United States Patent

[11] **3,591,956**

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[54] **INTERVAL TIMER MECHANISM**
12 Claims, 12 Drawing Figs.

[52] **U.S. Cl.** **58/21.13**
[51] **Int. Cl.** **G04f 3/02**
[50] **Field of Search** 58/21.13, 16, 21.15, 21.155

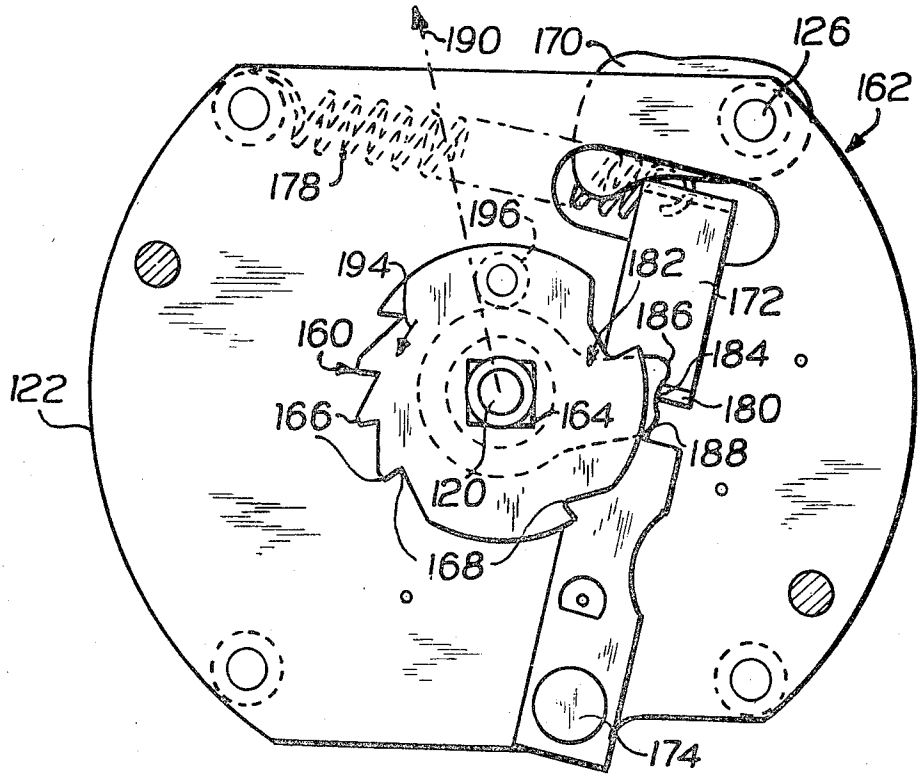
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ABSTRACT: An interval timer with an audible or electrical output has a springwound motor driving a control cam which governs the output mechanism, whereby to enable operation upon the completion of time intervals of irregular duration. A blocking member obstructs movement of the control cam follower to prevent any output if the mainspring is not fully wound.



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SHEET 1 OF 2

FIG. 1.

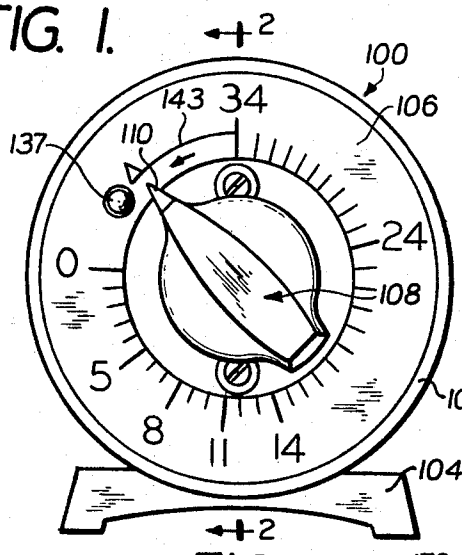


FIG. 2.

