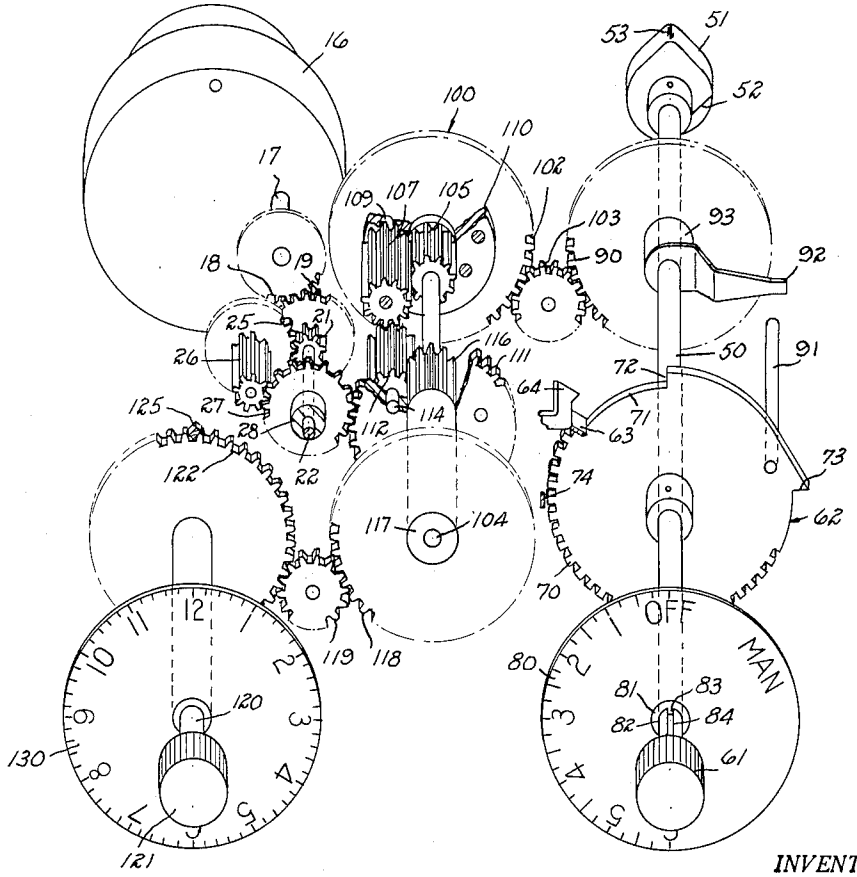


FIG. 7



INVENTOR.
HARVEY N. BLISS
BY
Lindsey and Prutzman
ATTORNEYS

United States Patent Office

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Patented Feb. 7, 1956

2,733,764

TIMER

Harvey N. Bliss, Windsor, Conn., assignor to Veeder-Root, Incorporated, Hartford, Conn., a corporation of Connecticut

Application May 1, 1952, Serial No. 285,360

24 Claims. (Cl. 161—1)

The present invention relates generally to timers and more particularly to timers for performing a plurality of actuating movements in timed sequence, the time intervals between movements being selective over a desired range.

The timer of the present invention is particularly useful for performing a plurality of switching operations at selected time intervals, and as such, has particular utility as a range timer of the type employed with electric kitchen ranges. For simplicity of presentation the invention will be described in detail as embodied in a range timer, although it will be appreciated that the invention is not limited to such use and that it will have a wide range of applications generally both in the commercial and in the household fields.

A general object of the invention is to provide a timer which will have a plurality of setting means arranged so that the occurrence of a first actuating movement can be set to take place at a selected time relative to clock time and the occurrence of a second actuating movement can be set to take place at a selected time interval after the first actuating movement, the two setting means being settable individually with respect to a fixed reference point and therefore not required to be set by reference to each other. In a range timer, for example, this means that separate controls may be employed for independent setting to select the cook period and finish time desired for the operation of the range.

Another object of the invention is to provide a timer of the character referred to in which the operation is always synchronized with the clock mechanism embodied therein and accurate and dependable timing is assured. Included in the object is the aim of providing independent setting elements which, however, cannot be inadvertently set for time periods which are mutually incompatible.

A further object is to provide a timer which will indicate in a clear and readable understandable manner the exact condition of the timer at any given instant and which is so arranged that it will be clearly evident to the operator whether or not the timer has been properly conditionsd to accomplish the result desired by the operator.

A more specific object of the invention is to provide a timer having the above described functions which is of simple and efficient design and construction so that it may be economically fabricated and assembled for production at a price competitive with conventional timers.

Another specific object is to provide such a timer which will be simple and easy to set, which will be foolproof in operation, and which will function effectively and reliably over long periods of time without requiring repair or adjustment.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction

hereafter set forth and the scope of the application of which will be indicated in the appended claims.

