March 14, 1939. M. H. RHODES ET AL 2,150,633

TIMING DEVICE AND ESCAPEMENT THEREFOR

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FIG.1.

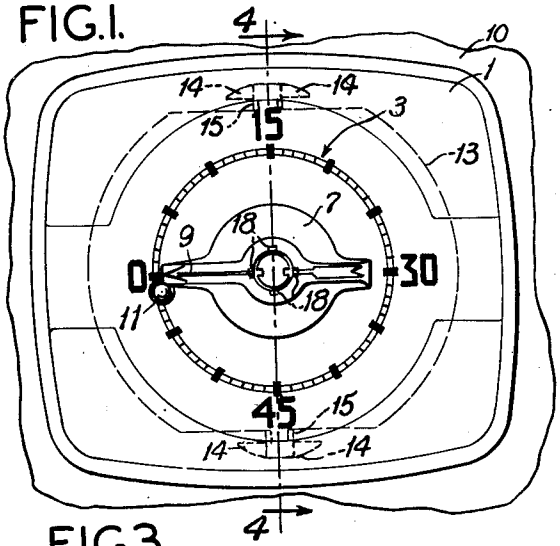


FIG.2.

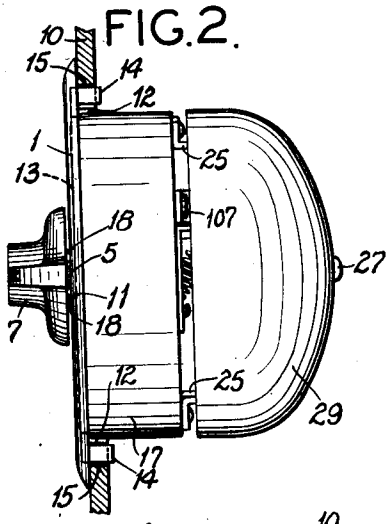


FIG.3.

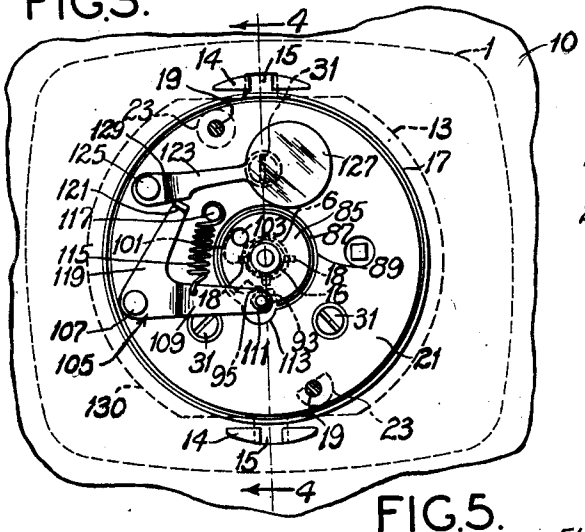


FIG.4.

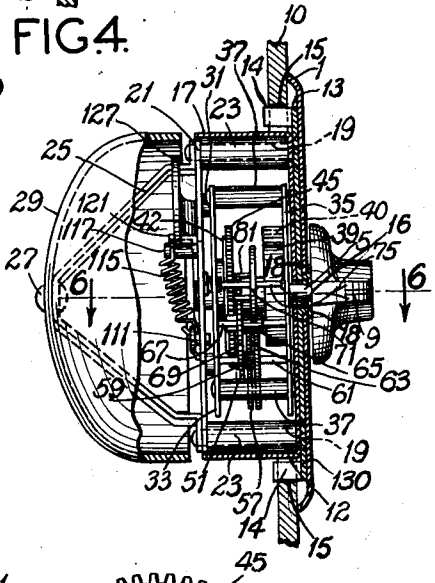
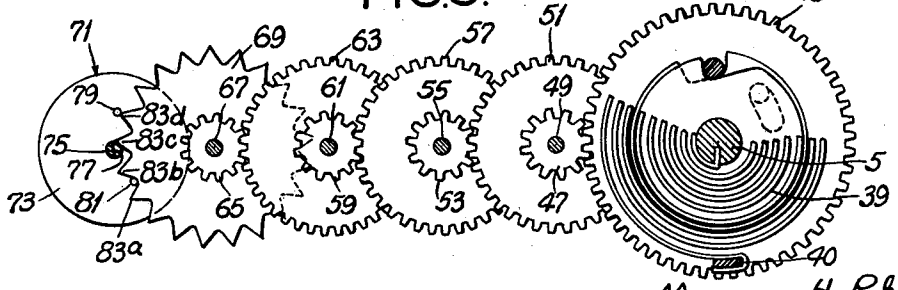


FIG.5.