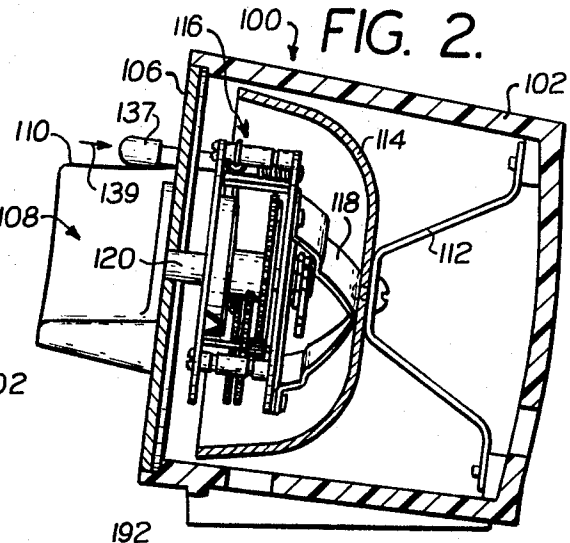


FIG. 3.

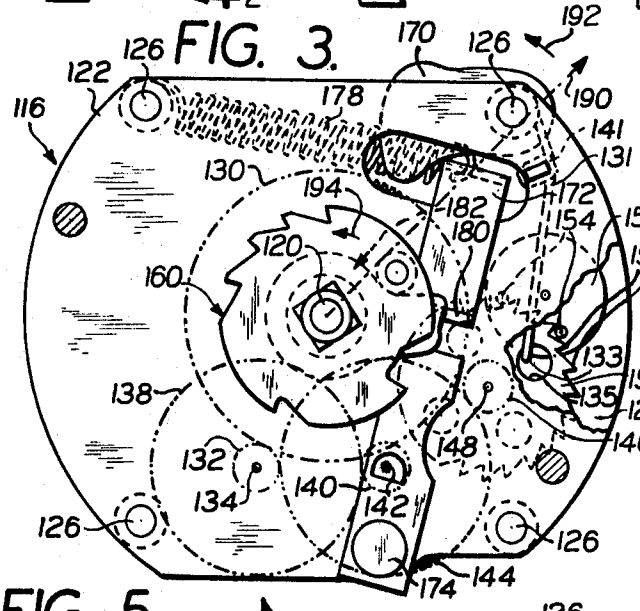


FIG. 4.

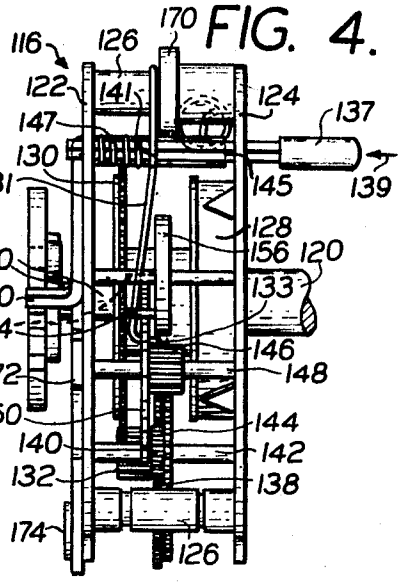


FIG. 5.

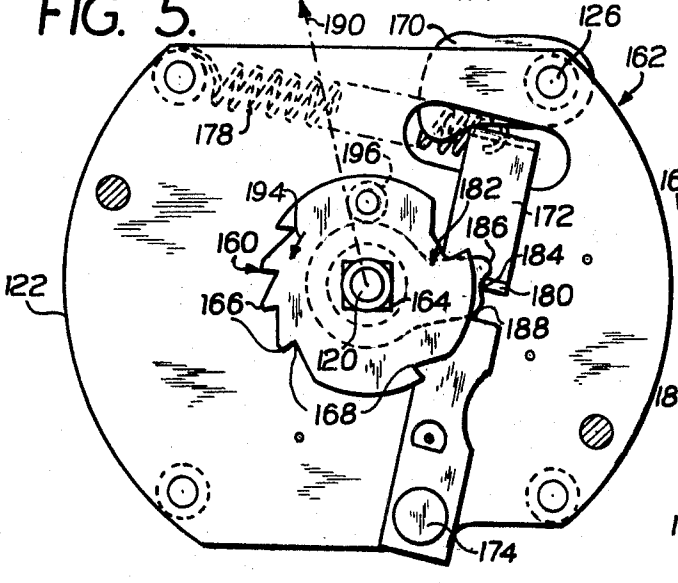
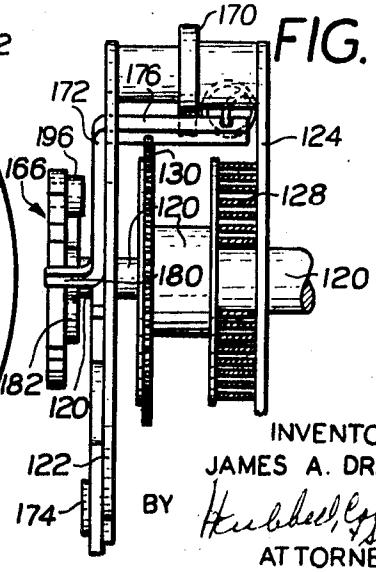


FIG. 6.



