

May 21, 1940.

R. SARDESON

2,201,456

MECHANICAL TIMER FOR TOASTERS

Filed Aug. 19, 1937

3 Sheets-Sheet 1

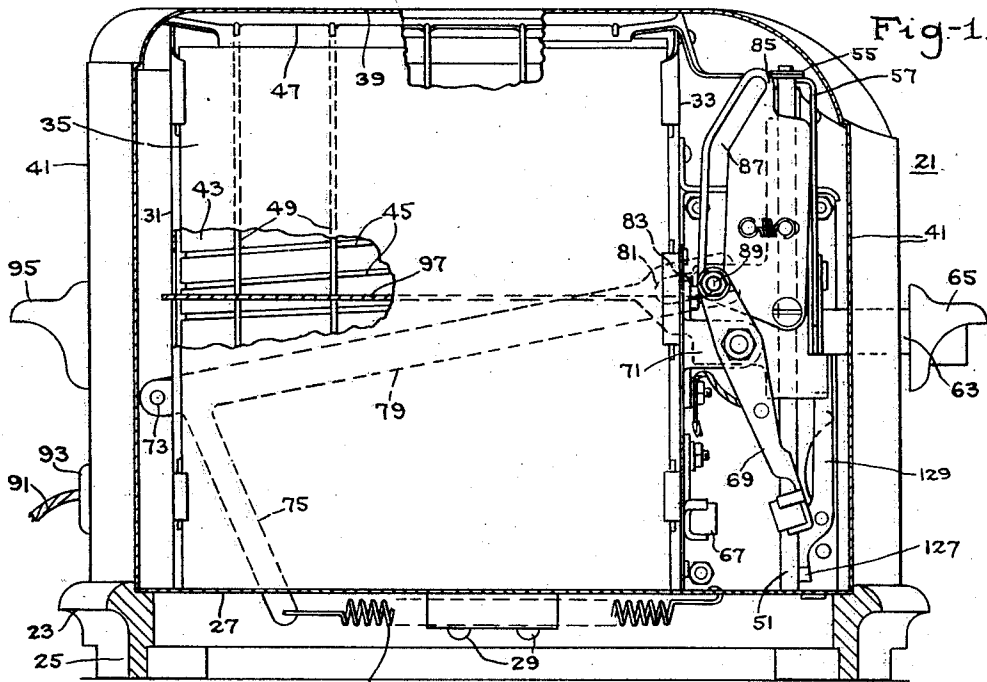
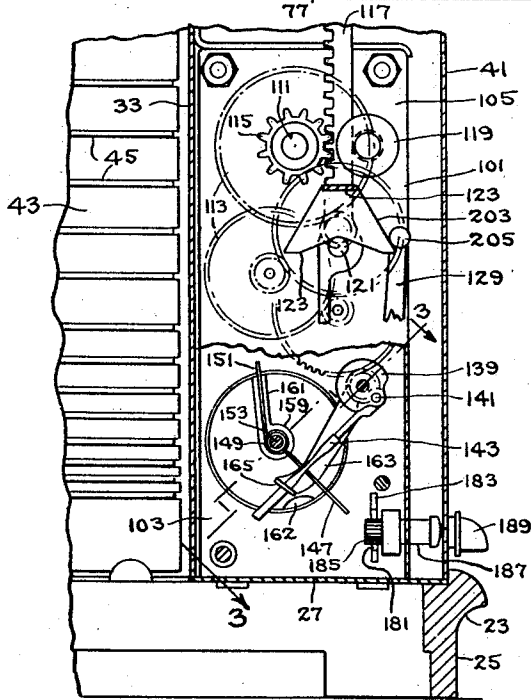


Fig-2

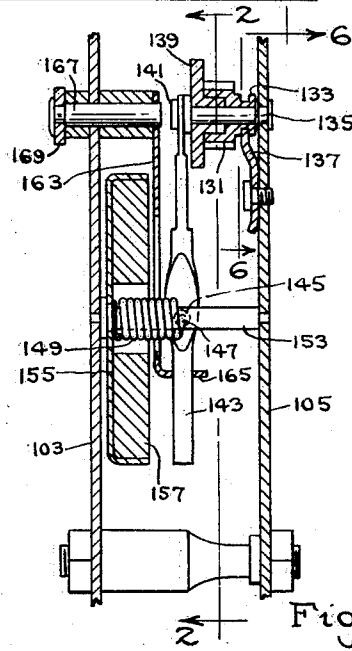


Fig-3

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3 Sheets-Sheet 2

Fig-4.

