Sept. 14, 1943. C. L. ANDERSON 2,329,447

TIMING MECHANISM

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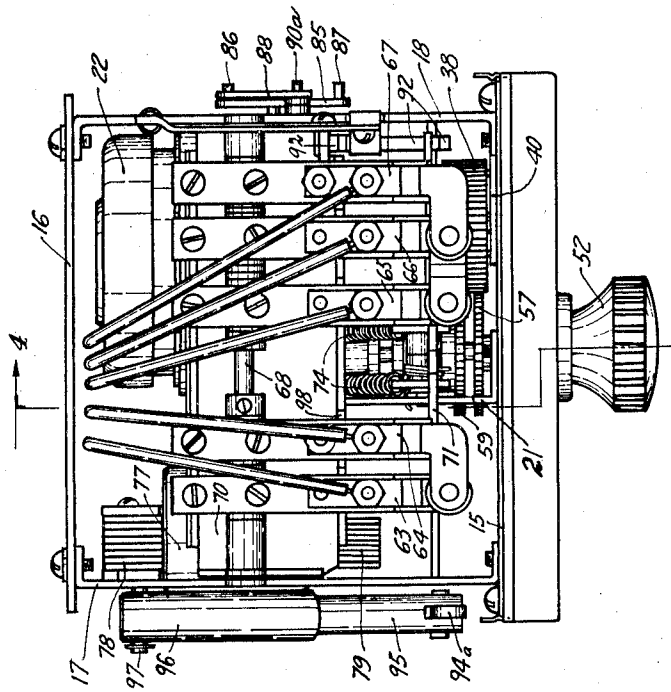

Fig. 3

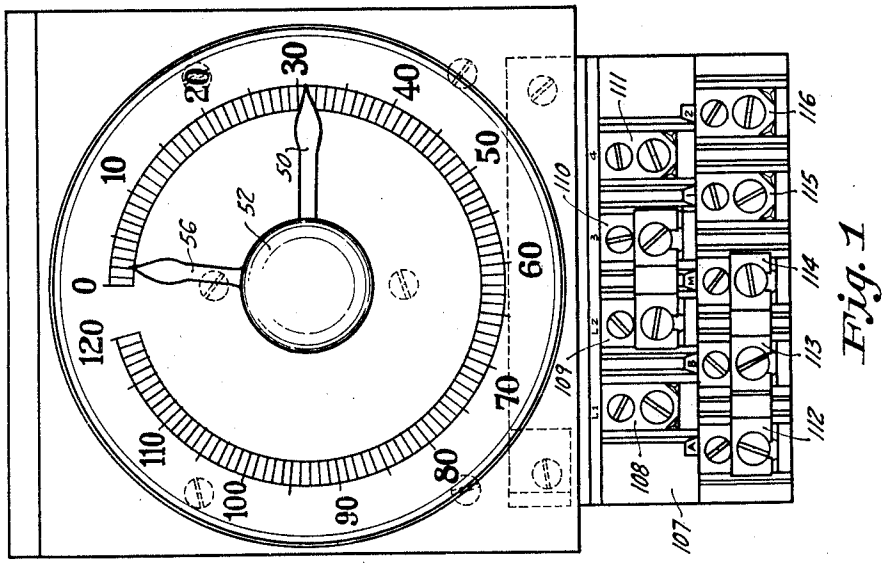

Fig. 1

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TIMING MECHANISM

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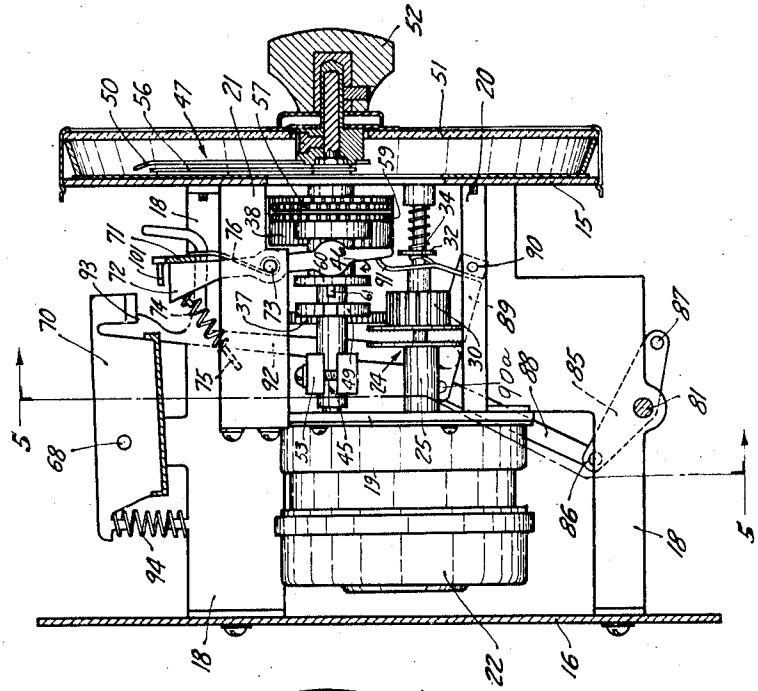

