Oct. 3, 1944. A. B. POOLE 2,359,580

INTERVAL-TIMER

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Fig. 2.

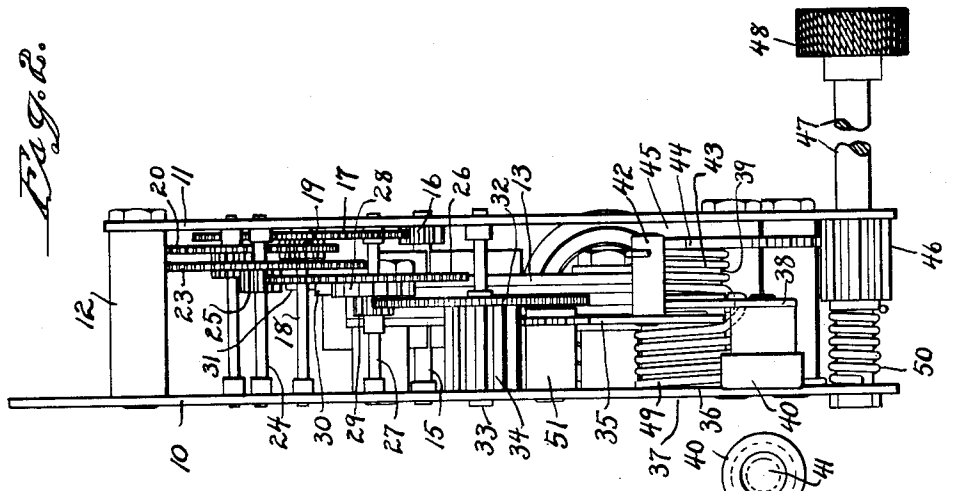
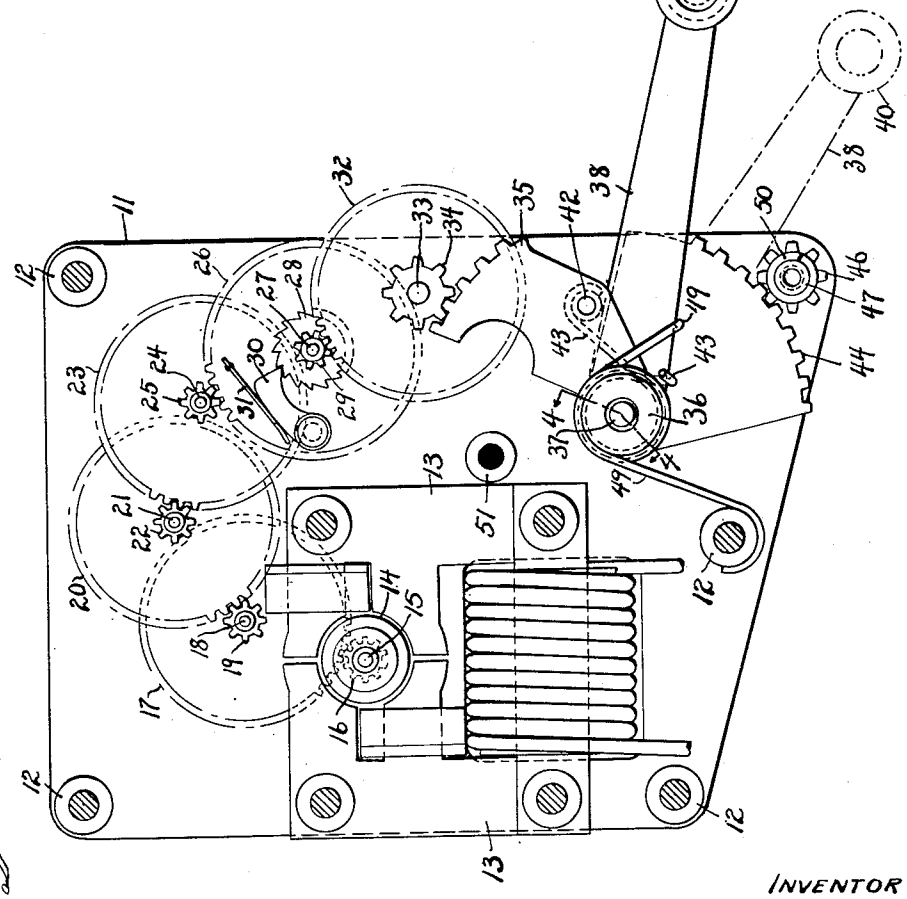


Fig. 1.



