Sept. 9, 1947. A. B. POOLE 2,427,159

INTERVAL-TIMER

Filed Aug. 29, 1945 3 Sheets-Sheet 1

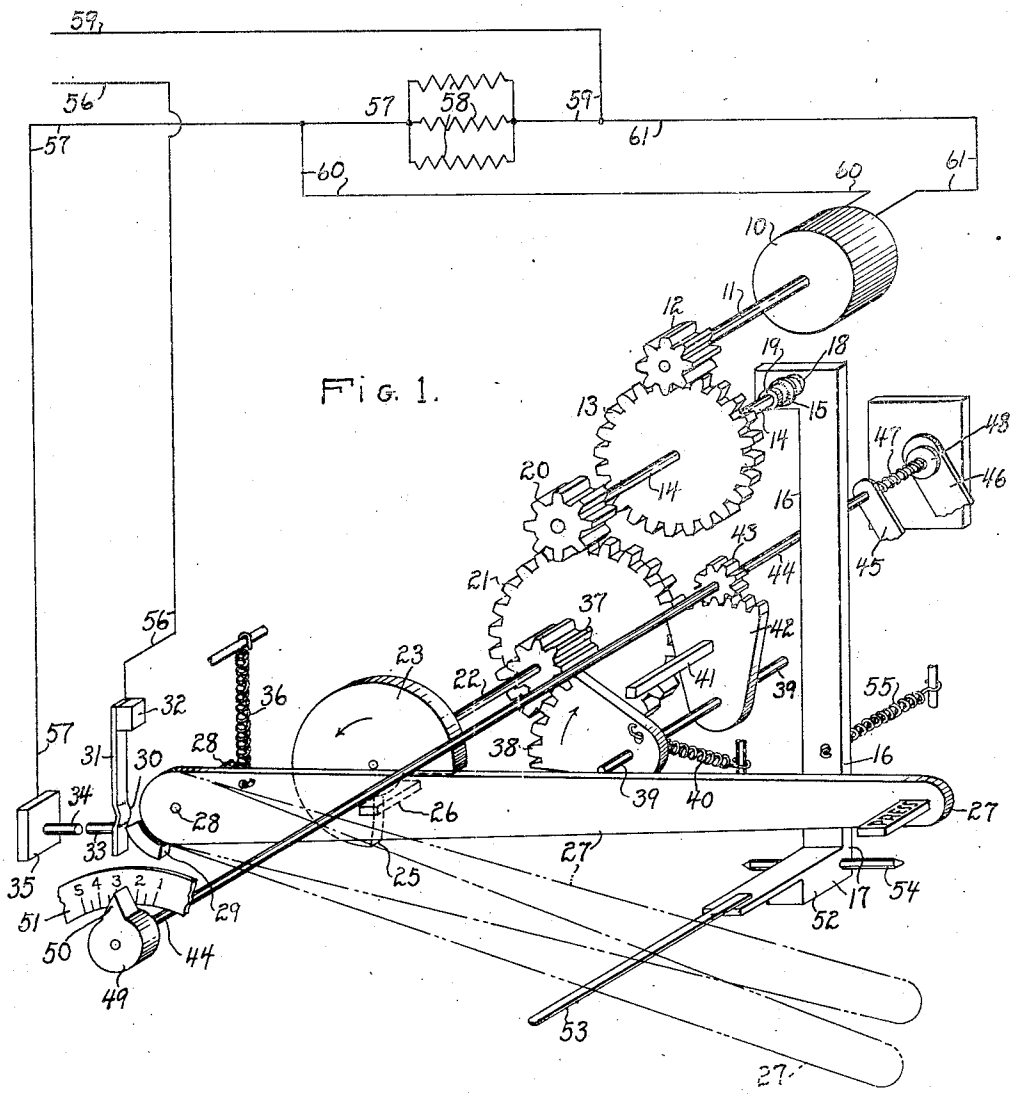


Fig. 1.