In the drawings:

Fig. 1 is a front view of a range timer embodying the present invention;

Fig. 2 is a top view of the timer;

Fig. 3 is a cross-sectional view taken along the line 3—3 of Fig. 2 and looking in the direction of the arrows;

Fig. 4 is a rear view of the timer;

Fig. 5 is a cross-sectional view taken along the line 5—5 of Fig. 1 and looking in the direction of the arrows;

Fig. 6 is a cross-sectional view taken along the line 6—6 of Fig. 1 and looking in the direction of the arrows;

Fig. 7 is an exploded perspective view of the operating parts; and

Fig. 8 is a fragmentary view similar to Fig. 2 showing the switch and control elements in the "set" position.

Referring to the range timer shown in the drawings, the same is mounted in a frame consisting of a front plate **10**, intermediate plate **11**, center plate **12**, and a partial rear plate **13**. The plates are held in spaced apart, parallel relationship by spacer posts **14** extending rearwardly from adjacent the corners of the front plate and by the additional spacer posts **15** extending between the rear plate **13** and the center plate **12**.

Mounted on the rear face of the center plate **12** and to one side of the back plate **13** is a conventional electrically driven clock motor **16**. The clock motor **16** has an off-center drive shaft **17** which extends through an opening in the plate **12**, the shaft **17** being provided on its outer end with a driving gear **18**. The driving gear **18** is in mesh with a driven gear **19** which is connected by a friction clutch **20** to a pinion **21** which is mounted on and fixed to a minute hand shaft **22**. The shaft **22** is journaled in the center plate **12** and extends forwardly through openings in the plates **11** and **10** so as to project outwardly from the face of the front plate **10**. Fixed to the forward end of the minute hand shaft **22** is a conventional minute hand **23** and a setting knob **24** by means of which the clock setting may be adjusted (turning of the shaft **23** independently of movement of the clock **16** being permitted by the slip clutch **20**). The pinion **21** previously referred to meshes with a gear **25** which is fixed to a pinion **26** which in turn meshes with a gear **27** provided with an enlarged hub **28** in which the forward end of the minute hand shaft **22** is journaled, the hub **28** being journaled in plate **11**. The gearing just referred to will be recognized as conventional gearing whereby the relative rotative speeds of a minute hand and hour hand are attained. Mounted on the forward end of the hub **28** is a dial **29** on which is painted the representation of an hour hand indicated at **30**. The dial **29** seats within the periphery of a large circular opening **31** in the front plate **10** and is disposed just behind the minute hand **23**. The front plate **10** has painted or inscribed thereon about the periphery of the opening **31** the numbers 1 through 12, inclusive, to facilitate the reading of time indicated by the hands **23** and **30**.

In the specific embodiment of the invention shown in the drawings, the timer is constructed and arranged to operate a switch mechanism indicated generally at **40** and which may be connected by suitable electrical conduits (not shown) to the oven heating elements of the range with which the time is associated. The switch mechanism **40** comprises four flexible contact arms denoted at **41**, **42**, **43**, and **44** carrying contact points **41'**, **42'**, **43'**, and **44'**, respectively. The ends of the contact arms opposite from the contact points are secured to the rear plate **13** which is formed of insulating material and are

provided with terminal plates 41*a*, 42*a*, 43*a*, and 44*a*, respectively, by means of connections which may be made to the oven heating elements. The flexible contact arms 42 and 43 are adapted to be flexed in unison and are provided with an interconnecting bridge 45 formed of a strip of insulating material. The contact arms 41 and 44 likewise are adapted to be flexed in unison and for this purpose are interconnected by an insulating strip 46. The arrangement is such that the contact points 42' and 43' are situated in the same vertical plane adjacent the rear plate 13, while the contact points 41' and 44' are disposed respectively in horizontal alignment therewith but in a vertical plane forwardly of the contact points 42' and 43'. The circuit to the oven heating elements is closed whenever contact is established between the contact points 41' and 44' and the contact points 41' and 43', respectively. The circuit may be opened or interrupted by movement of either pair of contacts away from the other pair.

The means for operating the contact arms comprises a shaft 50 which is mounted for rotatable and axially slidable movement and extending at right angles between the upper and lower switch contacts. The shaft 50 has fixed thereto a cam 51 which is disposed between the insulating connecting strips 45 and 46. In the rearmost axial position of the shaft 50, hereinafter referred to as the "set" position and which is illustrated in Fig. 8 of the drawings, the cam 51 pushes the contact arms 42 and 43 rearwardly to open the range circuit. When the shaft 50 is moved forwardly from the "set" position it reaches an intermediary position, hereinafter referred to as the "running" position which is best illustrated in Fig. 6 of the drawings and in which position the pairs of contacts are permitted to close, thus closing the oven circuit. When the shaft 50 is moved forwardly for an additional distance, it reaches a forward position, hereinafter referred to as the "off" position wherein the cam 51 moves the contact arms 41 and 44 forwardly to break the oven circuit. A stop 48 projecting between the sets of contact points provides sufficient clearance for the points to close, but serves to hold either pair of contact points when the other is moved away, thus insuring the desired separating action of the contacts.