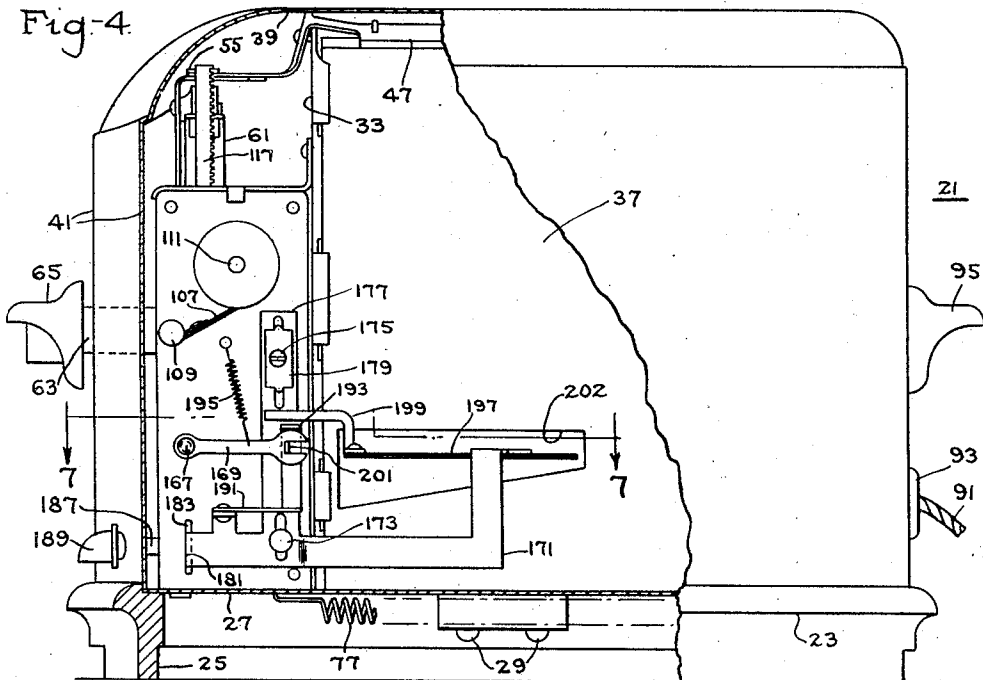
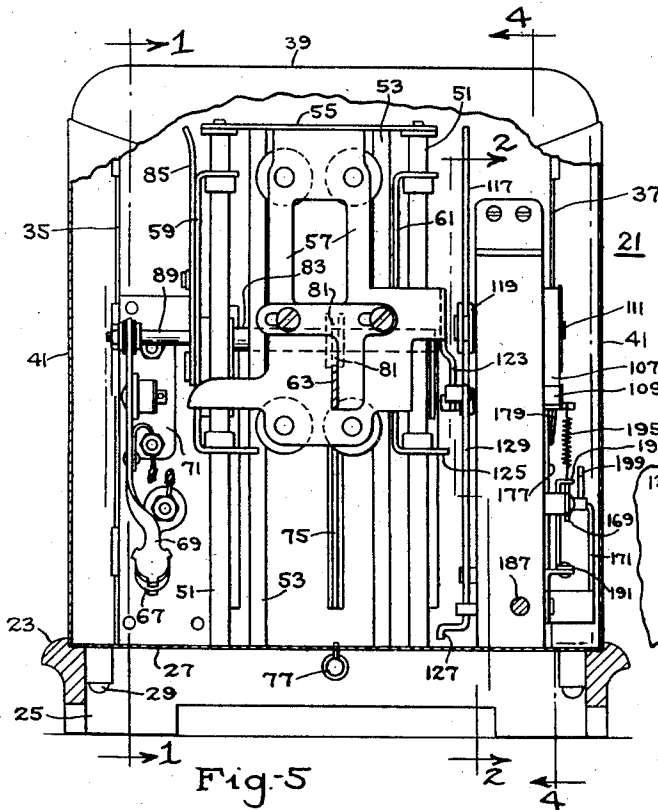


Fig-7.