Fig. 4

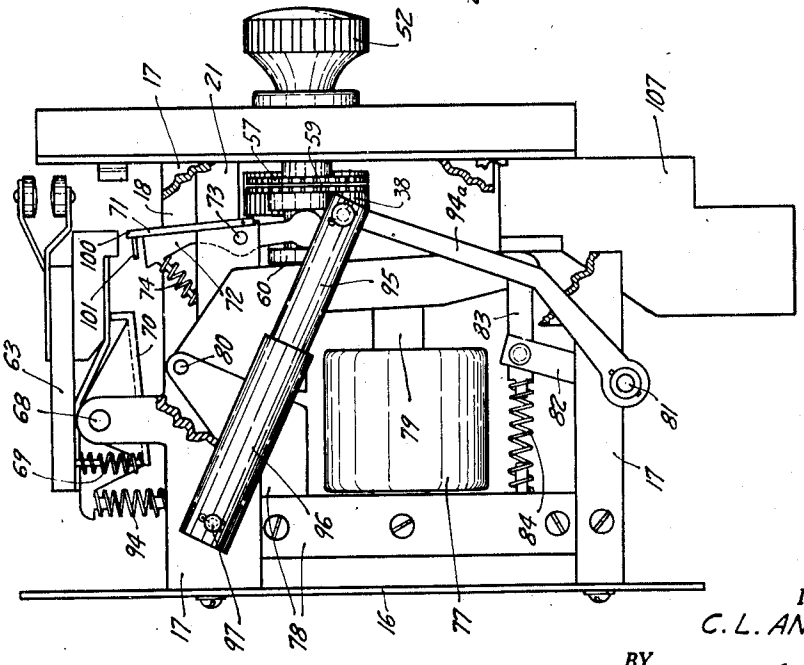

Fig. 2

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Fig. 17

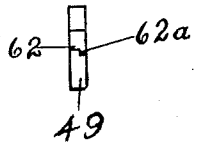
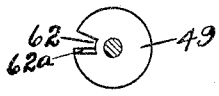