As best shown in Figs. 2 and 7 of the drawings, the cam 51 has an indented portion 52 which is provided for the purpose of permitting the contacts to close when the shaft 50, and hence the cam 51, is rotated while in the forward position from "off" to the so-called "manual" position. The "manual" position is employed when the operator does not wish to employ the timer and desires to operate the range manually by use of the usual oven switches provided for this purpose. The cam 51 also has a nose or high point 53 which is adapted to engage under a switch contact member 54 and break the connection between that contact and a second contact member 55 when the shaft 50 is rotated to place the indented portion 52 between the main circuit contacts permitting them to close. The contact members 54 and 55 may be connected in series with a signal light (not shown) to visibly indicate when the timer is in any position other than the so-called "manual" position.

The shaft 50 is urged in an axial direction forwardly of the frame by means of a spring 60 disposed between the cam 51 and the rear plate 13. The shaft 50 may be manually moved rearwardly against the bias of spring 60 by means of a knob 61 disposed on the forward end of the shaft 50. When the shaft 50 is pushed inwardly by the operator and released, its axial position is controlled by a disk 62 fixed to the shaft 50 and which cooperates with a pair of detents 63 and 64, the detent 63 being struck up from the intermediate plate 11 or otherwise fixed thereto and the detent 64 being pivotally mounted at 65 on the plate 11. The detent 64 is biased against the detent 63 by means of a spring 66 which is fastened at one end to an inturned ear 67 on the plate 11.

The disk 62 is of a particular configuration and comprises a gear segment portion 70, an elongated notch 71, and a shoulder portion 72 having a radial stop edge 73. When the shaft 50 is moved inwardly and turned in a clockwise direction to place the shaft in the set position, the nose of spring 66 will engage in one of the notches of the gear segment 70, thus functioning as a detent and aiding in positioning the disk 62 so that when it is released one of the teeth of the gear segment portion 70 of disk 62 will rest on the rear edge of the pivotal detent 64, thus retaining the shaft 50 in the set position. As soon as any rotary movement is imparted to the disk 62, however, the succeeding notch in the gear segment 70 will come into registry with the pivotal detent 64 and permit the disk 62 to slip off detent 64 and move forwardly to a position resting on the fixed detent 63. The fixed detent 63 extends farther inwardly radially of the disk 62 and the notches in segment portion 70 are not deep enough to clear the same. In this condition, the shaft 50 is in running position and the main contacts are closed. Finally, when the disk 62 is rotated sufficiently to bring the elongated and deeper notch 71 in registry with the fixed detent 63, then the disk 62 is permitted to move forwardly the additional amount required to move the shaft 50 to the off position. The notch 71 is elongated so that when the shaft is in the off position, it may be rotated by means of the knob 61 to the manual position which, as previously described, permits the main contacts to close, thus conditioning the range for manual operation.

Positioned between the front plate 10 and the intermediate plate 11 is an indicating disk 80 which is fixed to a hub or bushing 81 which is rotatably journaled in the intermediate plate 11. The hub or bushing 81 has an axial bore 82 which serves as a journal for the front end of the shaft 50. The hub or bushing 81 is provided with an inner lug 83 which is positioned in a longitudinal groove 84 in the shaft 50. By reason of this construction, the shaft 50 may be moved axially without changing the position of the indicating disk 80 but any rotation of shaft 50 will be accompanied by rotation of disk 80. The indicating disk 80 is provided with indicia which can be viewed through a window 85 in the front plate 10, this indicia in the specific embodiment consisting of the abbreviation "man" to indicate the manual position, the word "off" to indicate the off position, and the numerals 1 through6, inclusive, as well as divisional marks indicating the rotated position of the shaft away from the "off" position. As will be described more particularly hereinafter, the numerals 1 to 6 indicate the "cook period," i. e. the period between the automatic closing and opening of the main circuit under the control of the timer. If desired, the indicia "cook period" may be printed or inscribed on the front plate 10 beneath the window 85.

Extending rearwardly from the disk 62 and normal to the plane thereof is a pin 91. When the shaft 50 is in either the "set" or "running" position, the disk 62 and hence the shaft 50 is adapted to be rotated in a clockwise direction by the engagement with pin 91 of a finger 92 fixed to the hub 93 of a gear 90. The gear 90 and finger 92 fixed thereto are freely rotatable with respect to the shaft 50. The hub 93 is journaled in plate 12 and is retained against axial movement thereby and in turn forms a support for shaft 50. A driving connection is provided between the gear 90 and the disk 62 when the gear 90 and disk 62 are in such relatively rotated positions that the finger 92 engages against the pin 91.

The gear 90 is adapted to be driven through a differential indicated generally at 100 which in connected in turn to the clock drive previously referred to and manual setting means for selecting the desired "finish time," i. e. the time at which the cooking operation is to be terminated by the timer. The "finish time" setting means, which will be described more fully hereinafter, includes a shaft 120 journaled in the plates 10, 11 and 12 and

having a setting knob 121 at its outer end for manipulation by the operator. As will be apparent from the following description, the differential can be driven either by the clock motor, the clock setting means or the finish time setting means to determine the position of finger 92.