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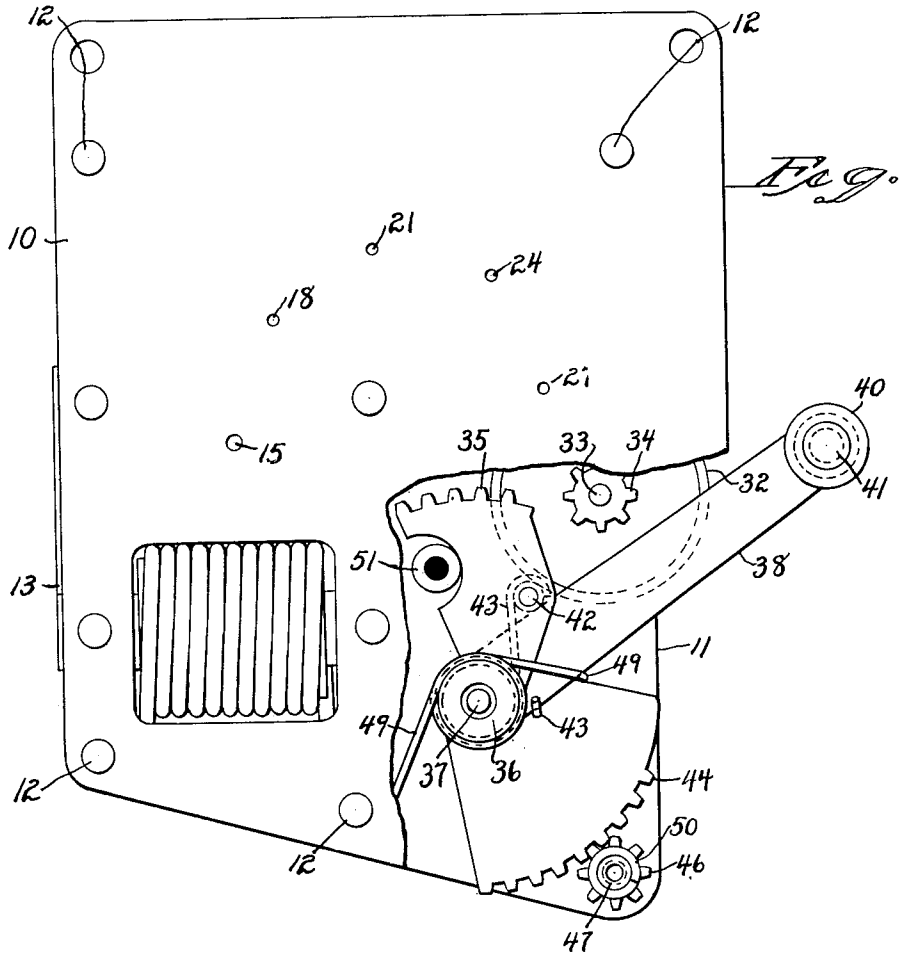


Fig. 3.

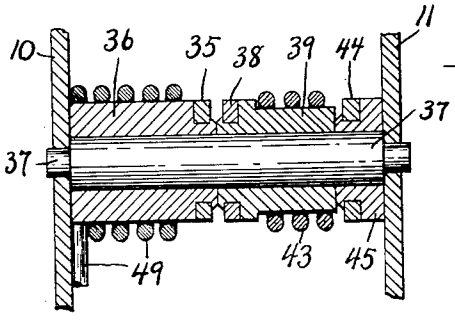


Fig. 4.