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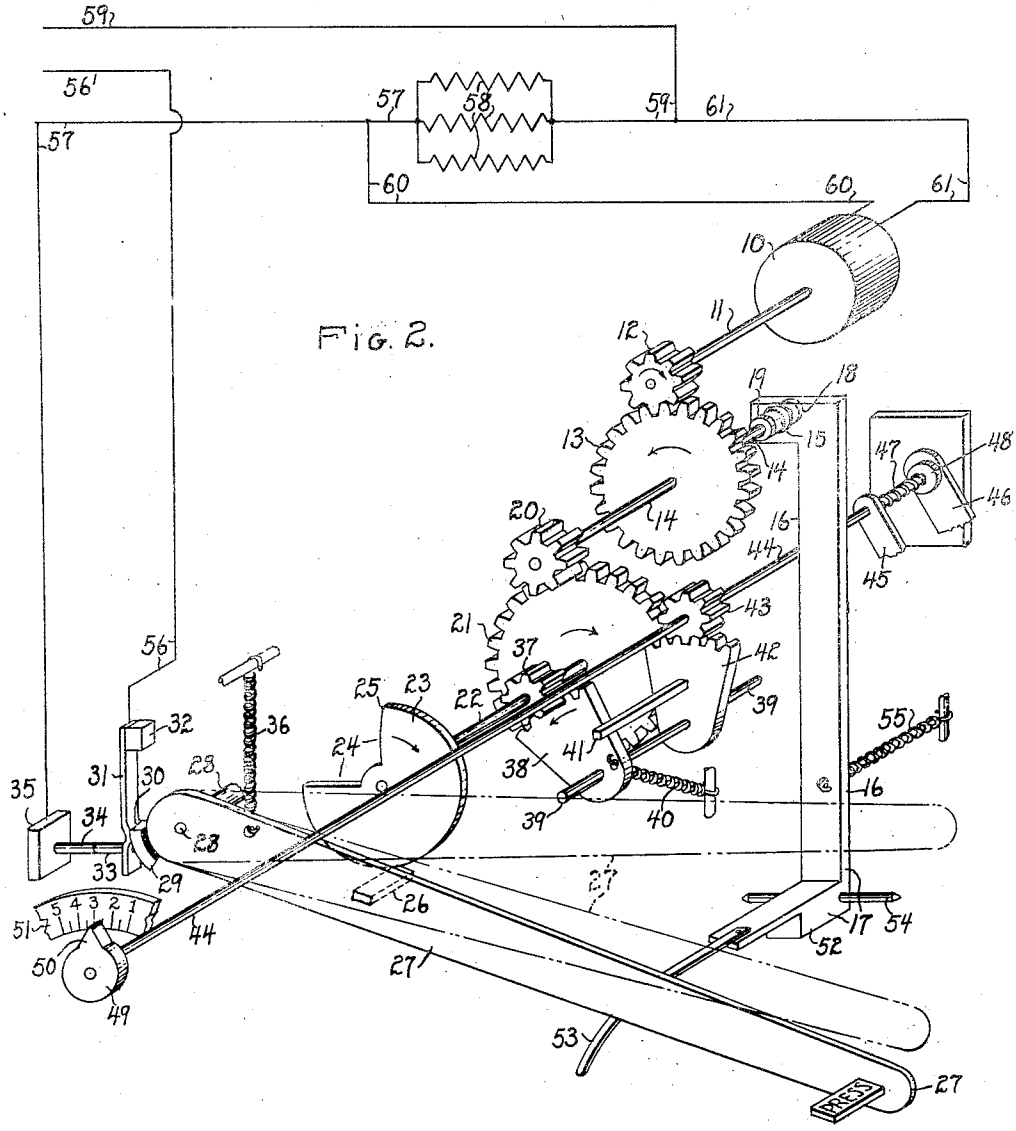


Fig. 2.