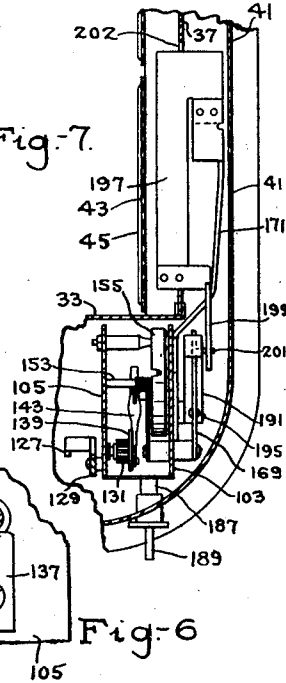


Fig-6

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3 Sheets-Sheet 3

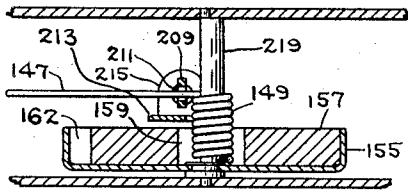


Fig. 8

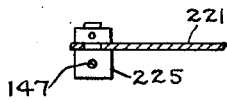


Fig. 12

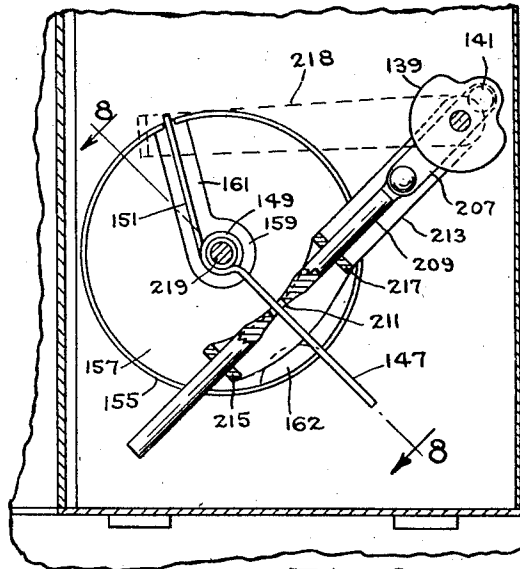


Fig. 9

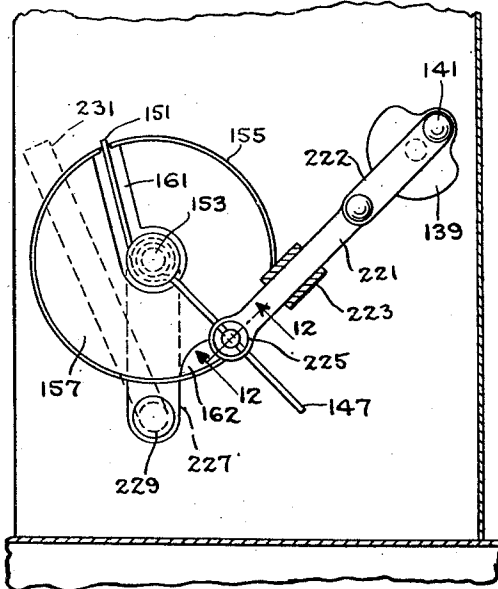


Fig. 10

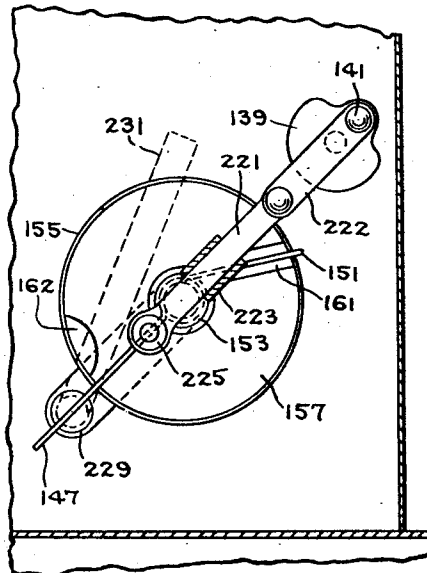


Fig. 11

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UNITED STATES PATENT OFFICE

2,201,456

MECHANICAL TIMER FOR TOASTERS

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Application August 19, 1937, Serial No. 159,880

17 Claims. (Cl. 161-16)

My invention relates to timing mechanisms and particularly to variable speed mechanical timers.

Among the objects of my invention are the following: To provide a relatively simple, quiet variable speed mechanical timer; to provide a mechanical timer having a wide variation in speed; to provide a variable speed timer embodying novel means to vary the speed of operation thereof; to provide a relatively simple and compact oscillator and oscillator actuating mechanism for a variable speed timer, and to provide a relatively simple and efficient variable speed timing mechanism operatively associated with an electric toaster cooperating therewith to vary the operating period of the toaster in accordance with temperature changes of the toaster.

Other objects of my invention will more fully appear from the following description and the accompanying drawings and will be pointed out in the claims.

In the drawings,

Figure 1 is a view in vertical longitudinal section through a toaster with which is associated a mechanical timer embodying my invention, the view being taken on the line 1-1 of Fig. 5,

Fig. 2 is a fragmentary sectional view thereof taken on the line 2-2 of Figs. 3 and 5,

Fig. 3 is a fragmentary sectional view taken on the line 3-3 of Fig. 2 and shown on an enlarged scale,

Fig. 4 is a view in vertical section, taken on the line 4-4 of Fig. 5,

Fig. 5 is a view in front elevation, with the front part of the outer casing broken away,

Fig. 6 is a fragmentary sectional view taken on the line 6-6 of Fig. 3,

Fig. 7 is a fragmentary view in horizontal section, taken on the line 7-7 of Fig. 4,

Fig. 8 is a fragmentary sectional view of a modified form of oscillator and oscillator actuating mechanism taken on the line 8-8 of Fig. 9,

Fig. 9 is a fragmentary view, partially in section and partially in side elevation of the parts shown in Fig. 8,

Fig. 10 is a fragmentary view partially in side elevation and partially in section of a still further modification of an oscillator and its associated actuating mechanism,

Fig. 11 is a view similar to Fig. 10 but showing parts thereof in another position, and,

Fig. 12 is a fragmentary view thereof taken on the line 12-12 of Fig. 10.

While the mechanical timer embodying my invention is of general application it has been de-

veloped particularly for use with a vertical oven-type toaster, although its use is not limited thereto.

A toaster designated in its entirety by the numeral 21 includes a skeleton base frame 23 which may be made of a suitable molded composition material having depending supporting members 25 thereof and a metal base plate 27, which latter may be secured to the frame 23 in any suitable or desired manner such means being shown as including a plurality of machine screws 29 (see Figs. 1 and 4). A toasting chamber structure is supported on the base plate 27 and includes a rear intermediate plate 31, a front intermediate plate 33. The bottom wall of the toasting chamber is constituted by the base plate 27 while the top wall thereof is constituted by a top or cover member 39 which constitutes a part of an outer enclosing casing having front, rear and side walls 41 adapted to be supported on the base plate or the frame 23. Side walls or baffle plates 35 and 37 are also provided within the side walls of the outer casing.

A plurality of substantially vertical extending heating elements 43 are provided, there being two such heating elements, spaced apart a suitable distance, for each bread slice to be toasted in a toaster of this kind and it is to be noted that a two-slice toaster has been shown although this is for illustrative purposes only. A resistor strip 45 is wound on suitable sheets of electric-insulating material, such as mica, for each heating element, in a manner well known in the art. The outermost sheets of mica constitute the side walls of the toasting chamber.

Top frame plates 47 cooperate with the front and rear intermediate walls to hold the top portions of the respective heating elements in their proper operative positions, guard wires 49 depending from the respective top frame plates to prevent direct engagement of the resistor 45 and a slice of bread being toasted.