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UNITED STATES PATENT OFFICE

2,359,580

INTERVAL TIMER

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Application April 4, 1944, Serial No. 529,538

12 Claims. (Cl. 161—1)

The present invention relates to improvements in interval-timers and relates more particularly to interval-timers suitable for use in controlling electric toasters, though available for use in a wide variety of other situations.

One of the objects of the present invention is to provide a superior interval-timer characterized by reliability of action and economy of manufacture.

Another object of the present invention is to provide a superior interval-timer adapted for being driven by a synchronous electric motor.

A further object of the present invention is to provide a superior interval-timer capable of having its drive-train continuously operated, if desired, without deranging the actuating-mechanism of the timer.

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 and which are not claimed in any separate application.

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

Fig. 1 is a rear face view of an interval-timer embodying the present invention but omitting the rear movement-plate and showing the parts in the positions which they assume when the actuating-member is set in the position which it assumes at the start of the timing-period;

Fig. 2 is an edge view thereof;

Fig. 3 is a face view similar to Fig. 1 but showing the rear movement-plate in place and partly broken away to expose a portion of the actuating-mechanism and train, the actuating-member and associated parts being shown in the positions which they assume following the completion of the timing-period; and

Fig. 4 is a broken detail sectional view taken on the line 4—4 of Fig. 1.

The particular interval-timer herein chosen for illustrating one form of the present invention, includes two parallel laterally-spaced-apart movement-plates 10 and 11 held in spaced relationship with respect to each other by means of four (more or less) pillars 12. For purposes of description, the movement-plate 10 may be considered as the rear movement-plate, while the movement-plate 11 may be viewed as the front movement-plate. Rigidly connected to the rear movement-plate 10 is the field- or stator-structure 13 of a self-starting synchronous electric motor which includes a rotor 14 and which does not herein require detailed description other than to note that its said rotor is rigidly mounted upon a drive-shaft 15 which is journaled for rotation at its respective opposite ends in the movement-plates 10 and 11.

As viewed in Figs. 1 and 3, the rotor 14 is turned in a counterclockwise direction by the electromagnetic forces developed in the stator-structure 13 and similarly turns the drive-shaft 15 which has rigidly mounted upon it a drive-pinion 16 located adjacent the front movement-plate 11. The said drive-pinion meshes into and drives a gear-wheel 17 rigidly mounted on a shaft 18, which latter is journaled at its respective opposite ends in the movement-plates 10 and 11. The shaft 18 also has rigidly mounted upon it a pinion 19 which meshes into and drives a gear-wheel 20 rigidly mounted upon a shaft 21 journaled at its respective opposite ends in the movement-plates 10 and 11. Like the shaft 18, the shaft 21 has rigidly mounted thereon a pinion 22 which meshes into and drives a gear-wheel 23 which is rigidly mounted upon a shaft 24 journaled at its respective opposite ends in the movement-plates 10 and 11. The shaft 24 also rigidly mounts a pinion 25 which meshes into and drives a gear-wheel 26 which is mounted upon a shaft 27 journaled at its respective opposite ends in the movement-plates 10 and 11.

The shaft 27 above referred to, also carries with freedom for rotation relative thereto, a unit which comprises a ratchet-wheel 28 and a pinion 29 rigid with the said ratchet-wheel.

On its rear face, adjacent the ratchet-wheel 28, the gear-wheel 26 has pivoted thereto a pawl 30, the free end of which is yieldingly urged into engagement with the teeth of the said ratchet-wheel 28 by a pawl-spring 31, also carried by the said gear-wheel 26. By means of the pawl 30, the ratchet-wheel 28 and hence, also, the pinion 29 are prevented from turning in a counterclockwise direction (Fig. 1) with respect to the said gear-wheel 26. It may be here noted that under the particular circumstances and as viewed in Figs. 1 and 2, the gear-wheel 26 is turned by the rotor 14 in a counterclockwise direction, while the ratchet-wheel 28 is normally urged to turn in a counterclockwise direction by means of a spring 49, in a manner as will be later described.