Marcus H. Rhodes,
John Fanzoi,
Inventors,
Delos G. Haynes,
Attorney.

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FIG.6.

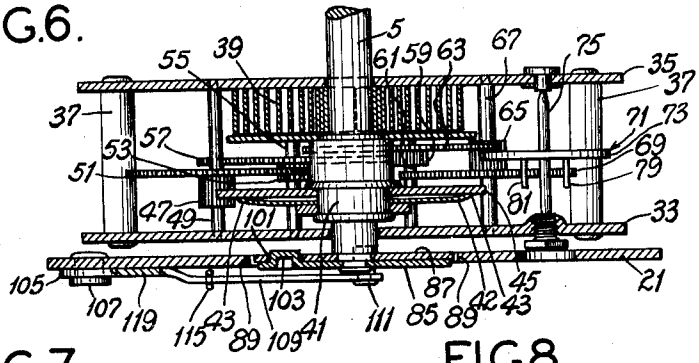


FIG.7.

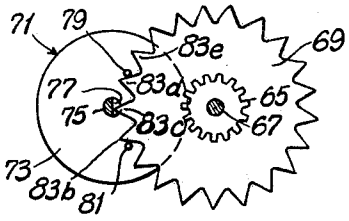


FIG.8.

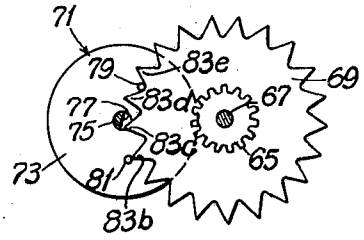


FIG.9.

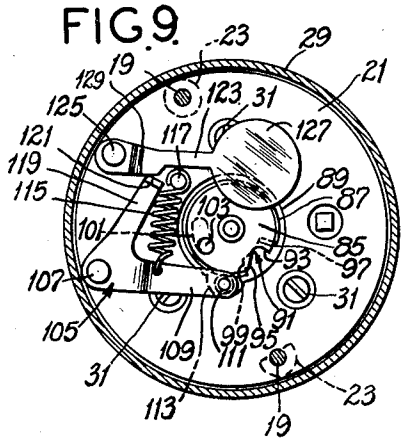
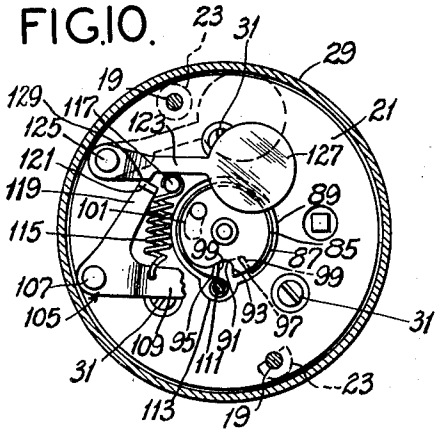


FIG.10.



Marcus H. Rhodes,
John Fanzoi,
Inventors,
Delos F. Haynes,
Attorney.

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UNITED STATES PATENT OFFICE

2,150,633

TIMING DEVICE AND ESCAPEMENT THEREFOR

Marcus H. Rhodes, New York, N. Y., and John Fanzoi, Hartford, Conn., assignors to M. H. Rhodes, Inc., New York, N. Y., a corporation of Delaware

Application September 26, 1936, Serial No. 102,640

1 Claim. (Cl. 161—23)

This invention relates to timing devices, and with regard to certain more specific features, to time signals.

Among the several objects of the invention may be noted the provision of a timing device of the class described which may be made to actuate a signal, in the form of a single stroke against a bell or other gong element, upon the expiration of any desired time interval; the provision of a timing device of the class described incorporating a timing train of simple and effective construction, but which nevertheless produces a signal of considerable intensity and audibility; the provision, in a timing device of the class described, of an improved form of escapement, which requires no balance spring for its satisfactory operation, and which escapement is relatively quiet and simple in action; the provision, in a timing device of the class described, of improved means of great simplicity for controlling the signal-actuating elements from the timing train; and the provision of a timing device of the class described which is relatively simple and economical in construction and operation. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claim.