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FIG. 7.

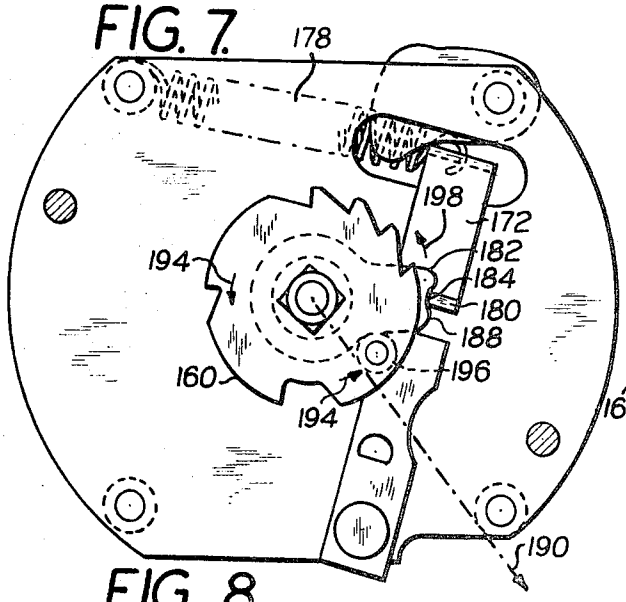


FIG. 10.

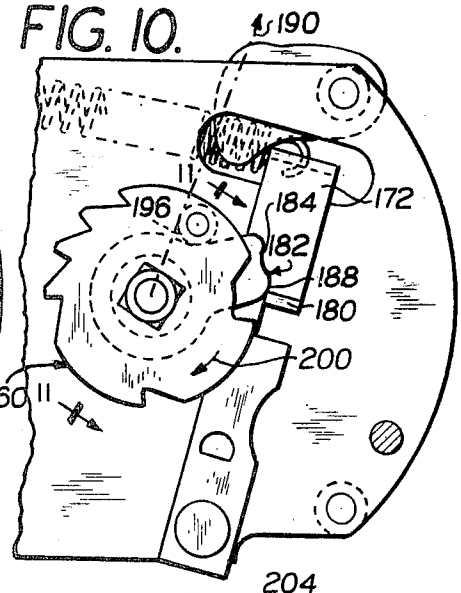


FIG. 8.

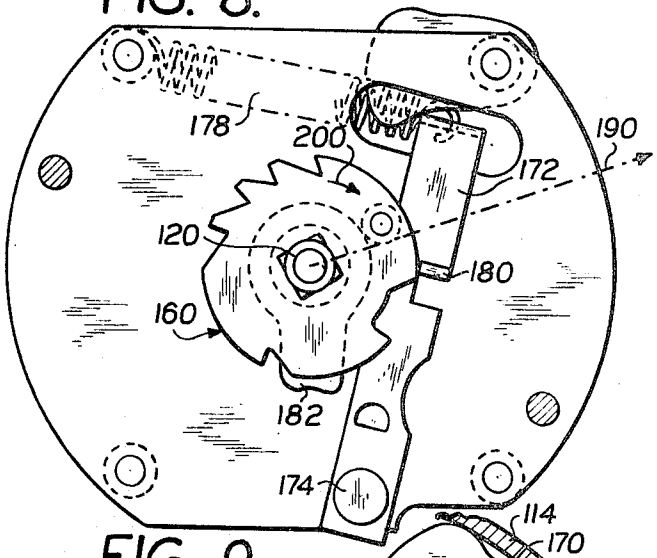


FIG. 11.

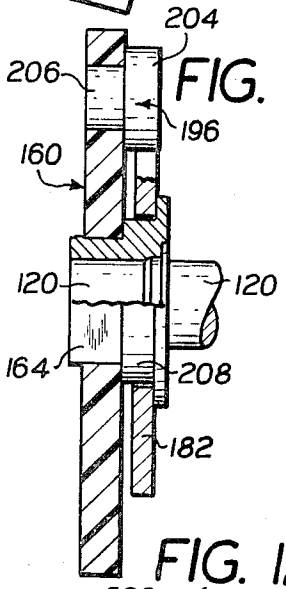


FIG. 9.