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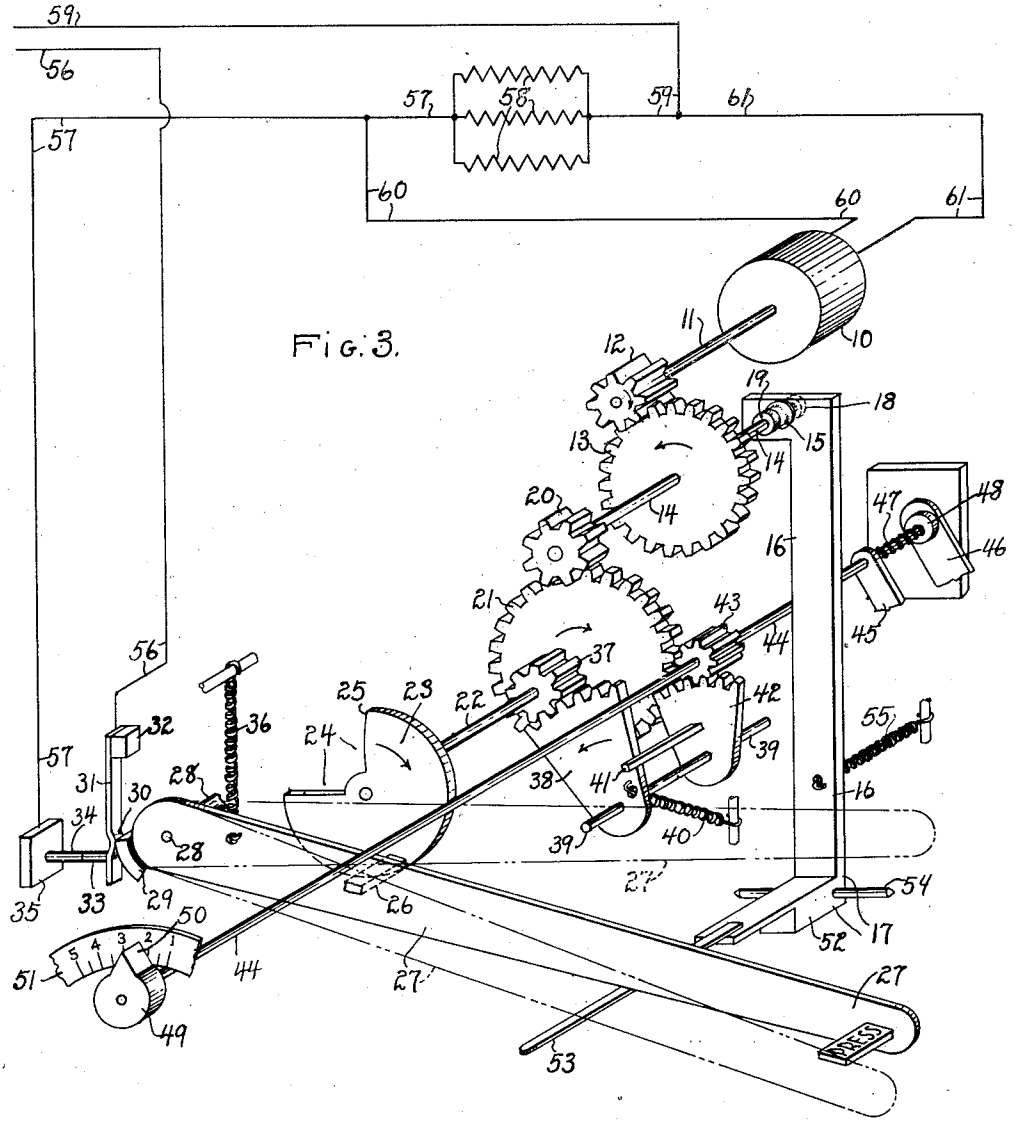


Fig. 3.

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INTERVAL-TIMER

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11 Claims. (Cl. 161—1)

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The present invention relates to improvements in interval-timers, i. e., timers which may be pre-set to discharge a desired function at the termination of a desired time period. The interval-timers of the present invention are admirably suited for use in controlling electric toasters, though available for controlling other devices.

One of the objects of the present invention is to provide a superior interval-timer which includes a gear-train between a synchronous electric motor and a switch-mechanism and so constructed and arranged that the backlash inherent in the said gear-train will not affect the timing function of the instrument to a harmful degree.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art.

In the accompanying drawings, in which certain modes of carrying out the present invention are shown for illustrative purposes:

Fig. 1 is a schematic perspective view of one form of interval-timer constructed in accordance with the present invention and showing the parts in their normal or at rest positions;

Fig. 2 is a view similar to Fig. 1 but showing the parts in the positions which they assume when the timing-lever is fully depressed; and

Fig. 3 is a view similar to Figs. 1 and 2, but showing the timing-lever released from downward pressure and the parts in the positions which they assume at the start of the timing cycle.

The interval-timer herein chosen for purposes of illustrating one form of the present invention, includes a synchronous electric motor 10 of any approved form not requiring detailed description herein other than to note that the said motor is provided with a drive-shaft 11 which carries at its outer end, a drive-pinion 12.

The drive-pinion 12 is adapted under certain conditions as will hereinafter appear, to be meshed into by a gear-wheel 13 which is rigidly mounted intermediate the respective opposite ends of a shaft 14, which latter is adapted to both rotate and reciprocate axially, as will presently appear. The rear end of the shaft 14 is mounted for rotation in a bearing-sleeve 15 mounted in the upper end of the vertical arm 16 of an L-shaped disconnecting-lever generally designated by the reference character 17 and which will be more fully hereinafter described.