An outer pair of vertically extending rods or standards 51 are located between the front wall of casing 41 and the front intermediate wall 33 in what may be called the mechanism chamber. A second pair of vertical standards 53 are provided intermediate the outer standards 51, the bottom end portions of the standards being held by base plate 27 while the top end portions may be held by forwardly extending parts of the frame plates 47 and by a crossbar 55.

A carriage 57 is vertically movable on the inner pair of standards 53 while sliders 59 and 61 are similarly movable on the outer pair of standards

51. Carriage 57 has a forwardly extending arm 63 secured thereon to receive an actuating knob 65, the arm 63 extending outwardly through a suitable slot in the front wall of casing 41.

5 A switch controlling the energization of the heating elements includes a fixed contact member 67 insulatedly mounted on the front intermediate wall 33 and a pivotally mounted switch arm 69 carried by a bracket 71 also insulatedly mounted on the front intermediate wall 33. Switch arm 69 is biased to open position by a bell crank lever pivotally supported at 73 on the rear intermediate wall 31 and including a short arm 75, the outer end of which is connected to one end of a biasing spring 77, the other end of which is connected to base plate 27. The bell crank lever includes also a longer arm 79 having a slotted front end portion 81. A crossbar 83 (see Fig. 5) is rigidly connected to the sliders 59 and 61 and this bar fits into the slot in the front end portion 81 whereby, when the carriage 57 bearing upon portions of the sliders is moved downwardly by an operator pressing on knob 65, arm 79 is moved in a clockwise direction to tension spring 77.

25 Slider 59 has secured thereto a plate 85 having an angularly extending slot 87 therein (see Fig. 1) while switch arm 69 has a pin 89 secured thereto at its upper end which pin moves in slot 87. As plate 85 is moved downwardly the effect will be to cause switch arm 69 to engage fixed contact member 67 thereby effecting energization of the heating elements. A twin conductor cord 91 electrically connected to the switch and the heating elements extends outwardly of the toaster assembly through the rear wall of outer casing 41 and preferably through a bushing 93 of electric insulating material. The rear wall of the casing 41 may be provided with a carrying or lifting knob 95 in a manner well known in the art.

40 Reference may here be made to Ireland Patent No. 2,001,362 as showing a toaster embodying substantially all of the features thus far described.

It is desired to provide a timing mechanism to control the operating period of a toaster of this kind, that is the length of time during which one or more slices of bread placed upon bread slice supports 97, which supports are secured to and movable with the sliders 59 and 61, are subjected to high temperature radiant heat from the heating elements after an operator has depressed knob 65 to a lower position, in which bread slice supports 97 are near the bottom of the toasting chamber with all of the respective slices of bread positioned within the toasting chamber and where the switch is in closed position. Since the length of time required to toast a slice of bread to a given desired degree varies with the temperature of the toaster, that is the operating period of the toaster is less when a toaster is hot than when it is cold, it is highly desirable to provide a variable speed timing mechanism which shall follow the variations of temperature of the toaster so that when a user has once adjusted the toaster to obtain the degree of toasting desired, no further manual control of the timing mechanism shall be necessary.

The duration of an operating period of a toaster of this kind has been found to vary between wide limits. Thus an operator may start with a cold toaster and may be receiving energy from a supply circuit of abnormally low voltage and the length of time required for satisfactorily toasting a slice of bread may be nearly four minutes. A toaster of this kind may be operated on abnormally high voltage until heated to its maximum operating temperature, when the operating period

may be fifty-five to sixty seconds to cause substantially the same degree of toasting of similar slices of bread. Thus a speed range of not less than four to one is necessary in a timing mechanism used with a toaster, to insure uniform toasting of slices of bread under all operating conditions.

I provide a timing mechanism designated generally by the numeral 101 which includes two side plates 103 and 105. The timer includes also a clock spring 107 having one end connected to a fixed post 109 on outer plate 103 while the inner end thereof is connected to a spring shaft or arbor 111 rotatably supported in the side plates 103 and 105. A train of gears designated generally by 113 in Fig. 2 of the drawings, is driven by the spring 107 after the spring has been wound up and is then permitted to unwind. In order to effect winding of the spring the spring shaft 111 has a spur pinion 115 thereon which meshes with a rack bar 117, a grooved roller 119 being provided to maintain rack bar 117 in mesh with pinion 115. The lower end of rack bar 117 is provided with a lateral lug 121, which lug is adapted to be engaged by a depending portion 123 constituting a part of or secured to carriage 57. When carriage 57 is moved downwardly as has already hereinbefore been described, member 123 engages lug 121 to thereby move rack bar 117 downwardly to wind up spring 107.

Slider 61 is further provided with a portion 125 at its lower end, which is adapted to move below a detent 127 of a latch arm 129 pivotally mounted on side plate 105 to thereby hold the switch in closed position and the bread slice supports in their toasting position.

Gear train 113 ends in a pinion 131 which pinion includes a grooved collar 133 (see Fig. 3) and which is removably mounted on a suitable stub shaft 135. A resilient bar 137 is secured to plate 105 and has its offset outer end fitting into the grooved collar 133 to hold the pinion in proper operative position substantially as shown in Fig. 3 of the drawings. A counterbalanced crank disk 139 is fixedly mounted in or on pinion 131 and carries a crank pin 141. This crank pin is adapted to be rotated in a given direction during the unwinding of spring 107 which occurs during an operating period of the toaster. The counterbalancing of the crank disk reduces the unbalance which would otherwise occur and makes for smoother operation and less wear of these parts.