The pinion 29 previously referred to, meshes into a gear-wheel 32 rigidly mounted upon a shaft 33, which latter is journaled at its respective opposite ends in the movement plates 10 and 11. Also rigidly mounted upon the shaft 33 is

a timing-pinion 34 which is adapted to be meshed into and driven by a timing-rack 35.

The lower end of the timing-rack 35 above referred to is staked, or otherwise rigidly attached, to the forward end of a hub 36 which is mounted for rotation upon a shaft 37 adjacent the inner face of the movement-plate 10, as is particularly well shown in Fig. 4. The shaft 37 is supported at its respective opposite ends in the movement-plates 10 and 11. Mounted adjacent to and concentric with the timing-rack 35 is an actuating-member or -lever 38, which is staked at its inner end to the rear end of a hub 39 mounted for turning movement upon the shaft 37. The free end of the actuating-member 38 projects outwardly beyond the edges of the movement-plates 10 and 11, between which it is mounted, and carries at its said outer end an actuating-roller 40 mounted upon a stud 41 carried by the said element 38. The actuating-roller 40 just referred to, is adapted to engage with any desired mechanism to trip or actuate the same such, for instance, as the electric switch or the latching-mechanism of an automatic toaster.

The timing-rack 35 has rigidly mounted to it and extending forwardly from it toward the movement-plate 11, a limiting-stud 42 which is normally held in engagement with the adjacent edge of the actuating-member 38 by a helical torsion-spring 43. The said torsion-spring has one end hooked around the lower edge of the actuating-member 38 and has its opposite end hooked around the limiting-stud 42. The said limiting-stud 42 of the timing-rack 35 is adapted to engage with and be stopped by the upper edge of an interval-adjusting rack 44 arranged concentrically with respect to both the timing rack 35 and actuating-member 38. The said rack 44 has its inner portion staked to the rear end of a hub 45 which is mounted for turning movement upon the shaft 37 before referred to, intermediate the hub 39 and the inner face of the movement-plate 11, as is especially well shown in Fig. 4. The interval-adjusting rack 44 is adapted to be turned by means of a setting-pinion 46 meshing into the teeth of the rack 44 and rigidly mounted upon a setting-stem 47 at a point adjacent the inner face of the movement-plate 11, as is especially well shown in Fig. 2. The setting-stem 47 projects forwardly through the front movement-plate 11 and well beyond the outer face thereof, and may be provided with a knurled finger-button 48.

The actuating-member or -lever 38 before referred to, is yieldingly urged to turn in a counterclockwise direction (as viewed in Figs. 1 and 3) by means of a helical torsion-spring 49 encircling the hub 36 of the element 38 and having one end hooked beneath the lower edge of the latter and having its opposite end hooked around the adjacent one of the pillars 12.

As thus constructed and arranged, the torsion-spring 43 normally serves to hold the limiting-stud 42 of the timing-rack 35 in engagement with the upper edge of the actuating-member 38 for concurrent movement therewith, though providing a yielding connection which will permit the said actuating-member to be turned in a clockwise direction relative to the timing-rack 35. The torsion-spring 49 exerts a constant effort to swing the actuating-member 38 in a counterclockwise direction and hence also acts through the limiting-stud 42 to tend to swing the timing-rack 35 also in a counterclockwise direction. The timing-rack 35, in turn (when the instrument is set as shown in Fig. 1), exerts an effort to turn the timing-pinion 34 and gear-wheel 32 in a clockwise direction, and the said gear-wheel 32 will, in turn, tend to turn both the pinion 29 and its complemental ratchet-wheel 28 in a counterclockwise direction. Normally, this tendency of the ratchet-wheel 28 to turn in a counterclockwise direction will be resisted by the pawl 30 except insofar as the gear-wheel 26 carrying the said pawl, is turned at a timed rate in a counterclockwise direction by the rotor 14 of the synchronous electric motor.

To frictionally hold the setting-pinion 46 and hence, also, the interval-adjusted rack 44 in any desired position of adjustment, a helical compression-spring 50 is employed, as is shown in Fig. 2. The spring 50 is interposed between the inner face of the movement-plate 10 and the rear end of the setting-pinion 46, and exerts a constant effort to frictionally engage the outer face of the said setting-pinion with the inner face of the movement-plate 11, to provide frictional restraint against the unintentional turning of the said setting-pinion 46.