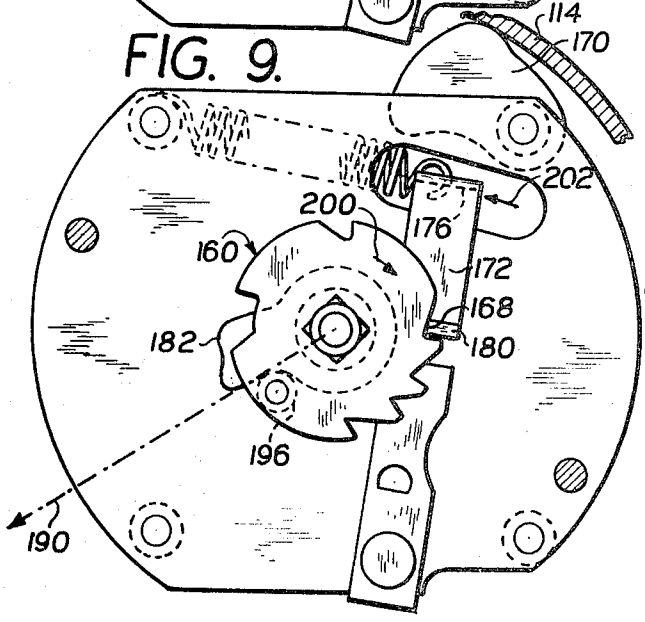
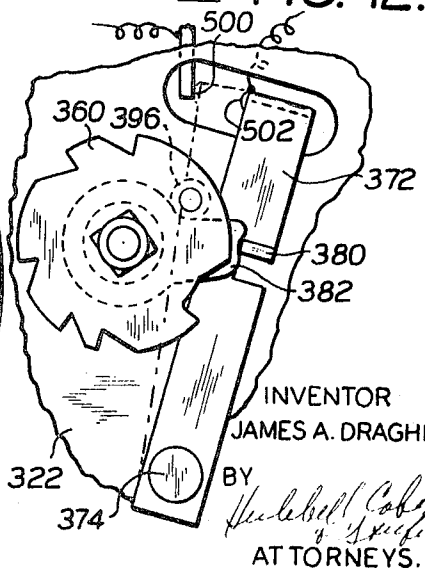


FIG. 12.



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INTERVAL TIMER MECHANISM

FIELD OF THE INVENTION

This invention relates generally to an improved spring-wound interval timer, and is particularly concerned with an interval timer capable of operation after the passage of time intervals of irregular duration. The mechanism for this timer includes means which prevent the timer from operating during winding.

THE PRIOR ART

There are many types of interval timer mechanisms. Most interval timer mechanisms are adapted to give a single output, such as an audible sound or the closing of a pair of electrical contacts, at the expiration of a single predetermined time interval. Others have been devised to give a plurality of output indications during a timing cycle but at uniform subintervals.

THE INVENTION

The present invention provides an improved spring-wound timing device in which a control cam allows an output mechanism to operate one or more times during the course of a runout cycle, which times can be irregularly spaced apart, if desired, and the output mechanism remains inoperative unless the mainspring is first fully wound. As a result, first of all, the timer mechanism will not ring the bell during winding, and secondly, if it is wound fully, it will ring the bell accurately at the expected times during the runout cycle, even though these times are irregularly spaced; if not wound fully there will be no output indication whatsoever.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view of a spring-wound interval timer in accordance with the present invention;

FIG. 2 is a sectional view of the timer, taken along the lines 2–2 of FIG. 1;

FIG. 3 is a rear elevational view of the timer movement taken from the timer of the preceding figures with the movement in the completely unwound condition;

FIG. 4 is a side elevational view of the timer movement in a condition corresponding to that of FIG. 3;

FIG. 5 is a view similar to that of FIG. 3, but showing the timer movement in a partially wound condition;

FIG. 6 is a view similar to that of FIG. 4, but showing the timer in the condition of FIG. 5;

FIG. 7 is a view similar to that of FIG. 5 showing the timer movement almost fully wound;

FIG. 8 is a view similar to that of FIG. 7 showing the timer movement in its fully wound condition;

FIG. 9 is a view similar to that of FIG. 8 showing the timer movement during the runout or unwinding cycle;

FIG. 10 is a view similar to that of FIG. 9 showing the timer movement near the completion of the runout cycle;

FIG. 11 is a fragmentary sectional view taken along the lines 11–11 of the FIG. 10; and

FIG. 12 is a fragmentary view, similar to FIG. 10, showing an alternative embodiment in which the timer operates a pair of electrical contacts.