A connecting rod 143 has one end thereof pivotally connected to crank pin 141 and is provided with an opening 145 intermediate its ends to receive the straight end 147 of a resilient connection, which connection includes in addition to the resilient arm 147 a helical coil 149 and a second straight and resilient end portion 151 thereby providing one major and two minor or auxiliary resilient connections between the connecting rod and the balance wheel. The helical coil portion 149 is positioned around a shaft 153 on which is fixedly mounted an oscillator comprising a cup shaped member 155 and a metal filling 157 therefor, there being a central recess 159 and a substantially radially extending recess 161 in the metal filling to receive respectively the helical part 159 and end portion 151 of the spring. The recesses 159 and 161 make it possible to use a relatively large number of turns in the coil 149 and still have a relatively short axial extension of the resilient connection beyond

one face of the oscillator. It is obvious that when pin 141 is rotated the connecting bar 143 will be moved substantially longitudinally of its length and thereby cause oscillating or reciprocal rotating movement of the oscillator or balance wheel.

It is obvious that an oscillator in the form of a balance wheel having the substantially radially extending slot 161 therein will be dynamically unbalanced and will operate unevenly at some one or several speeds of rotative movement. In order to correct this I remove some of the filling 157 at a point substantially diametrically opposite the slot 161 as indicated at 162 so that the balance wheel will have a constant predetermined inherent dynamic balance. A contributing factor is that the balance wheel itself comprises no relatively movable component parts of appreciable weight, the different relative positions of which might deleteriously affect the smooth and even operation of the balance wheel, by causing the balance wheel to have a variable dynamic unbalance.

It is further desired to shift the position of rod 143 on the spring end 147 as by moving it closer to shaft 153 or farther away therefrom and for this purpose I provide an adjusting member or bar 163 which is pivotally mounted coaxially with the axis of the crank disc, as shown clearly in Fig. 3 of the drawings. Member 163 is provided with a lateral extension 165 at its outer end, having an opening therethrough for receiving the outer end of rod 143 at a portion thereof slightly beyond member 147, in order to reduce to as great a degree as may be possible in the small dimensions available, variations in the distance of the connecting rod from the axis of shaft 153 during rotation of the crank pin. Member 163 may be pivotally supported on a pin 167 in plate 103 and the outer end of pin 167 may have secured thereto an adjusting arm 169 (see Fig. 4) whereby limited turning movement of member 163 may be effected by means hereinafter to be described. It is obvious that a connecting rod of this kind will not have a connection with the oscillator of constant length during any one revolution of the crank pin, but that the length of the effective lever arm of the transmitted force varies during each such revolution.

It is of course desirable, on the part of an operator, to vary the operating period of a timing mechanism and toaster of this kind not only to obtain light, medium and dark toast, but also to be able to properly toast different kinds of bread. For this purpose I provide a bracket 171 which has slidable movement relatively to the timing mechanism, being held against outer plate 103 by a pair of headed pins 173 and 175, which pins fit in elongated slots provided in a vertical portion 177 of bracket 171. A leaf spring 179 is held by pin 175 to tightly but movably clamp bracket 171 in its proper operative position against plate 103. The lower portion of bracket 171 has a part 181 extending into a slot 183 in plate 103, the inner edge thereof being provided with teeth to mesh with a pinion 185, which pinion is carried on a short rod or pin 187 extending outwardly through the front wall of casing 41 where it is provided with an actuating knob 189 which can be turned manually to thereby move bracket 171 upwardly or downwardly as desired. A member 191, of substantially

L-shape (see Fig. 4), is supported on bracket 171 and has an upper lateral extension 193 adapted to abut against the end portion of adjusting arm 169 which may be made of rounded shape as shown in Fig. 4 of the drawings. A spring 195 biases member 169 against projection 193.

Bracket 171 supports a bimetal element 197 which may be of the kind described and claimed in my co-pending application Serial No. 127,100, filed Feb. 23, 1937, and assigned to the same assignee as is the present application. The free end of bimetal element 197 carries an arm 199, the outer end of which is adapted to engage a laterally projecting lug 201 on member 169. The design and construction of bimetal element 197 is such that its free end flexes downwardly with increase in temperature whereby engagement between arm 199 and lug 201 is effected when bimetal 197 has reached a certain temperature, whereby turning movement of arm 169 is effected in a clockwise direction as seen in Fig. 4 of the drawings, and connecting rod 143 is moved away from the axis of shaft 153 to thereby reduce the braking effect of the oscillator on the timer and cause the timer to operate at a higher speed and thereby shorten the operating period of the toaster.

Figs. 4 and 7 show the location of the bimetal element 197 relatively to the toasting chamber and one of the heating elements 43. The bimetal element includes a long arm and a short arm, it being supported at the outer end of the short arm on a part of bracket 171. The long arm is located relatively close to the heating element, substantially at one side of the baffle plate 37 while the short arm is located outside of the baffle plate 37, which is provided with an opening 202 to receive the bimetal element. The long arm is thus subjected directly to high temperature radiant heat from a heating element 43 and is positioned adjacent to the toasting chamber as hereinbefore defined.