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The rear end of the shaft 14 is provided with a collar 18 rigidly mounted thereon and adapted to bear against the rear end of the bearing-sleeve 15, to hold the said shaft 14 against forward axial movement relative to the arm 16. Immediately forwardly of the bearing-sleeve 15, the shaft 14 is also provided with a fixed collar 19 which is adapted to engage with the forward end of the said bearing-sleeve to hold the shaft 14 against rearward axial movement relative to the arm 16.

At its forward end, the shaft 14 above referred to has rigidly mounted thereon a pinion 20 which meshes into and drives a gear-wheel 21. The said pinion 20 is of sufficient width in the direction of its axis to maintain its mesh with the gear-wheel 21, despite the axial shifting of the said pinion as an incident to the axial movement of the shaft 14, for purposes as will hereinafter appear.

The gear-wheel 21 just above referred to is rigidly mounted upon the rear end of a timing-shaft 22 extending in parallelism with the shaft 14 and the drive-shaft 11 before referred to. At its forward end, the timing-shaft 22 has rigidly mounted thereon a timing-disc 23 provided with a clearance-notch 24 and having it periphery substantially uniformly distant from the center of the timing-shaft 22. The portion of the timing-disc 23 at the clockwise end of the clearance-notch 24, may for convenience of description, be referred to as a "drop-off" nose 25, designed for purposes as will more fully hereinafter appear.

Adapted to ride upon the periphery of the timing-disc 23 and to enter the clearance-notch 24 therein, is a timing-finger 26 which is rigid with and projects rearwardly from a timing-lever 27. At its left or inner end, the said timing-lever 27 is mounted upon a stud 28 for pivotal movement about an axis paralleling the axis of the timing-shaft 22. At its inner end, adjacent the stud 28, the actuating-lever 27 is formed with a switch-operating finger 29 which is adapted to engage with a transverse cam-like rib 30 formed in the lower portion of a spring-like contact-arm 31 which is secured at its upper end to any suitable support such, for instance, as a block 32. At its lower end, the contact-arm 31 carries a movable contact 33 which is adapted to engage with a stationary contact 34 projecting from a stationary contact-plate 35. The spring-like contact-arm 31 is so tensioned as to normally hold the movable contact 33 out of engagement with the stationary contact 34.

A helical spring 36 serves to urge the timing-lever 27 to turn in a counterclockwise direction to maintain its timing-finger in engagement with the periphery of the timing-disc 23 or to enter the timing-finger 26 of the timing-lever into the clearance-notch 24, all in a manner as will hereinafter appear.

Returning now to the timing-shaft 22, it will be noted that the same has rigidly mounted thereon at a point intermediate the gear-wheel 21 and the timing-disc 23, a pinion 37 which meshes into an oscillating rack 38 to both turn the same and be turned thereby. The said rack 38 is mounted for pivotal movement upon a shaft 39 and is urged to turn in a clockwise direction by means of a helical spring 40. The right edge of the said rack 38 is adapted to engage with an adjustable stop-pin 41 which projects forwardly from an interval-adjusting rack 42 also mounted upon the shaft 37 with freedom for turning movement thereon.

The interval-adjusting rack 42 above referred to is meshed into by a pinion 43 rigidly mounted on an adjusting-shaft 44 which is supported for rotation at its rear by two spaced-apart brackets 45 and 46. Encircling the portion of the adjusting-shaft 44 lying intermediate the brackets 45 and 46 is a helical compression spring 47 which is seated in its forward end against the rear face of the bracket 45 and which thrusts rearwardly against a friction-collar 48 rigidly attached to the rear portion of the adjusting-shaft 44. The spring 47 serves to maintain the rear face of the friction-collar 48 in frictional engagement with the forward face of the bracket 46 to thereby yieldingly retain the adjusting-shaft 44 (and hence also the interval-adjusting rack 42) in any given position of rotary adjustment.

At its forward end at a point convenient for manual manipulation, the adjusting-shaft 44 has rigidly mounted thereon a finger-piece 49 having a radially projecting pointer 50 which is adapted to sweep over the indicia on the forward face of a dial-plate 51.

The L-shaped disconnecting-lever 17 before referred to includes in addition to its vertical arm 16, a substantially horizontal arm 52 which projects forwardly and has rigidly attached to it the rear end of a flexible actuating-finger 53 which is adapted to be engaged and flexed downwardly by the under edge of the timing-lever 27 before referred to.