Fig. 18



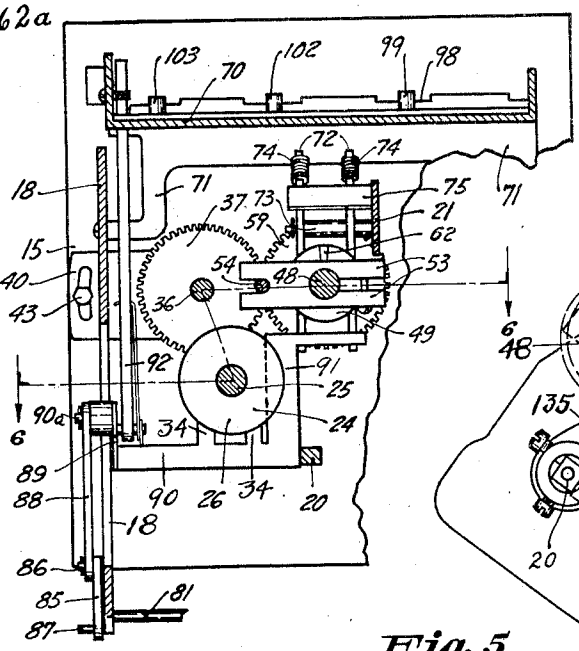


Fig. 5

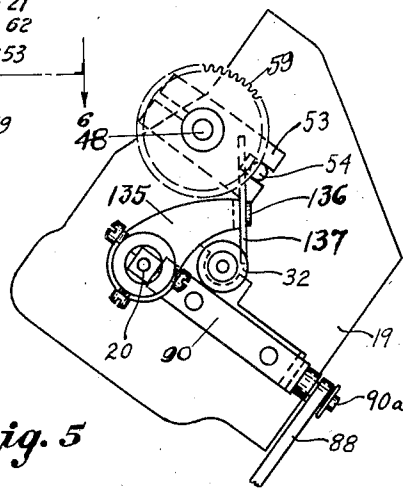


Fig. 6b

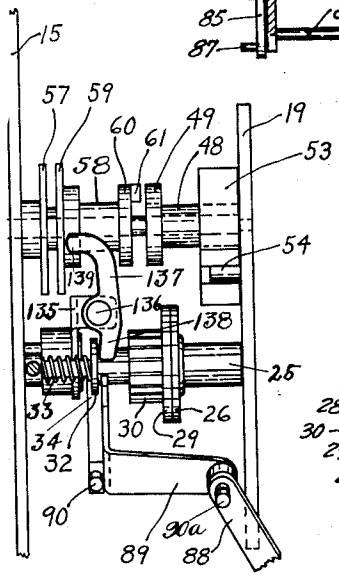


Fig. 6a

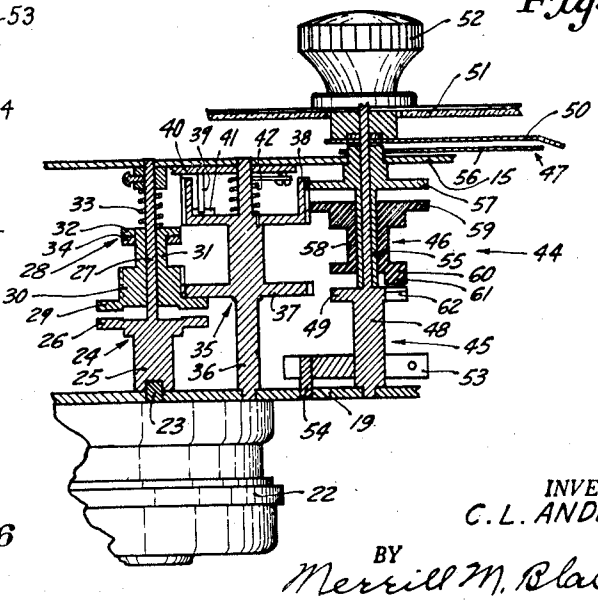


Fig. 6

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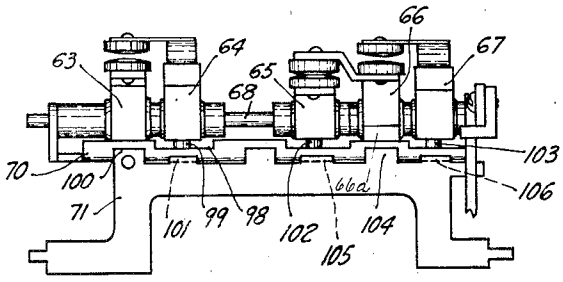