The differential 100 includes a driven gear 102 which through idler gear 103 rotates the gear 90 on the shaft 50 previously referred to. The driven gear 102 is rotatably mounted on a shaft 104 and has fixed thereto a pinion 105 which also is freely rotatable on the shaft 104. The shaft 104 is journaled in the intermediate plates 11 and 12 below the clock drive mechanism. The pinion 105 is in mesh with planetary gears 106 and 107 which are supported by trunnions 108 and 109. Trunnions 108 and 109 are journaled at one end in the disk 110 which is freely rotatable on the hub of the gear 102 and at their other ends in the gear 111 which also is freely rotatable on the shaft 104. Planetary gears 106 and 107 in turn mesh with planetary gears 112 and 113 which are supported on trunnions 114 and 115, similarly journaled in the disk 110 and gear 111. The disk 110 and gear 111 are interconnected by posts 101 to form a conventional differential cage. The gear 111 is in mesh with the gear 27 of the hour hand drive of the clock drive mechanism previously referred to. The planetary pinions 112 and 113 are also meshed with a pinion 116 formed on the hub 117 of a gear 118 which is rotatably mounted on the shaft 104. Gear 118 is adapted to be driven through the idler gear 119 by the gear 122 which is fixed to the shaft 120.

As previously mentioned, the shaft 120 is journaled in the front plate 10 and center plate 12, and the journal is such that both axial and rotational movement of shaft 120 is permitted. The shaft 120 has an intermediate enlarged portion 123 forming shoulders which by engagement with the inside surfaces of the front plate 10 and plate 12 limit axial movement of the shaft. The shaft is urged forwardly and outwardly by means of a spring 124 extending about the shaft between the intermediate plate 12 and the gear 122. When the shaft 120 is in the forward or outward position the gear 122 will engage a fixed detent 125 on the intermediate plate 11 which positions the gear and prevents it from turning. However, when the shaft 120 is thrust inwardly by the operator by inward pressure on the knob 121 the gear 122 is released from the detent 125 permitting the shaft 120 to be turned. The gear 122 is a wide gear so that it will remain in mesh with the idler gear 119 regardless of the axial position of the shaft 120. Fixed to the forward end of the enlarged portion 123 of the shaft 120 and disposed between the front plate 10 and intermediate plate 11 is an indicator disk 130 having the indicia 1 through 12, inclusive, for indicating the rotated position of the shaft 120 and gear 122. The indicia on the indicator 130 may be viewed through a window 131 in the front plate 10 and will indicate the time at which the timer will move to the "off" position thus completing the cook period and terminating the cooking operation as will be described more particularly hereinafter. As illustrated in the drawings, the indicia "finish time" may be placed on the front plate 10 beneath the window 131.

It is believed that the operation of the timer will be apparent from the foregoing description together with the following explanation. When the housewife or other operator desires to utilize the timer she will manipulate the knobs 61 and 121 to place the indicia in windows 85 and 131 indicating the desired cook period and finish time and also to place the shaft 50 in set position. Either knob 61 or knob 121 may be manipulated first, since these controls are entirely independent. In order to set the finish time by manipulation of the knob 121, the operator will thrust in the shaft 120 to free the gear 122 from the detent 125 and then will rotate the shaft 120 until the selected indicia is displayed in the window 131. During the turning of the shaft 120 the gear 122 through idler gear 119 will rotate the gear 118 and hence the pinion 116. The pinion 116 in turn will rotate the planetary pinions 112 and 113 which rotate the planetary pinions 106 and 107. The gear 111 on which the shafts for the planetary pinions are mounted may be assumed to be stationary during this operation. Planetary pinions 106 and 107 in turn drive the pinion 105 fixed to the driven gear 102, which through idler gear 103, will rotate the gear 90 on the shaft 50.

The rotated position of the gear 90 and hence the pickup arm 92 fixed thereto will also be determined by the clock time, since the gear 27 of the hour hand drive meshes with the gear 111 of the differential. The gear 111 carries the planetary pinion shafts and thus as gear 111 is rotated, the planetary pinions 112 and 113 will be rotated since they are in mesh with stationary pinion 116. Planetary pinions 112 and 113 in turn rotate planetary pinions 106 and 107 which cause rotation of the pinion 105 fixed to the gear 102.

It will be apparent that the arrangement is such that the rotated position of the gear 90 and hence the pickup finger 92 is dependent on the algebraic sum of the clock time and the finish time. In other words, the gear 90 is driven in a counterclockwise direction, as viewed in Fig. 7 of the drawings, by the running of the clock motor but is turned in a clockwise direction by the counterclockwise turning of the shaft 120. If the shaft 120 is turned in a clockwise direction by the operator to set an earlier "finish time," then the gear 90 is rotated in a counterclockwise direction. When the timer is assembled, the gears are meshed so that when the shaft 50 is in the "off" position shown in Fig. 7 of the drawings and the clock time and the finish time are the same the pickup finger 92 is in engagement with the pin 91. Thereafter, the position of the pickup finger will always be fixed by the relationship of clock time and finish time being advanced counterclockwise by advancement of the clock and being advanced further counterclockwise in proportionate amounts by advance of the finish time.