At the junction of its vertical arm 16 and its horizontal arm 52 the disconnecting-lever 17 carries a pintle-bar 54 adapted to rock in suitable bearings (not shown) to permit the entire disconnecting-lever 17 to swing about an axis extending at a right angle to the shafts 11, 14, 22, 39 and 44 for purposes of shifting the pinion 20 into an outer mesh with the gear-wheel 21. The disconnecting-lever 17 is yieldingly urged to turn in a direction required to move its vertical arm 16 rearwardly, by a helical spring 55 which however has a weaker tension than the tension of the flexible actuating-finger 53 before referred to.

The flexible contact-arm 31 is connected by means of a wire 56 to any suitable source of alternating current such, for instance, as 60 cycle 110 volts electric current. The stationary contact-plate 35 is connected by means of a wire 57 to one set of terminals of a plurality of resistance-heating coils 58 or such other electric device as it may be desired to control. The remaining terminals of the coils 58 are connected

by means of a wire 59 to the source of alternating current before referred to.

One terminal of the synchronous electric motor and before described is connected by means of a wire 60 to the wire 57 while the remaining terminal of the said motor is connected by a wire 61 to the wire 59 and hence is in electrical parallel with the resistance-heating coils 58.

Operation

For the purpose of making clear the operation of the interval-timer illustrated in the accompanying drawings, it may be assumed that the parts are in their normal or "at rest" positions as shown in Fig. 1.

In Fig. 1, it will be noted that the timing-lever 27 is in its uppermost position in which its timing-finger 26 is located in the clearance-notch 24 of the timing-disc 23. It will be further noted that the rack 38 is swung in a counter-clockwise direction away from the stop-pin 41 of the interval-adjusting rack 42 so as to place the spring 40 under further tension.

When the parts are in the positions in which they are shown in Fig. 1, the switch operating-finger 29 of the timing-lever 27 is out of engagement with the rib 30 of the contact-arm 31 so that the said contact-arm is swung to the right by its own tension, to thereby hold the movable contact 33 out of engagement with the stationary contact 34. Under the conditions just described, no current will flow either through the coils 58 or through the synchronous electric motor 10.

It may be further assumed that the finger-piece 49 on the adjusting-shaft 44 has been turned into a position to give the desired time interval.

Now when it is desired to energize the coils 58 for the predetermined time period, the user will swing the outer end of the timing-lever 27 downwardly from the position shown in Fig. 1 into the position in which it is shown in Fig. 2. In its downward movement, the under edge of the timing-lever 27 will engage with the flexible actuating-finger 53 of the disconnecting lever 17 and will swing the said disconnecting-lever so that its vertical-arm 16 moves forwardly against the tension of the spring 55.

The described forward swinging movement of the vertical-arm 16 of the disconnecting-lever 17 will move the shaft 14 axially forwardly to thus demesh the pinion 20 from the gear-wheel 21 as is shown in Fig. 2. The instant that the pinion 20 is demeshed from the gear-wheel 21 as just described, the spring 40 will assert itself to swing the rack 38 in a clockwise direction until the movement of the said rack is checked by the engagement of its right edge with the stop-pin 41 of the interval adjusting-rack 42 as is shown in Fig. 2. This clockwise swinging movement of the rack 38 as just described, will turn the pinion 37 in a counterclockwise direction and hence will also turn the gear-wheel 21, shaft 22 and timing-disc 23 in a similar direction. This counterclockwise turning movement of the timing-disc 23 will be permitted since the timing-finger 26 has been lowered out of the clearance-notch 24 when the timing-lever 27 was depressed as previously described and as shown in Fig. 2.

When the timing-lever 27 was swung downwardly as described to demesh the pinion 20 from the gear-wheel 21, its switch-operating finger 29 was swung upwardly and engaged with the cam-like rib 30 of the flexible contact-arm 31. The engagement just referred to will have flexed the said contact-arm to the left to thereby engage

the movable contact 33 thereof with the stationary contact 34, as illustrated in Fig. 2. As soon as the contact 33 has engaged with the contact 34 as just described, current will flow through both the coils 58 and the synchronous electric motor 10.

Thus substantially simultaneously with the demeshing of the pinion 20 from the gear-wheel 21, current will be supplied to the motor 10 (as well as to the coils 58) to thus start the said motor.