The same reference characters refer to the same elements throughout the several views of the drawing.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows a spring-wound timer **100** having a casing **102** and pedestal **104**. At the front of the casing **102** is a dial **106** which indicates the time scale of the timer runout cycle, and this dial is traversed by an indicating pointer **110** upon a rotatable knob **108**. The knob **108** also serves as a handle for manually winding the timer mainspring.

As best seen in FIG. 2, a bracket **112** floatingly mounts a bell gong **114** in the interior of the casing **102**. A spring-wound timer movement **116** is in turn mounted within the interior of the gong **114** by a bracket **118**. A main shaft **120** serves as the winding shaft as well as the output shaft of the spring-wound motor **116**. In order to serve as the winding shaft, shaft **120** extends through an aperture in the center of the dial **106** and the winding knob **108** is secured thereto on the front side of the dial.

As best seen in FIGS. 3 and 4, the movement **116** comprises a pair of conventional movement plates, a rear plate **122** and a front plate **124**, which are spaced apart by the usual spacer rods **126**. In the space between the movement plates, the main shaft **120** has a spiral mainspring **128** wound thereabout. The mainspring is anchored at one end to the front plate **124** and at the other end to the winding shaft **120**.

As the mainspring drives the shaft **120** during the runout cycle, the shaft turns a gearwheel **130** which is mounted on the shaft and frictionally clutched thereto. The gearwheel **130** in turn drives a pinion **132** secured to a shaft **134** which is journaled between the movement plates **122** and **124**. The shaft **134** also has secured thereto a gearwheel **138** which drives a pinion **140** secured to another shaft **142** which is also journaled between the movement plates. The shaft **142** has secured thereto another gearwheel **144** which drives a pinion **146** secured to still another shaft **148** journaled between the movement plates. Finally, the shaft **148** has mounted thereon an escape wheel **150** formed with teeth **152** which cooperate with the pallets **154** of a verge member **156**. The verge and pallets cooperate with the escape wheel teeth in the conventional way to time the runout of the timing movement **116**.

A flexible wire spring **131** is anchored at one end to one of the spacers **126**, and at the other end is bent to form a hook **133** which engages an opening **135** formed in the escape wheel **152**, thus locking the movement **116** when the timer **100** is not in use. To unlock it, an operator **137** protruding through an elongated slit **143** formed in the dial **106** is manually pushed inwardly as shown by arrows **139** so that a shoulder **141** formed thereon dislodges the hook **133** to release the escape wheel **150**. The unlocking operator **137** is biased back to its original position by a coil spring **147** engaging the shoulder **141** thereof, but it may be retained in position to unlock the timer movement by sliding it laterally in the dial slit **143** as shown by arrow **149** until a shoulder **145** engages the edges of the slit to restrain the operator **137**.

As the timer movement **116** rotates its main shaft **120** at a timed rate during the mainspring runout cycle, it drives a control cam **160** which in turn activates an output mechanism **162** to strike the gong **114** at appropriate intervals to provide an audible timer output (or, as will be later described, an electrical output.) The control cam **160** is preferable formed of nylon, Delrin, or a similar material and is pressed onto a square driver nut **164** at the rear of the main shaft **120**, behind the rear movement plate **122**. As shown, the cam **160** performs one complete revolution as the knob **108** and shaft **120** are turned to wind the mainspring **128**, and performs one full revolution during the runout cycle. The cam is formed with a plurality of rises **166** interspersed with notches **168** which control the output mechanism **162**. Preferably the notches **168** are shaped so that the leading edges thereof are radial and the trailing edges are slanted away from the direction of rotation whereby to permit a cam follower to move abruptly into a notch **168** and be cammed or wedged out of the notch by the trailing edge.

The use of the cam **160** as the control element for the timer has a number of important advantages. Thus, for example, by using a cam, the multiplicity of outputs need not be uniformly spaced apart but can be irregularly spaced by virtue of the fact that the cam notches **168** can be irregularly spaced on the cam. Secondly, in production, timers having widely differing characteristics will all include substantially the same structural elements, the only difference being the shape of the cam. This will drastically reduce the cost of such devices by virtue of the reduction in the number of different parts required and in the number of different assembly steps required.