For the purpose of limiting the counterclockwise turning of the timing-rack 35 (and hence, also, of the actuating-member 38), a stop-stud 51 is employed which projects forwardly from the rear movement-plate 10 into position to be engaged by the edge of the said timing-rack.

Operation

Normally, when the interval-timer is at rest, the parts will assume the positions in which they are shown in Fig. 3, in which it will be noted that the actuating-member or -lever 38 has its free end in its uppermost position and is yieldingly held therein by the tension of the torsion-spring 49. The tension of the torsion-spring 49 also acts through the said actuating-member 38 and the limiting-stud 42 to yieldingly hold the timing-rack 35 in its inactive position, in which its inner edge is engaged with the stop-stud 51, as shown in Fig. 3.

When it is desired to have the interval-timer perform its function, the actuating-member or -lever 38 may be swung downwardly, and the stator-structure 13 of the synchronous motor is energized to cause the rotation of the rotor 14 and the train of parts connected thereto. Since the timing-rack is yieldingly coupled to the actuating-member 38 by the torsion-spring 43, the downward movement of the said actuating-member 38 will also swing the timing-rack 35 in a clockwise direction and cause the teeth of the latter to mesh with the teeth of the timing-pinion 34 and turn the said pinion and its complemental gear-wheel 32 in a counterclockwise direction. The turning of the pinion 34 and gear-wheel 32 as just described, will cause the turning of both the pinion 29 and the ratchet-wheel 28 in a clockwise direction, thereby permitting the teeth of the said ratchet-wheel to ride under the nose of the pawl 30. As soon, during the clockwise setting or turning movement of the actuating-member 38 and the timing-rack 35, as the limiting-stud 42 of the said timing-rack engages with the upper edge of the interval-adjusting rack 44, the turning movement of the timing-rack 35 will thereby be stopped at an intermediate position such, for instance, as that shown in Fig. 1. However, due to the yielding coupling of the actuating-member 38 with the timing-rack 35, the clockwise movement of the

said actuating-member **38** may be continued until such movement is definitely checked by the engagement of the under-edge of the said element **38** with the periphery of the setting-pinion **46**, as is indicated by broken lines in Fig. 1.

Now, as soon as downward force is removed from the outer end of the actuating-member **38**, the torsion-spring **49** will assert itself and swing the said actuating-member in a counterclockwise direction until its upper edge engages with the limiting-stud **42** of the timing-rack **35**, as is shown by full lines in Fig. 1. Following this engagement, the torsion-spring **49** will now exert an effort to turn both the actuating-member **38** and the timing-rack **35** in a counterclockwise direction, and such movement will be held to a predetermined time-rate by the rotor **14** of the synchronous electric motor acting through the train of pinions and gear-wheels before described. As the rotor **14** turns and permits the torsion-spring **49** to slowly turn the timing-pinion **34** in a clockwise direction, both the timing-rack and the actuating-member **38** will turn in a counterclockwise direction.

Ultimately, as the timing-rack **35** turns in a counterclockwise direction, its teeth will run out of mesh with the timing-pinion **34**, whereupon both the said timing-rack **35** and the actuating-member **38** will snap in a counterclockwise direction under the urge of the torsion-spring **49**, until the counterclockwise turning movement just referred to is halted by the engagement of the timing-rack **35** with the stop-stud **51**, as is shown in Fig. 3.

The snap-like counterclockwise movement of the actuating-member **38** may be utilized to trip the switch of an electric toaster and to release the latch of the toast-holder thereof, or to discharge such other function as may be desired.