In setting the cook time, the operator will push in on the knob 61 which will move the shaft 50 inwardly to cause the main contacts to be opened, this position being shown in Fig. 8 of the drawings. If by any chance the pivoted detent 64 should be in the way of one of the teeth of the disk 62 during this operation, it will merely be cammed out of the way and will not interfere with the axial movement of the shaft 50 and disk 62. The operator may then turn the knob 61 to select any cook period desired which will be indicated by the numeral on the indicating disk 80 appearing at the window 85. A maximum cook period of six hours is provided and rotational movement of the shaft beyond the six hour figure will be prevented by engagement of the stop edge 73 with the stop 74 on the intermediate plate 11. When the operator releases the knob 61, after selecting the desired cook period, the shaft 50 will be retained in the set position by engagement of one of the teeth of the disk 62 on the edge of the pivoted detent 64. The spring 66 by engagement with the notches of disk 62 is sufficient to ensure that the disk 62 will be set in a rotated position so that one of the teeth will engage on the detent. As will be apparent, as soon as the pin 91 is engaged by the finger 92, the disk 62 will be rotated to cause the tooth engaging on the pivoted detent 64 to slide off permitting the shaft 50 to come forwardly until the disk 62 rests on the fixed detent 63. This, as previously described, is the so-called running position of the timer during which the switch contacts are closed and beginning the cooking operation. The time at which the pickup finger 92 engages on the pin 91 will be determined, of course, by how far the pin 91 has been moved toward the pickup finger 92, which in turn is determined by the amount of selected cook period. As the length of cook period is increased, the pin 91 is moved in a clockwise direction, as viewed in Fig. 7, and as the selected cook period is decreased in amount, the pin 91 will be moved

in counterclockwise direction. It is, therefore, apparent that the relative radial positions of the pickup arm **92** and pin **91** will be determined by the difference between clock time and finish time, less the cook time. For example, if the clock time is 9 o'clock and it is desired to finish the cook period at 12 o'clock as indicated by the dial **130**, then it is intended that the pickup finger **92** will, by engagement with the pin **91**, drive the disk **62** to the position shown in Fig. 7 of the drawings when 12 o'clock arrives. The finger **92** will be located 90° away from this position because of the 3 hour difference between clock time and finish time. When setting the "cook period," the pin **91** is advanced clockwise ahead of finish position (Fig. 7), however, by a distance equal to the desired cook period. Therefore, if a cook period of 1 hour is desired, the pin is moved clockwise 30°, for 2 hours the movement would be 60°, and for 3 hours, the movement would be 90°. In the case of a 3 hour cook period with the clock time and finish time settings referred to, of course, the pin would be brought into contact with finger **92** and the cook period would be set to commence immediately. It is impossible for the operator to select more cook time than is available by the setting of the finish time because of the engagement of pin **91** with finger **92**. Conversely, if the cook period is set first and then a finish time is selected which is not sufficiently in advance of clock time to include the selected cook time, the cook time setting will be changed by engagement of the finger **92** with pin **91**.

When the disk **62** has been advanced to the position shown in Fig. 7 of the drawings, then the gear segment portion of the disk rides off the fixed detent **63** by reason of the long notch **71** which permits the shaft **50** to move forwardly to the off position under the influence of spring **60**, thus causing the switch contacts to be opened. In this position, the pin **91** no longer extends into the plane of rotation of finger **92** so that there can be no interference therebetween. During the rotation of disk **62** during the cooking operation, the indicator disk **80** also will be rotated, thus progressively showing the decrease of the remaining cooking period.

With the shaft **50** in the off position, the operator may then turn the dial to the manual position, this being permitted by the elongated notch **71** in the disk **62**, whereupon the indented portion **52** of cam **51** will permit the main contacts to again close rendering the range oven suitable for manual operation. At the same time the cam **51** will open the switch contact members **54** and **55** which, as previously explained, may be used to operate a signal light.

It thus will be seen that there has been provided in accordance with the invention a timer which is fully automatic and foolproof in operation, which can be set in a simple and easy manner, and which will accurately and dependably perform timed actuating movements at the intervals selected.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense, the limitations of the invention being defined in the scope of the appended claims.

I claim as my invention:

1. In a timer, a rotatable driven element, first setting means for setting the driven element in selected rotated positions away from a predetermined initial rotated position, a rotatable driving element having means for engaging the driven element in relatively rotated positions of the elements and for returning the driven element to initial rotated position therewith when the driving element is rotated in one direction, a clock mechanism, a driving connection between the clock mechanism and the driving element including a differential for rotating the driving element in said one direction, second setting means connected to said differential for varying the setting of the driving element relative to the clock mechanism, and means for disengaging the driving and driven elements when the driven element is in said predetermined initial position.

2. In a timer, a driving element, a plurality of setting means, differential gearing interconnecting said driving element and one of said setting means, a clock motor, a frictional connection between said motor and said differential, locking means for the other of said setting means, a driven element movable relative to said driving element and adapted to be engaged by the driving element in predetermined relative settings of the elements, and the other of said setting means connected to the driven element for rotating the same independently of said driving element.