Fig. 7

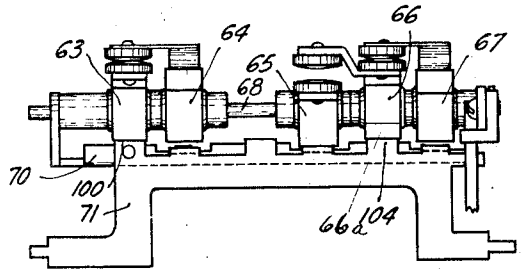

Fig. 8

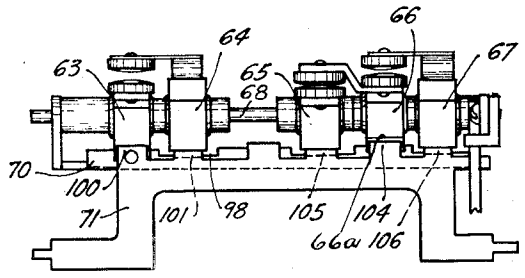

Fig. 9

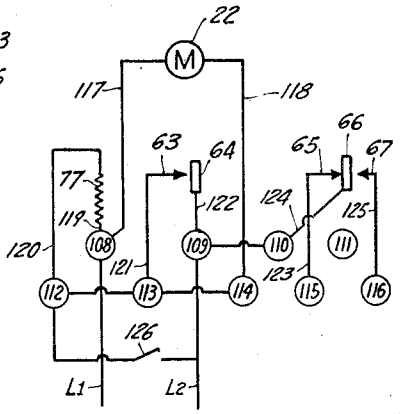

Fig. 10

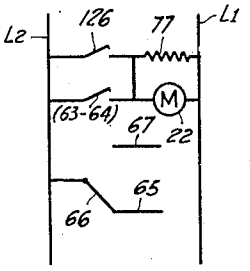

Fig. 11

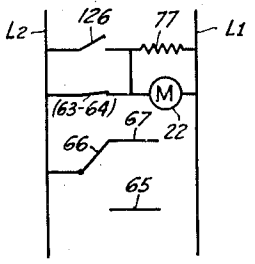

Fig. 12

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TIMING MECHANISM

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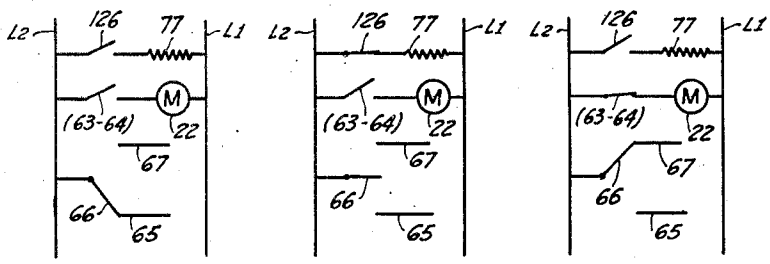

Fig. 13 Fig. 14 Fig. 15

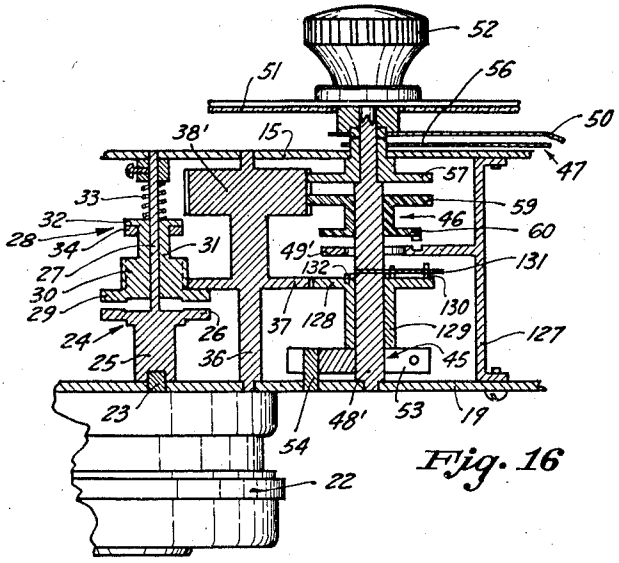

Fig. 16

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Patented Sept. 14, 1943

2,329,447

UNITED STATES PATENT OFFICE

2,329,447

TIMING MECHANISM

Carl Ludwig Anderson, Moline, Ill., assignor to Eagle Signal Corporation, Moline, Ill., a corporation of Massachusetts

Application September 9, 1940, Serial No. 356,005

9 Claims. (Cl. 161—1)

This invention relates to timing mechanisms and has special reference to mechanisms particularly suited to the timed operation of switches, though it should be understood that within the broad purview thereof other mechanisms besides switches may be controlled by the timing mechanisms hereof.

In the construction of timers, rotary timing members have advantages over other types of construction due to the relatively low cost of fabrication thereof and due to the compactness attainable with rotary types. The disadvantages of rotary types of low cost have been, first, the lack of accuracy when employing simple compact types of rotary members and the resultant necessity of large timing members, and, second, the impossibility of using indicating means to show the elapsed time within the cycle. Thus, one timer which others have unsuccessfully attempted to sell recently was provided with an elaborate device to insure accurate setting of the timing member but the deviation in time of actuation at any particular setting was so great that the extreme accuracy of the setting was needless expenditure.

It is a principal object of this invention to provide a timing mechanism which, with a simple arrangement of parts, increases the accuracy of operation many fold. It is a further object to provide a simple, low-cost, accurate timing mechanism having means for indicating at all times the period in the cycle of operation.

In the accompanying drawings, I have shown illustrative embodiments of this invention as applied to the timed actuation of switches. In the drawings,

Fig. 1 is a front elevation of a timer in accord with this invention;

Fig. 2 is a left end elevation with a portion of the framework broken away, better to show the construction and arrangement of the operative parts;

Fig. 3 is a plan of the timer shown in Fig. 1;

Fig. 4 is a vertical section substantially on the line 4—4 in Fig. 3 but with the switches and the terminal block omitted;

Fig. 5 is a partial section substantially on the line 5—5 in Fig. 4;

Fig. 6 is a diagrammatic illustration best described as a section substantially on the plane of the line 6—6 in Fig. 5;