Should a longer interval of time be desired than that for which the device is shown as set in the drawings, the interval-adjusting rack **44** may be turned in a clockwise direction by means of the parts **46**, **47** and **48**, to locate its upper edge at a lower level, so that when the device is again set in a manner corresponding to that before described, the timing-rack **35** may be turned to a greater degree and thus require a longer time-interval to return to a position wherein it will disengage from the timing-pinion **34**. Conversely, should it be desired to shorten the time-interval from that provided for by the setting shown in the drawings, the interval-adjusting rack **44** may be turned in a counterclockwise direction, to thereby advance its upper edge in a position wherein it will halt the clockwise swinging movement of the timing-rack **35** sooner than that provided for in the setting shown in the drawings.

By yieldingly coupling the timing-rack **35** to the actuating-member **38**, the latter may be always swung down into its fully-depressed position, as indicated by broken lines in Fig. 1, regardless of the setting of the interval-adjusting rack **44**. Thus, a switch or other similar member to which the outer end of the actuating-member **38** may be connected, may be given its full normal stroke without interference from the interval-timer and without causing any derangement of the assembly.

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: a motor; a timing-pinion; connecting-means operatively interconnecting the said motor and the said timing-pinion, the said connecting-means including ratchet-means permitting the said timing-pinion to be turned in one direction with respect to the said motor; a timing-rack constructed and arranged to be meshed with and de-meshed from the said timing-pinion; a movable actuating-member; coupling means including a spring yieldingly coupling the said actuating-member to the said timing-rack and constructed and arranged to permit the former to be retired relative to the latter; and spring-means constructed and arranged to advance both the said actuating-member and the said timing-rack and turn the said timing-pinion under the restraint of the said motor to ultimately de-mesh the said timing-rack from the aforesaid timing-pinion.

2. An interval-timer including in combination: a motor; a timing-pinion; connecting-means operatively interconnecting the said motor and the said timing-pinion, the said connecting-means including ratchet-means permitting the said timing-pinion to be turned in one direction with respect to the said motor; an arcuate pivotal timing-rack constructed and arranged to be meshed with and de-meshed from the said timing-pinion; a pivotal actuating-lever; coupling-means including a spring yieldingly coupling the said pivotal actuating-lever to the said pivotal timing-rack and constructed and arranged to permit the former to retire relative to the latter; and spring-means constructed and arranged to advance both the said pivotal actuating-lever and the said pivotal timing-rack and turn the said timing-pinion under the restraint of the said motor to ultimately de-mesh the said timing-rack from the aforesaid timing-pinion.

3. An interval-timer including in combination: a motor; a timing-pinion; connecting-means operatively interconnecting the said motor and the said timing-pinion, the said connecting-means including ratchet-means permitting the said timing-pinion to be turned in one direction with respect to the said motor; an arcuate pivotal timing-rack constructed and arranged to be meshed with and de-meshed from the said timing-pinion; a pivotal actuating-lever arranged substantially concentrically with respect to the said pivotal timing-rack; coupling-means including a torsion-spring yieldingly coupling the said pivotal actuating-lever to the said pivotal timing-rack and constructed and arranged to permit the former to be retired relative to the latter; and a torsion-spring constructed and arranged to advance both the said pivotal actuating-lever and the said pivotal timing-rack and turn the said timing-pinion under the restraint of the said motor to ultimately de-mesh the said timing-rack from the aforesaid timing-pinion.

4. An interval-timer including in combination: a motor; a timing-pinion; connecting-means operatively interconnecting the said motor and the said timing-pinion, the said connecting-means including ratchet-means permitting the said timing-pinion to be turned in one direction with respect to the said motor; a timing-rack constructed and arranged to be meshed with and de-

meshed from the said timing-pinion and having a limiting-abutment; a movable actuating-member having a limiting-abutment engageable with the limiting-abutment of the said timing-rack; spring-means yieldingly holding the limiting-abutment of the said actuating-member in engagement with the limiting-abutment of the said timing-rack; and spring-means constructed and arranged to advance both the said actuating-member and the said timing-rack and turn the said timing-pinion under the restraint of the said motor to ultimately de-mesh the said timing-rack from the aforesaid timing-pinion.