In the embodiment of FIGS. 1—11, the output mechanism comprises a lever 172 which is pivoted on the rear movement plate 122 by a pivot pin 174. Lever 172 has mounted thereon a cam follower here shown as an upstruck portion 180. The free end of lever 172 has secured thereto as on inturned free end 176 one end of a tension spring 178, the other end of which is anchored to one of the spacers 126. Spring 178 biases the lever 172 counterclockwise as viewed in FIGS. 3, 5, 7, 8 and 9, whereby to bias cam follower 180 toward engagement with the periphery of cam 160. Thus, with cam follower 180 riding on the periphery of cam 160, when a notch is encountered, i.e., registers with cam follower 180, the cam follower will drop abruptly into the notch to thereby permit lever 172 to pivot abruptly to the left or counterclockwise.

Disposed in the path of the free end of lever 172 is a striker element 170 which is pivoted on a spacer member 126 for movement from the position shown in FIG. 3 to the position shown in FIG. 9. Gravity normally biases the striker member 170 to the FIG. 3 position although a spring could be so employed. However, when lever 172 moves abruptly to the left under the influence of spring 178, it collides with striker 170 and knocks it clockwise or upward to strike bell 114 and thereby to ring the bell. Subsequent continued movement of the cam 160 will force cam follower out of the notch 168 to thereby restore lever 172 to its normal right-hand position and thereby permit the striker to drop down to its normal lowered position for the next operation.

To prevent operation of the output mechanism during the winding of the mainspring 128 and also to ensure that there will be no output unless the mainspring is substantially fully wound for a full-timed cycle, a blocking member 182 is provided which blocking member is rotatably mounted on the rear end of cam timer movement shaft 120 just is front of cam 160. The blocking member or element 182 has a portion which protrudes beyond the periphery of the cam 160 for engagement with the cam follower 180 to hold the cam follower away from the cam periphery and thereby prevent pivotal movement of lever 172 during rotation of the cam 160. Preferably, the portion of blocking member 182 that is engageable with cam follower 180 is provided with two protuberances 186 and 188 which flank an interposed depression 184 for receiving the cam follower 180 and holding it therein. As will be more fully described hereinafter, a reenabling driver element 196 is fixed to cam 160 and is engageable with blocking member 182 for moving the blocking member into and out of blocking relation with cam follower 180 upon the occurrence of certain events to be hereinafter described.

When the timer movement is completely unwound, as shown is FIGS. 3 and 4, the pointer 110 of the knob 108 points in the direction indicated by arrow 190, and the blocking element 182 is in its operative position in engagement with cam follower portion 180 to thereby hold the cam follower away from cam 160 and thus hold lever 172 in its rightmost position as viewed in FIG. 3. To start an operating cycle of the timer 100, the knob 108 is manually rotated to wind the mainspring 128, the control cam 160 thereby rotating with the mainshaft 120, the direction of rotation of the knob and control cam being shown by the arrows 192 and 194 respectively. During this winding operation, even though all the cam notches 168 are run past the cam follower tongue 180, the blocking element, which does not turn with the shaft 120 because it is freely rotatable thereon, remains in blocking engagement with the cam follower 180 to prevent lever 172 from ringing the bell during winding.

As the control cam 160 rotates in the mainspring-winding direction indicated by arrow 194, it carries with it a disabling and reenabling element 196 which is designed to drive the blocking element 182 into and out of its operative position relative to the tongue 180. Initially, however, the element 196 has no effect upon the blocking element 182.

FIGS. 5 and 6 show the timer mechanism partially wound. When the manual knob 108 has only been rotated as far as indicated by the arrow 190 in FIG. 5, the element 196 has not travelled far enough in the direction indicated by arrow 194 to engage the blocking element 182 and move it out of blocking relation with cam follower 180 to thus free lever 172. Subsequently, as seen in FIG. 7, when the manual winding knob 108 has been rotated a great deal further as shown by the position of the arrow 190, the element 196 is brought right up to the point of contact with the blocking element 182 but has not yet dislodged it from its blocking engagement with the cam follower tongue 180. In this view, the spring-wound timer movement 116 is almost but not quite fully wound, thus illustrating that even when the operator winds the mainspring almost all the way, if he inadvertently fails to wind it completely, the travel of the element 196 falls short of dislodging the blocking element 182, and as a result the blocking element continues to disable the output lever 172 and it will not be possible to strike a gong 114 during the following runout cycle.