3. In a timer, a driven element, a driving element movable relative to said driven element and adapted to engage the driven element and drive it to a predetermined initial position, first manually operable setting means for moving said driven element away from said predetermined initial position independently of said driving element, indicating means for indicating the setting of the driven element, a clock mechanism, a driving connection between the clock mechanism and driving element including a differential, indicating means for indicating the setting of the clock, second manually operable setting means connected to the differential for varying the position of the driving element relative to the clock setting, and indicating means for indicating the position of the last named setting means.

4. In a timer, a driven element, a driving element movable relative to said driven element and adapted to engage the driven element and drive it to a predetermined initial position, first manually operable setting means for moving said driven element away from said predetermined initial position independently of said driving element, a clock mechanism, a continuous driving connection between the clock mechanism and driving element including a differential, time indicating means driven by the clock, second manually operable setting means connected to the differential for varying the position of the driving element relative to the clock setting, and time indicating means connected to said last named setting means, said driving element being in the said initial position when the time indicating means of the clock mechanism and the time indicating means of the last named setting means are synchronized and being moved away from said initial position in proportion to the difference between the indications of said time indicating means.

5. In a range timer, a rotatable driving element, a clock motor, clock time indicating means, a frictional drive between the clock motor and the clock time indicating means, first setting means for setting the clock time indicating means, second setting means having finish time indicating means, a differential continuously interconnecting the clock time indicating means and finish time indicating means with the driving element whereby the position of the driving element is responsive to clock time minus finish time, a driven element rotatable relative to said driving element adapted to be engaged by the driving element at predetermined relatively rotated positions thereof, and third setting means for positioning the driven element independently of the driving element responsive to desired cooking time.

6. In a timer, a rotatable driven element, setting means for setting the driven element in selected rotated positions away from a predetermined initial rotated position, indicating means for indicating the setting of the driven element, a driving element rotatable independently of said driven element and having means for engaging the driven element in relatively rotated positions of the elements and for returning the driven element therewith to initial

rotated position when the driving element is rotated in one direction, a clock mechanism, a continuous driving connection between the clock mechanism and the driving element including a differential for rotating the driving element in said one direction, time indicating means for indicating the setting of the clock, rotatable setting means connected to said differential for varying the setting of the driving element relative to the clock mechanism, and time indicating means associated with the last named setting means for indicating the rotated position thereof, said driving element being in said initial rotated position when the time indicating means of the clock mechanism is synchronized with the time indicating means of the setting means and being moved in a direction opposite from said one direction when the last named time indicating means is advanced relative to clock time.

7. In a timer, a rotatable driven element, setting means including a rotatable shaft for setting the driven element in selected rotated positions away from a predetermined initial rotated position, indicating means operatively connected to the shaft for indicating the setting of the driven element away from initial rotated position, a driving element rotatable independently of said driven element and having means for engaging the driven element in relatively rotated positions of the elements and for returning the driven element therewith to initial rotated position when the driving element is rotated in one direction, a clock mechanism having time indicating means, a continuous driving connection between the clock mechanism and the driving element including a differential for rotating the driving element in said one direction during the normal operation of the clock, setting means including a rotatable shaft connected to said differential for varying the setting of the driving element relative to the clock mechanism, and time indicating means operatively connected to the last named shaft which is advanced as the driving element is moved in a direction opposite from said one direction upon rotation of the last named shaft, said driving element being positioned in said predetermined initial rotated position when the time indicating means are synchronized.

8. In a range timer, a frame, differential gearing disposed centrally of the frame comprising a plurality of sun gears, planetary pinions in mesh with the sun gears and rotatable supporting means for the pinions, said sun gears and rotatable supporting means being coaxially mounted, first setting means disposed on one side of the differential including a shaft parallel to the axis of the sun gears and connected to the differential, second setting means disposed on the opposite side of the differential including a shaft parallel to the axis of the sun gears, a driving element rotatably mounted on the last named shaft and connected to the differential, a driven element fixed to the last named shaft and rotatable therewith, a clock motor supported on the frame, and a drive shaft on said motor extending parallel to the axis of the sun gears and connected to the differential.

9. In a timer, a rotatable driven element, a driving element rotatable relative to said driven element and adapted to engage the driven element in relatively rotated positions thereof and drive the driven element to a predetermined initial position, setting means for rotating said driven element independently of said driving element away from said predetermined initial rotated position, a clock mechanism, second setting means, a differential connecting the clock mechanism and said second setting means to the driving element, a switch, and means responsive to the rotated position of the driven element for actuating the switch.

10. In a timer, a rotatable driven element, a driving element rotatable relative to said driven element and adapted to engage the driven element in relatively rotated positions thereof and drive the driven element to a predetermined initial position, setting means for rotating said driven element independently of said driving element away from said predetermined initial rotated position, a clock mechanism, second setting means, a differential connecting the clock mechanism and said second setting means to the driving element, a switch, releasable means for closing and opening the switch in sequence, and means for releasing the releasable means for limited movement upon initial movement of the driven element and for further releasing the releasable means when the driven element is in initial rotated position.