Fig. 6*a* is an edge view of a part of the structure illustrated in Fig. 6, showing certain ancillary control mechanism;

Fig. 6*b* is a front elevation of the structure shown in Fig. 6*a* with part of the structure removed for clearness;

Figs. 7, 8, 9 are details of the switches and switch-operating means in reset, timing, and timed out position, respectively;

Fig. 10 is a wiring diagram of the timer showing three bridges in place between certain of the terminals, and with a starting switch connected thereto;

Figs. 11 and 12 are wiring diagrams of simplified character illustrating operation of the timer when connected as in Fig. 10;

Figs. 13, 14, and 15 are simplified wiring diagrams of the timer connected for another of its applications, showing the operating cycle thereof;

Fig. 16 is a diagrammatic section similar to Fig. 6 but showing a modified form of the timer; and

Figs. 17 and 18 are detailed edge and face views of one element of the structure shown in Fig. 6*a*.

As shown in Figs. 2 and 4, a front frame plate 15 is secured in spaced relation to rear frame plate 16 by side frame plates 17 and 18. An intermediate bearing plate 19 is secured between the plates 15 and 16 parallel thereto by being secured at its right hand end to side frame plate 18 and at its left hand end to front frame plate 15 by frame members 20 and 21. A synchronous motor 22 is secured to the rear surface of the plate 19, and is provided with a driving stub shaft 23 which extends through an opening in the plate 19 into driving engagement with the clutch member 24. This clutch member 24 comprises a shaft 25, a clutch plate 26, and a shaft 27, extending forwardly from the plate 26 into bearing engagement with the frame plate 15. The shaft 25 has an opening in the rear end thereof for insertion of stub shaft 23 whereby the rear end of member 24 is held against lateral thrust. A second clutch member 28, comprising a clutch plate 29, gear 30, sleeve 31, and operating collar 32, is slidably supported on the shaft 27, with the plate 29 facing the plate 26. An operating spring 33 is positioned between the movable clutch member 28 and the frame plate 15. Clutch operator 34, described hereinafter, bears against the rear side of operating collar to cooperate with the spring 33 in moving the clutch under electromagnetic control into engaged and disengaged positions.

An intermediate driving member 35 comprises a shaft 36, which supports non-rotatably thereon a gear 37 in driven engagement with gear 30, and a gear 38, the forward side of which is concave.

The member 35 is rotatably supported by the plates 15 and 19. A pin 39 is carried by a plate 40, adjustable about shaft 36, and extends into the concavity of the gear 38 remote from the center thereof for engagement with a stop 41 in the gear. A helical rewind spring 42 is secured at its ends to plate 40 and shaft 36 in conventional manner for turning stop 41 into engagement with pin 39. This plate 40 is pivotally mounted on the shaft 36 and is provided with a set bolt 43 (see Fig. 5) to clamp the plate in adjusted position about the shaft. Adjustment of plate 41 adjusts the normal or reset position of driving member 35.

The main timing and indicating assembly 44 involves a frictionally held rotatably adjustable member 45 for determining the length of the timed period, a timing unit 46, mounted for rotation thereon and cooperation therewith in measuring the timed interval, and an indicating member 47, also mounted for rotation on member 45, being rotatable with timing element 46 to indicate visually the position thereof. The adjustable member 45 involves a shaft 48, supported for rotation in frame plates 15 and 19, a timing disc 49 secured to the shaft, an indicating pointer 50 secured to the shaft between the plate 15 and transparency 51, and an adjusting knob 52 secured to the shaft. A friction brake 53 is clamped on the shaft 48, and a pin 54 carried by plate 19 engages therewith, to prevent turning thereof, whereby a drag is placed upon the shaft to hold it in adjusted position.

The indicating member 47 comprises a sleeve 55 which is rotatable upon the shaft 48. This sleeve extends from the timing disc 49 forwardly through the plate 15 and has a pointer 56 secured to its forward end between the plate 15 and the pointer 50. The sleeve 55 is provided with a shoulder in engagement with the rear surface of the plate 15, whereby this shoulder and the rear end of shaft 48 prevent endwise movement of the entire timing assembly. The sleeve 55 is further provided with a gear 57 secured thereto in engagement with the gear 38, whereby to indicate the position of the gear 38 at all times during operation.

The timing unit 46 involves a sleeve 58, carried by the sleeve 55, between the gear 57 and the timing disc 49, slidable therealong. Member 46 is provided with a gear 59, in engagement with the gear 38, which is sufficiently wide that the two mesh in all axial positions of member 46. A timing disc 60 is secured to the rearward end of the sleeve 58, for cooperation with timing disc 49 in measuring the desired time interval for which the timer is adjusted.