On the other hand, if the manual knob 108 is turned somewhat further than the position of FIG. 7, the element 196 travelling with the control cam 160 in the direction indicated by arrows 194 will engage and dislodge the blocking element 182 as indicated by arrow 198. As this happens, the prominence 188 will ride under the cam follower tongue 180, stretching the biasing spring 178 somewhat until the tongue 180 is freed from its interlocking with the depression or low point 184.

FIG. 8 shows the position of the blocking element 182 after it has been dislodged from its engagement with the cam follower tongue 180 and is simply hanging loose on the main timer shaft 120. Once freed in this way of the blocking effect of the element 182, the output lever 172 is pivoted counterclockwise about its pivot 174 by the biasing spring 178, this motion carrying it at least far enough for the cam follower tongue 180 to engage the surface of the control cam 160 and be governed by the cam rises 166 and dwells 168 thereof.

At the moment depicted in FIG. 8 the timer movement 116 is fully wound, the blocking element 182 has been dislodged and disabled, the cam follower 180 and output lever 172 are under control of the cam 160, and the cam starts its timed return movement in the direction indicated by arrow 200 as the mainspring runout cycle begins.

In the view of FIG. 9 the runout cycle has been partially completed and the output lever 172 is seen pivoted counterclockwise as indicated by arrow 202 due to the fact that the cam follower tongue 180 thereof has now entered one of the cam notches 168 of the control cam 160. As this happens, the actuator lug 176 of the lever 172 impacts against the striker element 170 and drives it upwardly to strike the gong 114 as seen in FIG. 9, thus producing an audible ring of the bell. During the mainspring runout cycle this will occur once for each of the cam notches 168 formed on the profile of the control cam 160, the notches 168 each preferably having a radial leading edge to cause an abrupt leftward movement of lever 172 and a slanted trailing edge to wedge cam follower 180 out of the notch to rock lever 172 to the right.

In the view of FIG. 9 however, it is already apparent that as the runout cycle progresses and the knob 108 rotates to the position indicated by the arrow 190, the element 196 has once again engaged the blocking element 182 and is already in the process of returning it to its original operative position. In the view of FIG. 10 this process is well advanced as the timer movement 116 is seen entering the final stage of the runout cycle. As the manual knob 108 returns to the position indicated by the arrow 190, the continuing rotation of the control cam 160 in the direction indicated by arrow 200 causes the driver 196 to force the blocking element 182 angularly around to its operative position. Thus the cam follower tongue 180 is about to ride over the prominence 188 and reenter the retaining depression or low point 184 so that the output lever will again be engaged with the blocking element 182.

Thus the final event of each runout cycle is the repositioning of the blocking element 182 to disable the output lever 172 and thus make sure that the output lever will not function

during the next winding and runout cycle of the timer unless the mainspring thereof is first fully wound. Full winding is the only way that the blocking element 182 can again be dislodged.

In FIG. 11 it is seen that the disabling and reenabling driver element 196 comprises a small metal roller 204 rotatably mounted upon a pin 206 which is received within an opening in the control cam 160. The latter is fixedly mounted upon the square nut 164 formed at the end of the main shaft 120 so that the cam rotates with the shaft, but the blocking element 182 is seen in the view of FIG. 11 to be loosely rotatable upon a cylindrical shoulder 208 which is integral with the nut 164 and surrounds the shaft 120.

In the alternative embodiment of FIG. 12 the operation is much the same as already described in that a cam 360 controls an output lever 372 by means of a cam follower tongue 380, and the lever is prevented from pivoting about a pin 374 on the movement plate 322 by a blocking element 382, except when the latter is dislodged by a driver element 396.

In this embodiment however the output is the closing of an electrical circuit comprising a first contact 500 which is fixed in place upon the movement plate 322, and a second contact 502 which moves with the output lever 372 to form a closed circuit with the first contact 500 when the blocking element 382 and the control cam 360 permit counterclockwise pivoting movement of the output lever 372. Obviously, if necessary, a quick-acting mechanism such as an overcentering toggle can be interposed between lever 372 and contact 502 to insure snap-action opening and closing of the contacts.