11. In a timer, a rotatable driven element, a driving element rotatable relative to said driven element adapted to engage the driven element in relatively rotated positions thereof and return the driven element to a predetermined initial rotated position, setting means for rotating said driven element independently of said driving element away from said predetermined initial rotated position, a clock mechanism, a driving connection between the clock mechanism and driving element including a differential, setting means connected to the differential for changing the position of the driving element relative to the clock setting, a switch, and switch control means operatively connected to the driven element, and means responsive to movement of the switch control means for closing the switch upon initial movement of the driven element and for opening the switch when the driven element is in initial rotated position.

12. In a timer, a rotatable driven element, a driving element rotatable relative to said driven element and adapted to engage the driven element in predetermined relatively rotated positions of the elements and for driving the driven element therewith to an initial rotated position, setting means for rotating said driven element independently of said driving element away from said predetermined initial rotated position, indicating means for indicating the setting of the driven element, a clock mechanism, a driving connection between the clock mechanism and driving element including a differential, indicating means for indicating the setting of the clock, manually operable setting means connected to the differential for varying the position of the driving element relative to the clock setting, indicating means for indicating the position of the last named setting means, a switch, switch actuating means, and means operatively connected to the driven element for releasing the switch actuating means in stepwise fashion.

13. In a timer, a rotatable and longitudinally movable shaft, switch means responsive to the longitudinal position of the shaft, manually operable means for moving said shaft longitudinally in one direction to an initial longitudinal position, means biasing the shaft in the opposite direction, means for releasing the shaft responsive to rotation of the shaft, a driven element fixed to the shaft for rotation therewith, a rotatable driving element adapted to engage the driven element in relatively rotated positions thereof, a clock mechanism, setting means, and a differential connecting the clock mechanism and the setting means to the driving element.

14. In a timer, a rotatable and longitudinally movable shaft, switch means responsive to longitudinal position of the shaft, means biasing the shaft in one longitudinal direction, a control member fixed to the shaft comprising a disk having a series of spaced apart notches in its periphery followed by a deeper notch, a first stop member engageable with the side of the disk but arranged to release the disk when the disk is rotated to align one of said series of notches with the stop member, a second stop member spaced in said one longitudinal direction from the first stop member engageable with the side of the disk but arranged to release the disk when the disk is rotated to align the deeper notch therewith, manually operable means for moving the shaft longitudinally to a position with the control disk resting on the first stop member, a driven element fixed to the shaft, a driving element adapted to engage the driven element in rela-

tively rotated positions of the elements, a clock mechanism for driving the driving element, and means for varying the rotated position of the driving element relative to the clock setting.

15. In a timer, a rotatable and longitudinally movable shaft, switch means responsive to longitudinal position of the shaft, means biasing the shaft in one longitudinal direction, a control member fixed to the shaft comprising a disk having a series of spaced apart notches in its periphery followed by a deeper notch, a first stop member engageable with the side of the disk but arranged to release the disk when the disk is rotated to align one of said series of notches with the stop member, a second stop member spaced in said one longitudinal direction from the first stop member engageable with the side of the disk but arranged to release the disk when the disk is rotated to align the deeper notch therewith, manually operable means for moving the shaft longitudinally to a position with the control disk resting on the first stop member, a driven element fixed to the shaft, a driving element adapted to engage the driven element in relatively rotated positions of the elements, a clock mechanism, means interconnecting the clock mechanism and driving element including a differential, and setting means connected to the differential for varying the position of the driving element relative to the clock mechanism.

16. In a timer, a rotatable and longitudinally movable shaft, means biasing the shaft in one longitudinal direction, a control member fixed to the shaft, a first stop cooperating with the control member for retaining the control member in a first longitudinal position of the shaft and releasable upon rotation of the control member, a second stop longitudinally spaced from the first stop for retaining the control member in a second longitudinal position of the shaft and for releasing the shaft for movement to a third longitudinal position upon rotation of the control member to a predetermined rotated position, a pair of normally closed switch contact arms extending generally transversely of the shaft, an actuating member fixed to the shaft and extending between the arms whereby the switch is opened when the shaft is in said first and third positions and closed when the shaft is in said second position, a driven element fixed to the shaft for movement therewith, manually operable means for moving the shaft to said first position and for rotating the shaft away from the said predetermined rotated position, a driving member adapted to engage and rotate the driven member to initial rotated position therewith, a clock mechanism operatively connected to the driving element, and means for varying the position of the driving element relative to the clock mechanism.