5. An interval-timer including in combination: a motor; a timing-pinion; connecting-means operatively interconnecting the said motor and the said timing-pinion, the said connecting-means including ratchet-means permitting the said timing-pinion to be turned in one direction with respect to the said motor; an arcuate pivotal timing-rack constructed and arranged to be meshed with and de-meshed from the said timing-pinion and having a limiting-abutment; a pivotal actuating-lever having a limiting-abutment engageable with the limiting-abutment of the said pivotal timing-rack; spring-means yieldingly holding the limiting-abutment of the said pivotal actuating-lever in engagement with the limiting-abutment of the said pivotal timing-rack; and spring-means constructed and arranged to advance both the said pivotal actuating-lever and the said pivotal timing-rack and turn the said timing-pinion under the restraint of the said motor to ultimately de-mesh the said timing-rack from the aforesaid timing-pinion.

6. An interval-timer including in combination: a motor; a timing-pinion; connecting-means operatively interconnecting the said motor and the said timing-pinion, the said connecting-means including ratchet-means permitting the said timing-pinion to be turned in one direction with respect to the said motor; an arcuate pivotal timing-rack constructed and arranged to be meshed with and de-meshed from the said timing-pinion and having a limiting-abutment; a pivotal actuating-lever arranged substantially concentrically with respect to the said pivotal timing-rack and having a limiting-abutment engageable with the limiting-abutment of the said timing-rack; coupling-means including a torsion-spring yieldingly coupling the said pivotal actuating-lever to the said pivotal timing-rack and constructed and arranged to permit the former to be retired relative to the latter; and a torsion-spring constructed and arranged to advance both the said pivotal actuating-lever and the said pivotal timing-rack and turn the said timing-pinion under the restraint of the said motor to ultimately de-mesh the said timing-rack from the aforesaid timing-pinion.

7. An interval-timer including in combination: a motor; a timing-pinion; connecting-means operatively interconnecting the said motor and the said timing-pinion, the said connecting-means including ratchet-means permitting the said timing-pinion to be turned in one direction with respect to the said motor; a timing-rack constructed and arranged to be meshed with and de-meshed from the said timing-pinion; a movable actuating-member; coupling-means including a spring yieldingly coupling the said actuating-member to the said timing rack and constructed and arranged to permit the former to be retired relative to the latter; spring-means constructed and arranged to advance both the said actuating-member and the said timing-rack and turn the said timing-pinion under the restraint of the said motor to ultimately de-mesh the said timing-rack from the aforesaid timing-pinion; and a shiftable interval-adjusting member having a portion engageable by a portion of the said timing-rack and constructed and arranged to limit the movement of the latter when the timing-rack is moved against the tension of the last-mentioned spring-means while leaving the actuating-member free of restraint.

8. An interval-timer including in combination: a motor; a timing-pinion; a connecting-means operatively interconnecting the said motor and the said timing-pinion, the said connecting-means including ratchet-means permitting the said timing-pinion to be turned in one direction with respect to the said motor; an arcuate pivotal timing-rack constructed and arranged to be meshed with and de-meshed from the said timing-pinion; a pivotal actuating-lever; coupling-means including a spring yieldingly coupling the said pivotal actuating-lever to the said pivotal timing-rack and constructed and arranged to permit the former to retire relative to the latter; spring-means constructed and arranged to advance both the said pivotal actuating-lever and the said pivotal timing-rack and turn the said timing-pinion under the restraint of the said motor to ultimately de-mesh the said timing-rack from the aforesaid timing-pinion; and a shiftable interval-adjusting member having a portion engageable by a portion of the said pivotal timing-rack and constructed and arranged to limit the movement of the latter when the timing-rack is moved against the tension of the last-mentioned spring-means while leaving the actuating-lever free of restraint.