Now as manual pressure is removed from the outer end of the timing-lever 27 following its full depression as shown in Fig. 2, the said lever will rise under the urge of the spring 36, until its timing-finger 26 engages with the periphery of the timing-disc 23 which latter has in the interval been turned by the spring 40 from the position in which it is shown in Fig. 1 into the position in which it is shown in Fig. 2. In rising as described, the timing-lever 27 will move up sufficiently to relax its downward pressure upon the flexible actuating-finger 53 of the disconnecting-lever 17 to thereby permit the spring 55 to swing the vertical arm 16 of the said disconnecting-lever rearwardly. This rearward movement of the arm 16 will shift the pinion 20 rearwardly and back into mesh with the gear-wheel 21.

The parts will now have assumed the positions in which they are shown in Fig. 3 in which it will be noted that the switch-operating finger 29 of the timing-lever 27 is still serving to maintain the contact 33 in engagement with the contact 34 and hence current is flowing through both the coils 58 and the synchronous electric motor 10.

Now as the motor 10 continues to turn (in a clockwise direction in the instance shown) it will, through the chain of parts 11, 12, 13, 14, 20 and 21, serve to turn the timing-shaft 22 in a clockwise direction. Similarly, the timing-disc 23 and the pinion 37 on the said timing-shaft 22 will also be turned in a clockwise direction against the tension of the spring 40 by the timed action of the synchronous electric motor 10.

As the timing disc is turned in a clockwise direction as above described, the timing-finger 26 of the timing-lever 27 will ride upon the periphery of the timing-disc 23 until such time as the drop-off nose 25 comes into full registry with the left edge of the timing-finger 26. As soon as the registry referred to takes place, the timing-finger 26 will be snapped into the clearance-notch 24 in the timing-disc 23 by the tension of the spring 36 which latter will, of course, swing the free end of the timing-lever 27 upwardly. The swinging movement of the timing-lever 27 as just described will retire its switch-operating finger 29 out of engagement with the rib 30 of the flexible contact-arm 31 thus permitting the said contact-arm to swing the movable contact 33 out of engagement with the stationary contact 34 and thus deprive both the coils 58 and the synchronous electric motor 10 of further current.

As the timing-disc 23 was being turned in a clockwise direction at a timed rate of speed by the motor 10, the pinion 37 on the timing-shaft 22 was simultaneously swinging the rack 38 in a counterclockwise direction away from the stop-pin 41 of the interval-adjusting rack 42.

The parts will now have reassumed the positions in which they are shown in Fig. 1 preparatory to another cycle of operation, when desired.

The selected interval during which the contacts 33 and 34 remained closed may be varied by suitable manipulation of the finger-piece 43 of the adjusting-shaft 44. By way of example, should the adjusting-shaft 44 be turned in a clockwise direction from the position in which it is shown in the drawings, it will swing the interval-adjusting rack 42 and the latter's stop-pin 41 in a counterclockwise direction to thereby limit to a greater degree the clockwise swinging movement of the rack 38 under the urge of the spring 40 when next the pinion 20 is demeshed from the gear-wheel 21.

On the other hand, should the adjusting-shaft 44 be turned in a counterclockwise direction, it will swing the interval-adjusting rack 42 and the latter's stop-pin 41 in a clockwise direction from the position in which the said parts are shown in the drawing. When the stop-pin 41 is moved clockwise, as just described, it will permit the rack 38 to also swing to a greater degree in a clockwise direction when next the pinion 20 is demeshed from the gear-wheel 21. This greater clockwise movement of the rack 38 will turn the timing-disc 23 through a greater angle in a counterclockwise direction thereby requiring a longer time interval for the motor 10 to again bring the drop-off nose 25 of the said timing-disc into registry with the timing-finger 26 of the timing-lever 27.

Now inasmuch as the synchronous electric motor 10 or its equivalent in discharging its timing function in turning the timing-disc 23 or its equivalent, is always working against the tension of the spring 40 or other suitable yielding means, it follows that the back-lash in the train of parts is always substantially fully taken up. In this manner a high degree of accuracy is achieved.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. An interval-timer, including in combination: an electric driving-motor; a rotary timing-disc having a clearance-notch therein; a driving-train operatively interposed between the said driving-motor and the said timing-disc to cause the former to turn the latter at a predetermined rate of speed; a timing-member associated with the said timing-disc and having a portion constructed and arranged to ride upon the periphery thereof and to enter the clearance-notch therein; an electric circuit supplying current to the said driving-motor; switch-means interposed in the said electric circuit and associated with the said timing-member to be opened and closed by the movement thereof; and spring-means associated with the said timing-disc and constructed and arranged to yieldingly oppose the turning movement thereof under the drive of the said driving-motor to thereby maintain the said driving-train free of backlash.