In either of its alternative forms, this invention provides an improved spring-wound timer mechanism in which the output function is governed by the control cam that will predetermine the sequence of operation. Accordingly, one mechanism can be produced for all sequences, the only part to be changed being the cam. Further, the output function is disabled by a blocking element during winding and also during runout unless the operator takes the precaution of fully winding the mainspring. If the user does not do this, the blocking element will not be dislodged from its operative position and the subsequent runout cycle will not produce any audible or other output. Thus, although the timing of a short runout cycle could be misleading, no damage will be done because no one will hear the bell or other output. If the mainspring is fully wound, the output function will be performed under control of the cam, but at the end of the runout cycle the blocking element will again be replaced in its operative position in case the next winding of the mainspring is not complete.

Since the foregoing description and drawings are merely illustrative, the scope of protection of the invention has been more broadly stated in the following claims; and these should be liberally interpreted so as to obtain the benefit of all equivalents to which the invention is fairly entitled.

The invention I claim is:

1. In an interval timer having a spring motor, rotatable means for first winding the spring thereof to a condition for driving said timer during a predetermined full runout of said spring, output means, and a control mechanism responsive to said motor driving means for actuating said output means at one or more phases of said full runout; the improvement comprising:

means for preventing said control mechanism from actuating said output means, and means for disabling said preventing means only upon said spring being wound to condition said spring for said predetermined full runout.

2. The interval timer of claim 1; further comprising:

means for reenabling said preventing means effective upon the conclusion of said spring runout.

3. An interval timer as defined in claim 1, wherein said control mechanism includes a movable member, means for biasing said movable member to perform said output function, and a control element for controlling the movement of said movable member, whereby to perform said output function; said preventing means comprising:

a blocking element movable into and out of blocking relation with said movable member.

4. The interval timer safety mechanism of claim 3; further comprising:

means responsive to the winding displacement of said spring-winding means to condition said spring for said full runout for moving said blocking element out of blocking relation with said movable member; and

means responsive to said drive means near the conclusion of said spring runout for moving said blocking element into blocking relation with said movable member.

5. The interval timer safety mechanism of claim 3, wherein:

said control element is a cam connected with said driving and winding means and rotatable therewith;

and a cam follower in cooperative relation with said control cam and operatively connected to said movable member for controlling the movement of same.

6. The interval timer safety mechanism of claim 5; wherein:

said driving and winding means comprises a rotatable shaft connected to said spring motor;

said control cam is affixed to said shaft;

said blocking element is freely rotatable on said shaft and capable of obstructing said cam follower when rotated to a preselected operative angular position thereon;

and said disabling means comprises a disabling element connected to said control cam and engageable with said blocking element for rotating said blocking element out of said operative angular position when said control cam is rotated with said shaft to condition said spring for said full runout.

7. The interval timer safety mechanism of claim 6, wherein:

said disabling element is also said reenabling means, and is engageable with said blocking element as said control cam rotates with said shaft near the conclusion of said spring runout for restoring said blocking element to said operative angular position.

8. The interval timer safety mechanism of claim 7, wherein:

said output means comprises a lever pivoted on said timer;

said cam follower is a tongue struck from said lever;

and said biasing means urges said lever angularly about its pivot to press said cam follower tongue against said control cam and said blocking element.

9. An interval timer comprising:

at least one movement plate;

a spring motor including an output shaft for driving said timer through a predetermined full runout;

a control cam on said output shaft;

an output lever pivoted on said movement plate;

biasing means anchored to said movement plate and connected to urge said output lever pivotally toward said control cam;

cam follower means on said output lever biased into engagement with said control cam by said output-lever-biasing means;

and output means operative in response to movement of said output lever;

a blocking element freely rotatably mounted on said shaft and engageable with said cam follower for holding said cam follower out of engagement with said cam when said blocking element is in a given angular position on said shaft;

and a disabling element operatively connected to said cam and engageable with said blocking element for moving said blocking element out of said given angular position when said output shaft is rotated to condition said motor for said predetermined full runout.

10. An interval timer as in claim 9 wherein:

said cam follower is a tongue struck from said output lever.

11. An interval timer as in claim 9 wherein said output means comprises:

a bell adjacent said movement plate;

a striker mounted on said movement plate for movement from a normal position in the path of movement of said

operating lever to an operated position in engagement with said bell; whereby when said operating lever moves under the influence of said control cam, it causes said striker to strike said bell to produce at least one audible output ring.

12. An interval timer as in claim 9 wherein said output means comprises:

a first electrical contact mounted upon said movement plate;

and a second electrical contact operatively connected to said output lever and movable in response to movement thereof to engage said first electrical contact when said output lever is moved under the control of said control cam.