9. An interval-timer including in combination: a motor; a timing-pinion; connecting-means operatively interconnecting the said motor and the said timing-pinion, the said connecting-means including ratchet-means permitting the said timing-pinion to be turned in one direction with respect to the said motor; an arcuate pivotal timing-rack constructed and arranged to be meshed with and de-meshed from the said timing-pinion; a pivotal actuating-lever arranged substantially concentrically with respect to the said pivotal timing-rack; coupling-means including a torsion-spring yieldingly coupling the said pivotal actuating-lever to the said pivotal timing-rack and constructed and arranged to permit the former to be retired relative to the latter; a torsion-spring constructed and arranged to advance both the said pivotal actuating-lever and the said pivotal timing-rack and turn the said timing-pinion under the restraint of the said motor to ultimately de-mesh the said timing-rack from the aforesaid timing-pinion; and a shiftable interval-adjusting member having a portion engageable by a portion of the said pivotal timing-rack and constructed and arranged to limit the movement of the latter when the timing-rack is moved against the tension of the last-mentioned torsion-spring while leaving the actuating-lever free of restraint.

10. An interval-timer including in combination: a motor; a timing-pinion; connecting-means operatively interconnecting the said motor and the said timing-pinion, the said connecting-means including ratchet-means permitting the said timing-pinion to be turned in one direction with respect to the said motor; a tim-

ing-rack constructed and arranged to be meshed with and de-meshed from the said timing-pinion and having a limiting-abutment; a movable actuating-member having a limiting-abutment engageable with the limiting-abutment of the said timing-rack; spring-means yieldingly holding the limiting-abutment of the said actuating-member in engagement with the limiting-abutment of the said timing-rack; spring-means constructed and arranged to advance both the said actuating-member and the said timing-rack and turn the said timing-pinion under the restraint of the said motor to ultimately de-mesh the said timing-rack from the aforesaid timing-pinion; and a shiftable interval-adjusting member having a portion engageable by a portion of the said timing-rack and constructed and arranged to limit the movement of the latter when the timing-rack is moved against the tension of the last-mentioned spring-means while leaving the actuating-member free of restraint.

11. An interval-timer including in combination: a motor; a timing-pinion; connecting-means operatively interconnecting the said motor and the said timing-pinion, the said connecting-means including ratchet-means permitting the said timing-pinion to be turned in one direction with respect to the said motor; an arcuate pivotal timing-rack constructed and arranged to be meshed with and de-meshed from the said timing-pinion and having a limiting-abutment; a pivotal actuating-lever having a limiting-abutment engageable with the limiting-abutment of the said pivotal timing-rack; spring-means yieldingly holding the limiting-abutment of the said pivotal actuating-lever in engagement with the limiting-abutment of the said pivotal timing-rack; spring-means constructed and arranged to advance both the said pivotal actuating-lever and the said pivotal timing-rack and turn the said timing-pinion under the restraint of the said motor to ultimately de-mesh the said timing-rack from the aforesaid timing-pinion; and a shiftable interval-adjusting member having a portion engageable by a portion of the said pivotal timing-rack and constructed and arranged to limit the movement of the latter when the timing-rack is moved against the tension of the last-mentioned spring-means while leaving the actuating-lever free of restraint.

12. An interval-timer including in combination: a motor; a timing-pinion; connecting-means operatively interconnecting the said motor and the said timing-pinion, the said connecting-means including ratchet-means permitting the said timing-pinion to be turned in one direction with respect to the said motor; an arcuate pivotal timing-rack constructed and arranged to be meshed with and de-meshed from the said timing-pinion and having a limiting-abutment; a pivotal actuating-lever arranged substantially concentrically with respect to the said pivotal timing-rack and having a limiting-abutment engageable with the limiting-abutment of the said timing-rack; coupling-means including a torsion-spring yieldingly coupling the said pivotal actuating-lever to the said pivotal timing-rack and constructed and arranged to permit the former to be retired relative to the latter; a torsion-spring constructed and arranged to advance both the said pivotal actuating-lever and the said pivotal timing-rack and turn the said timing-pinion under the restrant of the said motor to ultimately de-mesh the said timing-rack from the aforesaid timing-pinion; and a shiftable interval-adjusting member having a portion engageable by a portion of the said pivotal timing-rack and constructed and arranged to limit the movement of the latter when the timing-rack is moved against the tension of the last-mentioned torsion-spring while leaving the actuating-lever free of restraint.

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