In the accompanying drawings, in which is illustrated one of various possible embodiments of the invention,

Fig. 1 is a front elevation of a timing device embodying the present invention;

Fig. 2 is a side elevation of the device of Fig. 1;

Fig. 3 is a back elevation of the device of Fig. 1, a certain bell element having been removed;

Fig. 4 is a vertical section taken substantially along line 4—4 of Figures 1 and 3;

Fig. 5 is an ideal section of a timing train and escapement device;

Fig. 6 is an enlarged horizontal section taken substantially along line 6—6 of Figures 3 and 4;

Figures 7 and 8 are diagrammatic views illustrating, together with Fig. 5, the progressive positions in the operation of the escapement device; and,

Figures 9 and 10 are views similar to a part of Fig. 3, illustrating, together with Fig. 3, the progressive positions in the operation of a signal actuating member.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

Referring now more particularly to Fig. 1, numeral 1 indicates the outer face plate of a timing device embodying the present invention. In the embodiment shown in the drawings, the invention is adapted for panel mounting, although it will be seen that by suitable, simple changes in enclosure elements, the invention may likewise be adapted for table or any other type of mounting.

The face plate 1, which is of generally rectangular shape, carries thereon a circular scale indicated by numeral 3. Mounted on a shaft 5 extending forwardly through a hole 6 in the center of the face plate 1 is a knob 7 having a pointer 9. The pointer 9 cooperates with the indicia of the scale 3. Projecting through a suitable opening in the face plate 1 is a knob or stop member 11, that provides an abutment for the knob 7 with the pointer 9 at its "zero" position.

The manner in which the timing device of the present invention is mounted on a panel 10 is an important feature of the invention. Numeral 12 indicates a circular hole cut in the panel 10. Numeral 13 indicates a generally circular mounting plate that fits flush against the front side of the panel 10, the diameter of the plate 13 being somewhat greater than the diameter of the hole 12. At diametrically opposite points on its periphery, plate 13 carries pairs of deformable ears 14, which fit snugly into slots 15 suitably provided in the panel 10, extending out from the hole 12. The ends of ears 14 are bent down on the rear side of panel 10, thereby clamping the plate 13 to the panel 10. Shaft 5 extends through a suitable hole 16 in plate 13. Ears 18 are provided from the metal of plate 13 that would have occupied the position of the hole 16, and these ears 18, extending through the hole 6 in face plate 1, are bent down to clamp face plate 1 against mounting plate 13. Stop 11 is mounted on plate 13.

Numeral 17 indicates a cup-shaped enclosure element that is secured to the plate 13 by means of screws 19. The open front of the enclosure element 17 is substantially closed by a circular plate 21, which is held in proper parallel position by collars or sleeves 23 on the screws 19. The threaded ends of screws 19 are secured in suitably threaded openings at the ends of a central V-shaped bracket 25. A rivet 27 at the point of the bracket 25 serves to mount a bell or gong 29 concentrically with the enclosure element 17. The edge of the bell 29 is preferably spaced close to the edge of the enclosure element 17, as indicated.

Screws 31 extending inwardly from the circu-

lar plate 21 serve to mount a timing train, which will next be described. The timing train comprises a pair of parallel mounting plates 33 and 35, which are held in parallel relation by supports 37. Plates 33 and 35 serve to support the ends of several shafts upon which the various elements of the timing train are mounted.

The timing train itself may be described by reference to Fig. 5, which is an ideal or extended section, and to Fig. 6. The heretofore-described shaft 5 comprises the main shaft of the timing train. To the shaft 5 is secured (see Fig. 5) the inner end of a main spring 39, which is of the usual coiled type. The outer end of the main spring 39 engages a projection 40 struck up from the plate 35. To a drum 41 forming part of the shaft 5 is made fast a friction disc 42, which is made of a suitable springy material. The outer periphery of the friction disc 42 is slightly flared, as indicated at numeral 43. Loosely mounted on the drum 41, in position to be engaged by the flared edge 43 of the friction disc 42, is a gear 45. The gear 45 meshes with a pinion 47 on a shaft 49 that also carries a gear 51. The gear 51 in turn meshes with a pinion 53 on a shaft 55 that also carries a gear 57. The gear 57 in turn meshes with a pinion 59 on a shaft 61 that carries a gear 63. The gear 63 in turn meshes with a pinion 65 on a shaft 67 that also carries a ratchet wheel 69. The teeth of the ratchet wheel 69 are preferably pointed, as indicated in Fig. 5, but other forms of teeth may be used.