As rack bar 117 is moved upwardly during the running-down period of the timer, lug 121 causes upwardly movement of carriage 57 by reason of its engagement with member 123 which member has a cam surface 203, (see Fig. 2) which cam surface is adapted to engage a cam follower 205 on latch bar 129 at substantially the upper end thereof. When this engagement occurs latch arm 129 is turned in a clockwise direction as seen in Fig. 2 of the drawings and thereby releases portion 125 from detent 127 so that spring 77 may cause upward movement of the bread slice supports 97 and opening of the switch hereinbefore described.

It is obvious that the oscillator or balance wheel and its actuating mechanism as thus far disclosed and described is subject to a variable push or pull because of the fact that the angular position of rod 143 relative to the axis of shaft 153 varies during each revolution of the crank pin. While these variations have no harmful effects on the operation of the timer, it may be desirable to overcome this and I will now describe a modified form of balance wheel or oscillator and actuating mechanism therefor, which is not subject to this variation and reference may be had first to Figs. 8 and 9 of the drawings. I have there shown a crank pin 141 which may be driven in substantially the same manner as shown in Figs. 1 to 7 of the drawings and which has pivotally connected thereto a short rod 207 which is pivotally connected to a slidable rod 209 having an opening

211 therein intermediate its ends to receive straight end portion 147 of a spring connection of the same kind as has already been hereinbefore described. Rod 209 is supported and guided in a frame 213 having two bearing lugs 215 and 217 each with an opening therethrough to receive a part of rod 209. Frame 213 is pivotally supported at one of its ends coaxially with crank disc 139. An arm 218, which is the counterpart of arm 169 in Fig. 4 of the drawings, is suitably secured in fixed relation to frame 213 so that movement of arm 218 will cause swinging movement of frame 213 and a variation in the distance of rod 209 from the axis of the oscillator.

The shell 155 and its filling 157 may be mounted on a special form of shaft 219, which as shown in Fig. 8 of the drawings, has its end bearing portions offset relatively to the axis of the shaft so that it is possible to move rod 209 closer to the axis of turning movement of the balance wheel 155 than would be possible if the axis of the bearing portions were the same as the axis of the shaft. This means of course that a greater braking effect of the balance wheel or oscillator is obtainable than is possible with the structure shown in Figs. 2 and 3 of the drawings. Further, there is no variation in the distance between the rod 209 and the axis on which the oscillator turns during the rotation of the crank pin.

Referring now to Figs. 10, 11 and 12 of the drawings, I have there illustrated a still further modification in which a crank disc 139 having a crank pin 141 thereon actuates a slidable rod 221 through a short connecting rod 222, the rod 221 being caused to move parallel to its longitudinal axis by being mounted in a suitable bearing means 223, which may be fixedly supported by one of the side plates of the timing mechanism. A pin 225 is pivotally mounted on the outer end of rod 221 and has an opening therethrough to receive spring member 147, so that reciprocating movement of bar 221 may cause reciprocal turning movement of oscillator 155 in substantially the same manner as is effected by the other modification hereinbefore described.

The shaft 153 of balance wheel or oscillator 155 is pivotally supported as by one or more bars 227 pivotally mounted at 229 on a shaft which may be supported in one of the frame plates 183 and 185. The axis of the supporting shaft is longitudinally aligned with the axis of rod 221. An arm 231 is fixedly connected with the swinging support 227 whereby, upon turning movement in a clockwise direction as seen in Figs. 10 and 11 of the drawings, the axis of the shaft supporting the oscillator may be moved relative to the longitudinal axis of slidable bar 221. Thus Fig. 10 shows the parts of the oscillator in one operative position where a given amount of braking or retarding effect is obtained and Fig. 11 shows the parts where substantially no braking or retarding effect is obtained since slidable bar 221 moves on the straight end 147 longitudinally thereof without appreciable or any retarding effect. Arm 231 is equivalent to arm 169 of Fig. 4 of the drawings and may be adjusted both manually and thermally as was hereinbefore set forth in connection with arm 169.

Tests on a device of the kind illustrated in Figs. 1 to 7 have shown that it has a relatively high mechanical efficiency, is very quiet in operation, is easily adjusted for different speeds and has a wide range of operating speeds, and it is to be noted that at present I prefer this form of device because of its simplicity and lower cost. The

use of resiliently connected resilient arms provides one main and two auxiliary resilient elements or one major and two minor resilient elements in the balance wheel actuating means, these elements having different degrees of resiliency, whereby very quiet operation of the timer is obtained.

The device embodying my invention thus provides a relatively simple, compact and easily operable timer mechanism which has been found very effective for its intended purpose. It has for instance been found that a device of the kind shown particularly in Figs. 1 to 7 of the drawings is effective to vary the operating period of a toaster from approximately fifty seconds when the toaster has been operated for some time and has reached substantially its maximum operating temperature and is also effective to provide an operating period of almost four minutes in length starting at ordinary room temperature, thereby making possible a range of over four to one in speed or duration of operating period.

It is desired to here make of record certain pertinent prior art all of which was known to applicant and which has been considered in the claims as drawn up, to clearly define applicant's invention and to distinguish it therefrom. German Patent No. 58,196 discloses a mechanical timer having an escapement wheel and an anchor operated thereby, which anchor is mounted on a fixed pivot and has a longitudinal slotted outer arm. An oscillator in the form of a balance wheel has a pin projecting from one face thereof and fitting into the slot in the outer arm of the anchor. The balance wheel may be moved in a straight line relatively to the pivot shaft of the anchor to thereby vary the effective length of power arm of the anchor, the length of power arm of the oscillator remaining constant.