2. An interval-timer, including in combination: an electric driving-motor; a rotary timing-disc having a clearance-notch therein; a train of gears operatively interposed between the said driving-motor and the said timing-disc to cause the former to turn the latter at a predetermined rate of speed; a timing-member associated with the said timing-disc and having a portion con-

structed and arranged to ride upon the periphery thereof and to enter the clearance-notch therein; an electric circuit supplying current to the said driving-motor; switch-means interposed in the said electric circuit and operatively associated with the said timing-member to be opened and closed by the movement thereof; a gear-like member meshing into the said train of gears at a portion thereof remote from the said driving-motor and turned in one direction by the latter; and spring-means constructed and arranged to yieldingly oppose the turning movement of the said gear-like member by the said driving-motor.

3. An interval-timer, including in combination: an electric driving-motor; a rotary timing-member; a driving-train operatively interposed between the said driving-motor and the said rotary timing-member to cause the former to turn the latter at a predetermined rate of speed; a second timing-member associated with the said rotary timing-member and controlled thereby; an electric circuit supplying current to the said driving-motor; switch-means interposed in the said electric circuit and associated with the said second timing-member to be opened and closed by the movement thereof; spring-means operatively connected to the said rotary timing-member and constructed and arranged to turn the same in a direction opposite to that in which it is turned by the said driving-motor; and disconnecting-means actuated by the movement of the said second timing-member and constructed and arranged to disconnect the said driving-train to permit the said spring-means to reversely turn the said rotary timing-member independently of the said driving-motor.

4. An interval-timer, including in combination: an electric driving-motor; a rotary timing-disc having a clearance-notch therein; a driving-train operatively interposed between the said driving-motor and the said timing-disc to cause the former to turn the latter at a predetermined rate of speed; a timing-member associated with the said timing-disc and having a portion constructed and arranged to ride upon the periphery thereof and to enter the clearance-notch therein; an electric circuit supplying current to the said driving-motor; switch-means interposed in the said electric circuit and associated with the said timing-member to be opened and closed by the movement thereof; spring-means operatively connected to the said timing-disc and yieldingly urging the same to turn in a direction opposite to that in which it is turned by the said driving-motor; and disconnecting-means actuated by the movement of the said timing-member and constructed and arranged to disconnect the said driving-train and permit the said spring-means to reversely turn the said timing-disc independently of the said driving-motor.

5. An interval-timer, including in combination: an electric driving-motor; a rotary timing-member; a train of gears operatively interposed between the said driving-motor and the said rotary timing-member to cause the former to turn the latter at a predetermined rate of speed; a second timing-member associated with the said rotary timing-member and controlled thereby; an electric circuit supplying current to the said driving-motor; switch-means interposed in the said electric circuit and operatively associated with the said second timing-member to be opened and closed by the movement thereof; a gear-like member meshing into the said train of gears at a portion thereof remote from the said driving-motor and turned in one direction by the latter; spring-means operatively connected to the said gear-like member and constructed and arranged to turn the same in a direction opposite to that in which it is turned by the said driving-motor; and disconnecting-means actuated by the movement of the said second timing-member and constructed and arranged to disconnect the said train of gears to permit the said spring-means to reversely turn the said gear-like member independently of the said driving-motor.

6. An interval-timer, including in combination: an electric driving-motor; a rotary timing-disc having a clearance-notch therein; a train of gears operatively interposed between the said driving-motor and the said timing-disc to cause the former to turn the latter at a predetermined rate of speed; a timing-member associated with the said timing-disc and having a portion constructed and arranged to ride upon the periphery thereof and to enter the clearance-notch therein; an electric circuit supplying current to the said driving-motor; switch-means interposed in the said electric circuit and operatively associated with the said timing-member to be opened and closed by the movement thereof; a gear-like member meshing into the said train of gears at a portion thereof remote from the said driving-motor and turned in one direction by the latter; spring-means operatively connected to the said gear-like member and constructed and arranged to turn the same in a direction opposite to that in which it is turned by the said driving-motor; and disconnecting-means actuated by the movement of the said timing-member and constructed and arranged to disconnect the said train of gears and permit the said spring-means to reversely turn the said gear-like member independently of the said driving-motor.