Rotation of the ratchet wheel 69 is controlled by an escapement device indicated broadly by numeral 71. The escapement device forms one of the principal features of the present invention. It comprises a solid disc 73 mounted on a shaft 75 in turn mounted in bearings on plates 33 and 35 for substantially frictionless rotation. The shaft 75 is mounted in proximity to the teeth of ratchet wheel 69; in fact, it is so close that it is half-cut, as indicated at numeral 77, in order to provide sufficient room for the teeth of the ratchet wheel 69 to pass the shaft 75. Numerals 79 and 81 indicate a pair of pins that are mounted on the disc 73, extending downwardly at right angles thereto. The positions of the pins 79 and 81 at equal distances from the shaft 75, and on opposite sides of a line connecting the centers of rotation of shafts 67 and 75, are such that, cooperating with the half-cut 77, they permit only a slow controlled movement of the teeth of ratchet wheel 69 when said ratchet wheel 69 attempts to rotate. The manner in which the device functions as an escapement is indicated progressively in Figures 5, 7 and 8. For example, in Fig. 5, the pin 81 lies in the trough between two successive teeth 83*a* and 83*b* of the ratchet wheel 69. The next tooth 83*c* is about to pass the shaft 75, through the half-cut 77. The pin 79 is at the crest of the next tooth 83*d*.

It is assumed that the ratchet wheel 69 tends to rotate in a counter-clockwise direction under the influence of the main spring 39. In order for the ratchet wheel 69 to rotate, however, it must push the pin 81 aside. In order to do this, it must rotate the disc 73 in a clockwise manner, by causing the pin 81 to ride up the advancing edge of tooth 83*b*. This movement is indicated in Fig. 7. As the pin 81 rides up the advancing edge of tooth 83*b*, permitting gradual rotation of the ratchet wheel 69, the tooth 83*c* passes through the half-cut 77 of shaft 75. At the same time, the pin 79 is descending into the trough between teeth 83*d* and 83*e*. This motion continues until the position indicated in Fig. 8 is assumed, at which time the pin 81 is at the crest of tooth 83*b*, tooth 83*c* has passed entirely through the half-cut 77, and pin 79 is positioned in the bottom of the trough between teeth 83*d* and 83*e*. Further rotation of the ratchet wheel 69 is now achieved by driving the disc 73 in a counter-clockwise manner, through the engagement of pin 79 with the advancing edge of tooth 83*e*. Meanwhile, pin 81 will drop into the bottom of the trough between teeth 83*b* and 83*c*. By the time the pin 79 reaches the crest of tooth 83*e*, pin 81 is in the trough between teeth 83*b* and 83*c*, and the position of the elements is again as illustrated in Fig. 5.

The half-cut 77 is provided in order that the shaft 75 may be mounted closer to the shaft 67 (and hence closer to the periphery of ratchet wheel 69). The closer the shaft 75 is to the periphery of ratchet wheel 69, the greater will be the angle of rotation of shaft 75 as successive teeth 83 escape. The greater the angle of rotation of shaft 75, the longer will be the intervals of time between the escape of successive teeth 83, which is desirable from the standpoint of the timing operation of the escapement.

This escapement cannot overrun, because the ratchet wheel 69 cannot advance without driving the pins 79 and 81 in such manner as to rotate the disc 73 in an oscillating manner. With the symmetrical disposition of the pins 79 and 81 about the line of centers between shaft 67 and shaft 75, as indicated, it will be seen that the escapement acts in the same manner whether the ratchet wheel 69 tends to advance in a clockwise or in a counter-clockwise direction.

Basically, the retarding force against the rotation of ratchet wheel 69 is the inertia of the disc 73 resisting change in the direction of its rotation. This inertia can be reduced, and the escapement thus permitted to operate in a faster manner, by reducing the mass of the disc 73. In the extreme case, the mass of the disc 73 may be reduced by cutting away all of said disc except the amount necessary to extend from the shaft 75 to support each of the pins 79 and 81. It is to be noted that under such circumstances the disc 73 loses its character as a disc, and becomes merely a supporting member (of bell-crank shape) for the pins 79 and 81. Such an escapement is comprehended within the terms of the present invention.

A distinctly advantageous feature of the present invention, insofar as the escapement is concerned, is that it requires no balance spring or similar element for its operation.

The main shaft 5 extends through the timing train mounting plate 33, and to its outer end is made fast a disc 85. Also mounted on the shaft 5, but free to rotate thereon, is a second disc 87 of slightly larger diameter than the disc 85. The discs 85 and 87 are flush with each other, and both are positioned in a suitable circular opening 89 provided in the plate 21.