German Patent No. 432,323 discloses a device somewhat similar to that disclosed in German Patent No. 58,196, except that the fixedly mounted anchor has a pin projecting from one side thereof on its outer arm, which pin is adapted to fit into a radially-extending slot in a pivotally mounted oscillator. The oscillator may be moved relatively to the pivot pin of the anchor to thereby vary the length of power arm of the oscillator while the length of power arm of the anchor remains the same.

In contradistinction to these forms the preferred form of my device provides a connecting rod acting on a resilient member connected to a stationary balance wheel and movable on the resilient member to vary the effective length of lever arm of the resilient member. The device illustrated in Figs. 10 to 12 provides a rod reciprocally movable in a straight line and a pivotally mounted balance wheel actuable by the reciprocable rod through a resiliently connected resilient arm, the effective length of the resilient arm being variable. Both forms of my invention provide a resilient connection to the balance wheel having a plurality of resilient portions, of different degrees of resiliency.

Various modifications may be made in the device embodying my invention without departing from the spirit and scope thereof and I desire therefore that only such limitations shall be placed thereon as are imposed by the prior art or are set forth in the appended claims.

I claim as my invention:

1. In a mechanical timer for causing other mechanism to operate after a time interval, a power driven gear train, a crank pin connected

therewith and rotatable thereby, a connecting rod reciprocally actuable by said crank pin through a fixed distance in a direction substantially parallel to its longitudinal axis, a balance wheel, a shaft for supporting the balance wheel, a spring member connected with the balance wheel and including a substantially straight end portion having a movable and pivotal connection with the connecting rod to cause the balance wheel to be reciprocally angularly rotated by the substantially longitudinal movements of said rod and means for varying the distance between the axis of said balance wheel shaft and the longitudinal axis of said connecting rod.

2. In a mechanical timer adapted to cause other mechanism to operate after a time interval, a power driven gear train, a crank pin connected therewith and rotatable thereby, a connecting rod reciprocally actuable by said crank pin through a fixed distance in a direction substantially parallel to its longitudinal axis, a balance wheel, a rotatably mounted shaft supporting said balance wheel, a coil spring surrounding said shaft and having one end portion engaging the balance wheel and having its other end portion extending substantially radially outwardly of said shaft and having a slidable and pivotal connection with said connecting rod to cause the balance wheel to be reciprocally angularly rotated by said connecting rod and means for moving the connecting rod on said radially extending end portion to vary the distance between the axis of said balance wheel shaft and the longitudinal axis of said connecting rod.

3. In a mechanical timer for controlling the duration of an operating period of an automatic toaster including an electric toast heating element, a bread slice support movable into toasting and non-toasting positions relatively to said toast heating element and yieldingly biased to non-toasting position, means to move the bread support into toasting position and a detent for holding the bread support in toasting position, said timer comprising a spring driven means connected to act on said detent to cause release thereof after a time interval and a retarding means connected with said spring for delaying release of said detent and including a gear train, a crank disc driven by said gear train and having a crank pin thereon, a connecting rod reciprocally operable by said crank pin, a rotatably mounted balance wheel, an arm resiliently connected with said balance wheel and extending substantially radially of the axis of said balance wheel and slidably and pivotally connected with said connecting rod and means supported substantially coaxially with said crank disc for varying the point of engagement of said connecting rod with said arm to vary the rotative speed of said balance wheel.

4. In a mechanical timer for controlling the duration of an operating period of an automatic toaster including an electric toast heating element, a bread slice support movable into toasting and non-toasting positions relatively to said toast heating element and yieldingly biased to non-toasting position, means to move the bread support into toasting position and a detent for holding the bread support in toasting position, said timer comprising a spring driven means connected to act on said detent to cause release thereof after a time interval and a retarding means connected with said spring for delaying release of said detent and including a gear train, a crank disc driven by said gear train and having

a crank pin thereon; an elongated connecting rod reciprocally actuable by said crank pin, a rotatably mounted balance wheel, a coil spring substantially coaxial with said balance wheel and having one end portion connected with said balance wheel and having its other end portion extending outwardly of the axis of said balance wheel and slidably and pivotally connected with said connecting rod and thermally-controlled means pivotally supported substantially coaxially with said crank disc for varying the distance between the longitudinal axis of the connecting rod and the axis of the balance wheel and thereby the duration of said time interval.

5. A device as set forth in claim 4 in which the duration may be varied in substantially the ratio of four to one.

6. In a mechanical timer adapted for mounting on an automatic toaster including an electric toast heating element, a control switch therefor, a bread slice support movable into toasting and non-toasting positions relatively to the toast heating element, means to bias the switch to open position and the bread support to non-toasting position and means to move the bread support into toasting position and the switch into closed position, said timer including a detent for holding the bread slice support in toasting position and the control switch in closed position, a spring driven means connected to act on said detent to cause release thereof after a time interval and a retarding means connected with said spring for delaying release of said detent including a gear train, a crank disc driven by said gear train and having a crank pin thereon, a connecting rod reciprocally actuable by said crank pin through a fixed distance in a direction substantially parallel to its longitudinal axis, a balance wheel rotatably mounted with its axis at one side of the longitudinal axis of the connecting rod, a substantially radially-extending arm on the balance wheel resiliently connected therewith by a coil spring and having a slidable and pivotal connection with said connecting rod and means pivotally supported substantially coaxially with said crank disc and loosely slidably engaging and partially supporting said connecting rod for moving the same to vary its point of engagement with said arm and thereby vary the duration of said time interval.