17. In a timer, a rotatable and longitudinally movable shaft, means biasing the shaft in one longitudinal direction, a control member fixed to the shaft, a first stop cooperating with the control member for retaining the control member in a first longitudinal position of the shaft and releaseable upon rotation of the control member, a second stop longitudinally spaced from the first stop for retaining the control member in a second longitudinal position of the shaft and for releasing the shaft for movement to a third longitudinal position upon rotation of the control member to a predetermined rotated position, a pair of normally closed switch contact arms extending generally transversely of the shaft, an insulated disk secured to the shaft and extending between the arms whereby the switch is opened when the shaft is in said first and third positions and closed when the shaft is in said second position, said insulated disk being notched to permit closing of the switch upon rotation of the shaft and disk to predetermined rotated position while the shaft is in the said third longitudinal position, a driven element fixed to the shaft for moving therewith, manually operable means for moving the shaft to said first position and for rotating the shaft away from the said predetermined rotated position, a driving member adapted to engage and rotate the driven member to initial rotated position therewith, a clock mechanism operatively connected to the driving element, and means for varying the position of the driving element relative to the clock mechanism.

18. In a timer, a rotatable and longitudinally movable shaft, means biasing the shaft for longitudinal movement in one direction, a control member fixed to the shaft comprising a generally circular disk having a series of notches of predetermined depth in its periphery and a deeper notch adjacent said series of notches, a stop member engageable with one side of said disk between the notches to retain the disk and shaft against longitudinal movement in said one direction but releasing the disk and shaft when the stop is in registry with one of the notches, a second stop spaced in a longitudinal direction from the first stop to retain the disk and shaft against further longitudinal movement except when the second stop is in registry with the deeper notch, setting means for moving the shaft against the biasing means to a position with the disk resting on the first stop, a switch, means operatively connected to the shaft for closing the switch when the shaft is in longitudinal position with the disk resting on the second stop and for opening the switch when the shaft is in the longitudinal position with the disk resting on the first stop and after release by the second stop, a driven element connected to the shaft for rotation with the shaft, a co-axially mounted driving element engageable with the driven element when brought into predetermined angular relationship therewith, means for driving and setting the driving element comprising a clock, manually operable setting means, and a differential connecting the clock and setting means to the driving element.

19. In a timer, a rotatable and longitudinally movable shaft, means biasing the shaft for longitudinal movement in one direction, a control member fixed to the shaft comprising a generally circular disk having a series of notches of predetermined depth in its periphery and a deeper notch adjacent said series of notches, a stop member engageable with one side of said disk between the notches to retain the disk and shaft against longitudinal movement in said one direction but releasing the disk and shaft when the stop is in registry with one of the notches, a second stop spaced in a longitudinal direction from the first stop to retain the disk and shaft against further longitudinal movement except when the second stop is in registry with the deeper notch, setting means for moving the shaft against the biasing means to a position with the disk resting on the first stop, indicating means connected to the shaft for indicating the rotated distance of the deeper notch from the second stop, a switch, means operatively connected to the shaft for closing the switch when the shaft is in the longitudinal position with the disk resting on the second stop and opening the switch when the shaft is in the longitudinal position with the disk resting on the first stop and after release by the second stop, a driven element connected to the shaft for rotation with the shaft, a co-axially mounted driving element engageable with the driven element when brought into predetermined angular relationship therewith, a clock mechanism, a differential interconnecting the clock mechanism and driving element, time indicating means connected to the clock mechanism, manually operable setting means connected to the differential for varying the setting of the driving element relative to the clock setting, and time indicating means connected to the last named setting means, the last named time indicating means and the time indicating means of the clock mechanism being synchronized when the driving element is in engaging position with respect to the driven element and the deeper notch of the control disk is in registry with the second stop.

20. In a timer, a driven element, a driving element movable relative to the driven element and adapted to

engage the driven element and drive it to a predetermined initial position, setting means for moving said driven element independently of said driving element away from said predetermined initial position, a clock mechanism, second setting means, and a differential continuously connecting the clock mechanism and said second setting means to the driving element.

21. In a timer, a rotatable driven element, a driving element rotatable relative to the driven element and adapted to engage the driven element in relatively rotated positions thereof and drive the driven element to a predetermined initial rotated position, setting means for rotating said driven element independently of said driving element away from said initial rotated position, a clock mechanism, second setting means, and a differential continuously connecting the clock mechanism and said second setting means to the driving element.

22. In a timer, a driving element, a driven element movable relative to the driving element and adapted to be engaged by the driving element in predetermined relative settings of the elements, a first setting means connected to the driven element for positioning the same independently of the driving element, a second setting means, and differential gearing interconnecting said driving element and said second setting means.

23. In a timer, a driving element, a driven element movable relative to the driving element and adapted to be engaged by the driving element in predetermined relative settings of the elements, a first setting means connected to the driven element for positioning the same independently of the driving element, a second setting means, differential gearing interconnecting said driving element and said second setting means, a switch, and means responsive to the position of the driven element for actuating the switch.

24. In a timer, a rotatable driven element, a driving element rotatable relative to said driven element and having means for engaging the driven element in relatively rotated positions of the elements and for driving the driven element to a predetermined initial rotated position therewith when the driving element is rotated in one direction, first setting means for setting the driven element independently of the driving element in selected rotated positions away from said predetermined initial rotated position, a differential having a pair of inputs and having an output connected to said driving element for rotating the driving element in said one direction, a clock mechanism continuously connected to one input of the differential, and second setting means connected to the other input of said differential for varying the setting of the driving element relative to the clock mechanism.

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