Disc 85 has a notch 91 in its periphery, the said notch 91 having a radial edge 93 and a sloping edge 95. Disc 87 has a similar notch 97 in its periphery, but both edges 99 of the notch 97 are substantially radial. The disc 87 is also provided with an arcuate slot 101, which receives a projection 103 struck inwardly from the disc 85.

Numeral 105 indicates a bell-crank lever that is pivoted on a pin 107 supported in the plate 21. One arm 109 of the lever 105 carries an inwardly

projecting pin 111, that is positioned to engage the periphery of the disc 87. A suitable notch 113 extending outwardly from the opening 89 in the plate 21 makes this positioning of the pin 111 possible. A tension spring 115 is secured at one end to the arm 109, and at the other end to a pin 117 mounted on the plate 21, in order to urge the pin 111 into engagement with the periphery of the disc 87 at all times.

The other arm 119 of the bell-crank lever 105 has a projection 121 at its end.

Numeral 123 indicates an arm that swings on a pivot 125 mounted on the plate 21. The arm 123 carries a striker or clapper portion 127 of relatively large diameter at its outer end, and is provided with an anvil portion 129 near its inner end. The anvil portion 129 is positioned to be struck by the projection 121 on arm 119 of bell-crank lever 105.

When the knob 7 is at zero position (as indicated in Fig. 1), the discs 85 and 87 are positioned as indicated in Fig. 3. Under such circumstances, the pin 111 on arm 109 of bell-crank lever 105 is positioned in the troughs of juxtaposed notches 91 and 97 of discs 85 and 87, respectively. When, now, the knob 7 is rotated in a clockwise manner, referring to Fig. 1, so as to bring the arrow 9 into juxtaposition, say, with the numeral "30" on the scale 3, the following changes take place in the mechanism:

In the first place, the edge 43 of friction disc 42 will slip over the face of gear 45 without rotating said gear, because said gear 45 is prevented from rotating by the deterrent action of the escapement mechanism 71 at the end of the timing train.

The disc 85, being fast on the shaft 5, will rotate therewith. As the disc 85 rotates, the pin 111 will slide out of the notch 91 along the sloping face 95 of said notch, ultimately to be positioned against the periphery of disc 87. Disc 87, it will be recalled, is slightly larger in diameter than disc 85. The angular position of disc 87 at this time is not material, because, since it is free to rotate on the shaft 5, it will be forced out of the way by the engagement of pin 111 along the sloping face 95. However, as soon as the projection 103 comes into engagement with the forward edge of the arcuate slot 101, as indicated in Fig. 9, further forward (counter-clockwise) movement of the disc 85 will be accompanied by forward movement of the disc 87.

At the end of the setting movement of knob 7 (which may be to any desired position on the scale 3), the knob 7 is released. The turning of the shaft 5 will have placed a considerable tension in the main spring 39, which tension will tend to drive said shaft 5 to rotate in a reverse direction (e. g., to return the arrow 9 to "zero" position). However, the frictional engagement of the friction disc 42 and the gear 45 is now such that the main shaft 5 can rotate only with the gear 45, and the gear 45 can rotate only by operating the escapement mechanism 71 through the timing train comprising the gear train 47—51—53—57—59—63—65—69. This means that the return of the main shaft 5 to "zero" position will only be brought about in a slow, timed manner.

Return of the main shaft 5 to "zero" position means, with respect to Figures 9 and 10, clockwise rotation of the disc 85. For the first portion of this clockwise movement, the disc 87 will not move, because the projection 103 will be sliding along the length of arcuate slot 101. By the time the projection 103 reaches the end of slot 101, the radial edge 99 of notch 97 will be advanced in position over the sloping edge 95 of notch 91, as indicated in Fig. 10. Further movement of the disc 85 after this condition has been reached causes coextensive movement of the disc 87, because the projection 103 will now be engaged with the end of arcuate slot 101. This movement continues until the knob 7 is practically back to "zero" position, at which time the pin 111 on arm 109 of bell-crank lever 105 will suddenly pass over the radial edge 99 of notch 97, to drop into the troughs of both notches 91 and 97. Since the pin 111 has dropped over a radial edge 99 rather than along the sloping edge 95, it will drop to the trough of the notches with a quick, snapping movement, under the influence of the spring 115. This snapping movement of the bell-crank lever 105 brings the projection 121 in a fulcrum-like manner, forcibly against the anvil portion 129 of arm 123, with a hammer blow. This hammer blow causes a sudden swinging of the arm 123 with cumulative momentum on the pivot 125, and the clapper 127 hits the bell 29 a sharp, resounding blow. The relatively large size of the clapper 127, coupled with the sharpness of the movement throughout, and the cumulative fulcrum leverage of the projection 121 on anvil 129, means that the bell 29 will resound with a relatively loud musical note, thus effecting the desired signal. The striking force, it will be seen, comes from the spring 115, which may be made quite strong, as well as from the cumulative fulcrum leverage mentioned. In effect, the discs 85 and 87 and the bell-crank lever 105 constitute a mechanical relay, delivering the relatively strong force of the spring 115 upon actuation by the relatively weak timing train.