7. An interval-timer, including in combination: an electric driving-motor; a rotary timing-member; a driving-train operatively interposed between the said driving-motor and the said rotary timing-member to cause the former to turn the latter at a predetermined rate of speed; a second timing-member associated with the said rotary timing-member and controlled thereby; an electric circuit supplying current to the said driving-motor; switch-means interposed in the said electric circuit and associated with the said second timing-member to be opened and closed by the movement thereof; spring-means operatively connected to the said rotary timing-member and constructed and arranged to turn the same in a direction opposite to that in which it is turned by the said driving-motor; disconnecting-means actuated by the movement of the said second timing-member and constructed and arranged to disconnect the said driving-train to permit the said spring-means to reversely turn the said rotary timing-member independently of the said driving-motor; and adjustable stop-means constructed and arranged to limit the reverse turning movement of the said rotary timing-member under the urge of the said spring-means.

8. An interval-timer, including in combination: an electric driving-motor; a rotary timing-disc having a clearance-notch therein; a driving-train operatively interposed between the said driving-motor and the said timing-disc to cause the former to turn the latter at a predetermined rate of speed; a timing-member associated with the said timing-disc and having a portion constructed and arranged to ride upon the periphery thereof and to enter the clearance-notch therein; an

electric circuit supplying current to the said driving-motor; switch-means interposed in the said electric circuit and associated with the said timing-member to be opened and closed by the movement thereof; spring-means operatively connected to the said timing-disc and yieldingly urging the same to turn in a direction opposite to that in which it is turned by the said driving-motor; disconnecting-means actuated by the movement of the said timing-member and constructed and arranged to disconnect the said driving-train and permit the said spring-means to reversely turn the said timing-disc independently of the said driving-motor; and adjustable stop-means constructed and arranged to limit the reverse movement of the said timing-disc under the urge of the said spring-means.

9. An interval-timer, including in combination: an electric driving-motor; a rotary timing-member; a train of gears operatively interposed between the said driving-motor and the said rotary timing-member to cause the former to turn the latter at a predetermined rate of speed; a second timing-member associated with the said rotary timing-member and controlled thereby; an electric circuit supplying current to the said driving-motor; switch-means interposed in the said electric circuit and operatively associated with the said second timing-member to be opened and closed by the movement thereof; a gear-like member meshing into the said train of gears at a portion thereof remote from the said driving-motor and turned in one direction by the latter; spring-means operatively connected to the said gear-like member and constructed and arranged to turn the same in a direction opposite to that in which it is turned by the said driving-motor; disconnecting-means actuated by the movement of the said second timing-member and constructed and arranged to disconnect the said train of gears to permit the said spring-means to reversely turn the said gear-like member independently of the said driving-motor; and adjustable stop-means constructed and arranged to limit the reverse turning movement of the said gear-like member under the urge of the said spring-means.

10. An interval-timer, including in combination: an electric driving-motor; a rotary timing-disc having a clearance-notch therein; a train of gears operatively interposed between the said driving-motor and the said timing-disc to cause the former to turn the latter at a predetermined rate of speed; a timing-member associated with the said timing-disc and having a portion constructed and arranged to ride upon the periphery thereof and to enter the clearance-notch therein; an electric circuit supplying current to the said driving-motor; switch-means interposed in the said electric circuit and operatively associated with the said timing-member to be opened and closed by the movement thereof; a gear-like member meshing into the said train of gears at a portion thereof remote from the said driving-motor and turned in one direction by the latter; spring-means operatively connected to the said gear-like member and constructed and arranged to turn the same in a direction opposite to that in which it is turned by the said driving-motor; disconnecting-means actuated by the movement of the said timing-member and constructed and arranged to disconnect the said train of gears and permit the said spring-means to reversely turn the said gear-like member independently of the said driving-motor; and adjustable stop-means constructed and arranged to limit the reverse turning movement of the said gear-like member under the urge of the said spring-means.

11. An interval-timer, including in combination: a driving-motor; a rotary timing-disc having a clearance-notch therein; a driving train operatively interposed between the said driving-motor and the said timing-disc to cause the former to turn the latter at a predetermined rate of speed; a timing-member associated with the said timing-disc and having a portion constructed and arranged to ride upon the periphery thereof and to enter the clearance-notch therein; and spring-means associated with the said timing-disc and constructed and arranged to yieldingly oppose the turning movement thereof under the drive of the said driving-motor to thereby maintain the said driving-train free of backlash.

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