7. In a mechanical timer adapted for mounting on an automatic toaster including an electric toast heating element, a control switch therefor, a bread slice support movable into toasting and non-toasting positions relatively to the toast heating element, means to move the bread support into toasting position and the switch into closed position and means to bias the switch to open position and the bread support to non-toasting position, said timer including a detent for holding the bread slice support in toasting position and the control switch in closed position, a spring driven means connected to act on said detent to cause release thereof after a time interval and a retarding means connected with said spring for delaying release of said detent including a gear train, a counterbalanced crank disc structure rotatable by said gear train and having a crank pin thereon, a connecting rod connected to and reciprocally actuable by said crank pin through a fixed distance in directions substantially parallel to its longitudinal axis, a balance wheel, a rotatably mounted shaft supporting the balance wheel, a coil spring loosely surrounding the balance wheel shaft and having

a resilient end portion engaging the balance wheel and having another resilient end portion extending substantially radially outwardly of said balance wheel shaft, said other end portion of the spring having a slidable and pivotal connection with said connecting rod and a thermally-controlled adjusting arm for moving said connecting rod on said other end portion of the spring, said adjusting arm having one end portion pivotally supported substantially coaxially with said crank disc and having its other end portion slidably engaging and supporting said connecting rod at a part thereof longitudinally beyond said other end portion of the spring, the radial distance of the point of engagement of the connecting rod with the end portion of the spring from the axis of the balance wheel varying during each revolution of the crank pin.

8. A timer as set forth in claim 7 in which the timer includes two side plates, one of said side plates supporting a stub shaft on which said crank disc structure is loosely rotatably mounted and in which said one side plate has mounted thereon a resilient member interfitting with said crank disc structure to hold it in its proper operative position on said stub shaft.

9. A timer as set forth in claim 7 in which the timer includes two spaced side plates, one of said side plates having fixedly mounted thereon a stub shaft for supporting said crank disc and the other of said side plates having mounted thereon said adjusting arm and the thermal control therefor.

10. In a mechanical timer adapted to cause other mechanism to operate after a time interval, a spring driven gear train, a crank disc rotatable by said gear train and having a crank pin thereon, a slidable bar, a connecting rod having one end connected to said crank pin and its other end connected to said slidable bar to cause reciprocal movements thereof along its longitudinal axis, a balance wheel, a rotatably-mounted balance wheel shaft on which said balance wheel is mounted, the axis of the balance wheel being parallel to and spaced from the axis of the shaft, a resilient arm, a coil spring connecting said resilient arm and said balance wheel, means providing a slidable and pivotal connection between said arm and said slidable bar and a swinging support for said slidable bar pivotally supported substantially coaxially with said crank disc for shifting said slidable bar on said resilient arm to vary the amount of retarding effect provided by said balance wheel and thereby vary the time interval.

11. A timer as set forth in claim 10 and including a thermally-controlled means acting on said swinging support to cause shifting of the slidable bar in accordance with changes in temperature of the thermally-controlled means.

12. A timer as set forth in claim 10 and including a thermally-controlled means supported solely by said timer and connected with said swinging support to move the same and the slidable bar to a greater distance from the axis of said balance wheel upon increase of temperature.

13. In a mechanical timer adapted to cause

other mechanism to operate after a time interval, a spring driven gear train, a crank disc rotatable by said gear train and having a crank pin thereon, a slidable bar, a connecting rod having one end connected to said crank pin and its other end connected to said slidable bar to cause reciprocal movements thereof along its longitudinal axis, a balance wheel, a balance wheel shaft on which said balance wheel is mounted, a resilient arm, a coil spring connecting said arm and said balance wheel, means constituting a slidable and pivotal connection between said arm and said slidable bar and a swingable support for said balance wheel shaft to effect movement thereof in an arcuate path to vary the distance between the longitudinal axis of the slidable bar and the axis of the balance wheel.

14. In a mechanical timer adapted for mounting on an automatic toaster including an electric toast heating element, a control switch therefor, a bread slice support movable into toasting and non-toasting positions relatively to said toast heating element, means biasing the switch to open position and the bread support to non-toasting position and means to move the switch to closed position and the bread support into toasting position, said timer including a detent for holding the bread slice support in toasting position and the control switch in closed position, a spring driven means connected to act on said detent to cause release thereof after a time interval and a retarding means connected with said spring for delaying release of said detent including a gear train, a crank disc rotatable by said gear train and having a crank pin thereon, a slidable bar, a connecting rod having one end connected to said crank pin and its other end to said slidable bar to cause reciprocal movements thereof along its longitudinal axis, a balance wheel, a balance wheel shaft on which said balance wheel is mounted, a resilient arm, a coil spring connecting said resilient arm and said balance wheel, means providing a slidable and pivotal connection between said arm and said slidable bar and a pivotally mounted swingable support for said balance wheel shaft for effecting movement thereof in an arcuate path relative to said slidable bar to vary the amount of retarding effect caused by said balance wheel and consequently the time interval.

15. A timer as set forth in claim 14 and including a thermally-controlled means acting on said swingable support to cause a decrease in the retarding effect with increase of temperature of the thermally-controlled means.

16. A device as set forth in claim 7 in which the degree of movement of the connecting rod on the other end portion of the spring is such as to result in a range of duration of time interval of four to one.

17. A device as set forth in claim 10 in which the degree of shifting of the slidable bar on the resilient arm is such as to vary the time interval substantially four to one.

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