A feature of the present invention is the positioning of the pivot 125 of clapper arm 123 as far as possible from the center of the device, and as near as possible to the bell 29. This positioning enables clapper 127 to strike bell 29 along a nearly perpendicular line. The perpendicular blow thus given to the bell 29 by the clapper 127 results in a more forceful, sharp signal. When the pivot 125 is so positioned (such as nearer to the center of the device) that the clapper 127 strikes the bell 29 a glancing blow, the signal is not nearly as sharp or forcible. The mounting of the clapper so that it strikes the bell with a nearly perpendicular blow is accordingly one of the principal features of the invention.

In the embodiment as shown in the drawings, the vertical positioning of the elements is such that gravity causes the clapper arm 123 to drop again to the position shown in Figures 3, 9 and 10, immediately after it has struck a blow on the bell 29. If the device is installed under such conditions that gravity may not be relied upon for this return movement of the arm 123, it is preferable that a suitable light spring be provided in order to return the arm 123 to the position shown in Figures 3, 9 and 10, regardless of the operation of gravity.

A feature of the present invention is that the bell-crank lever 105 needs to be moved only through an angle of about seven degrees in order fully to actuate the arm 123. This permits easy setting of the signal with only a relatively slight turn of knob 7. Although the lever 105 moves only about seven degrees, it actuates the arm to move through about ten and one-half degrees, thereby giving momentum to the clapper

127. The projection 121 of bell-crank lever 105 engages the anvil portion 129 of arm 123 in such manner that the force is applied to the arm 123 at progressively shorter distances from its pivot 125 as the impulse is delivered, thereby accelerating the speed of the arm 123. These factors contribute to the attainment of a signal of maximum clearness and intensity of sound for a given size of elements.

The mounting means of the present invention is important. It will be seen that, in order to mount the signal on a panel, only one hole 12 needs to be cut in the panel 10. Demounting is easily accomplished, merely by unbending the ears 14 from their clamping position on the panel 10.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim:

In a time signalling device, a timing train, means for manually setting said timing train to run for a predetermined adjustable interval of time, cam means controlled by said timing train comprising a rotatable disc having a notch in its periphery, a V-shaped lever pivoted at the intersection of its two arms so as to turn in its own plane, and substantially in the plane of said disc, one of the said arms of the lever having a cam follower at its end engaging said cam means, spring means engaging said V-shaped lever and tending at all times to rotate said V-shaped lever so as to press said cam follower into firm engagement with said cam, a simple lever pivoted at one end and swinging in its own plane and substantially in the same plane as said V-shaped lever, the other end of said simple lever having a clapper thereon, a bell positioned in the path of movement of said clapper, said simple lever having an anvil edge provided intermediate its ends, the pivot points of said simple and V-shaped levers being so located with respect to each other that, as said cam follower drops into the notch in the edge of the cam disc, the end of the other arm of the V-shaped lever is brought forcibly against said anvil edge of the simple lever and slides therealong, towards the pivot point of said simple lever, thereby causing said simple lever to rotate on its pivot, as driven by the V-shaped lever, with a constantly decreasing mechanical advantage in the drive engagement, the simple lever thereby acquiring a rotational moment that causes the clapper end thereof to come against the bell with a sharp blow, thus providing a clear, resonant signal, driving movement of the V-shaped lever against the simple lever being stopped by the engagement of the cam follower with the bottom of the notch in the cam disc, at such a point that the aforesaid anvil edge of the simple lever must pass away from engagement with the aforesaid end of the other arm of the V-shaped lever, during the imparted rotational movement of the simple lever, before the clapper strikes the bell, there being accordingly provided a region of free movement of the clapper end of the simple lever, which, after the bell has been struck, permits the immediate retraction of the clapper to a position in which it does not interfere with the resounding vibrations of the bell.

MARCUS H. RHODES.
JOHN FANZOI.