When the timer is in reset position, the timing unit 46 is in forward position and the clutch is open, whereupon the spring 42 will move the gear train to a position in which the pin 39 engages the boss 61. In this position, pointer 56 is in line with the zero marking on the scale. The pointer 50 is positioned with respect to the timing disc 49 so that when the pointers are in alignment the boss 61 on timing disc 60 is in line with opening 62 on disc 49. The knob 52 may then be adjusted to any desired time as indicated by the scale. Upon timing, as will be explained herebelow, the clutch is closed, the motor driven, and the timing unit 46 spring-pressed rearwardly. Since in reset position, with the knob set for a time interval other than zero, the boss 61 is out of line with opening 62, the boss 61 will therefore ride upon the disc 49 until it is in line with the opening, whereupon under spring pressure the timing unit 46 will move rearwardly causing actuation of the switching means. As the pointer 47 is driven by the same gear as the timing unit, this pointer will indicate the movement of the timing unit and will read directly in the time elapsed since timing started.

A plurality of switch elements 63, 64, 65, 66, and 67 is pivoted on a rod 68 carried by the side plates 17, 18, each switch element comprising an insulated pivoted arm, to the forward end of which is secured a contact member to which electrical connection is made. Each switch element is provided with a spring 69, which bears against the rear edge of cradle 70, and engages the rear end of the respective switch element, whereby the forward end of each element is biased downwardly. A switch controller 71 is pivoted in the plates 17, 18 below the forward ends of the switch elements to control the relative positioning of the elements when allowed by the cradle 70 to be moved under action of springs 69. In order to move the switch controller from one of its controlling positions to another of its positions, as below explained in connection with switch actuation, a pair of identical arms 72 is pivoted on a pin 73 carried by frame member 21 above timing unit 46 (see Fig. 4). A pair of springs 74, supported by arm 75 carried by frame member 21, biases the arm 72 clockwise, as seen in Fig. 4. A spring 76 mounted on the pin 73 biases the controller 71 counterclockwise, as seen in Fig. 4, though the spring 76 is considerably weaker than the springs 74, whereby the arms 72 will move the controller 71 against the action of spring 76. The lower ends of the arms 72 are provided with enlargements which engage the timing unit 46 to move therewith, whereby upon translation of the timing unit rearwardly the arms turn clockwise. Upon such movement, the upper ends of the arms, which engage the switch controller 71, will move the controller from rear supporting position of the switch elements to the forward supporting position.

A solenoid 77 is provided for controlling the positioning of the cradle 70. The solenoid is provided with a fixed core section 78, and with a movable core section 79 pivoted thereto by pin 80. The movable core section is connected to rod 81 through a lever arm 82 fixed to the rod 81, and through a link 83 pivotally connected to the ends of the movable core section and the lever arm 82. A spring 84, engaging the fixed core section and the link 83, biases the rod 81 clockwise, as seen in Fig. 2. At its farther end, as seen in Fig. 4, the rod 81 is provided with a two-ended lever 85, the ends of which are provided with pins 86, 87 adapted to pivotally support one end of the link 88. The upper end of link 88 is pivotally connected by a pin 90a to the rear end of lever 89 which is secured to rod 90 pivotally supported on its axis by the frame plate 18 and the internal frame member 20. A second lever 91 is secured to rod 90 and is positioned so that in raised position of link 88 it turns the arms 72 counterclockwise, as viewed in Fig. 4, moving the timing disc 60 out of cooperative engagement with 49. In lowered position of link 88, the lever 91 is moved to a position allowing the boss 61 to enter the opening 62. A third lever 34 is likewise secured to rod 90 and cooperates with a collar 32, as heretofore described, in operating the clutch. In position such that the timing discs are out of cooperative engagement, lever 34 moves the clutch out of engagement. Upon actu-

ation of rod 90 by the electrically controlled means, involving solenoid 77 and spring 84, to move the timing discs into operative engagement, the clutch also moves into engagement. Therefore, with the knob turned to a position off of the zero reading so that the boss 61 is out of line with opening 62, the timing operation is initiated by turning of rod 81 to engage the clutch and allow the boss 61 to engage the surface of disc 49. The disc 60 is driven at constant speed by the motor until the boss is in line with the opening in the disc, whereupon the spring 74 will instantly snap the control member 71 from one of its positions to the other.

A rod 92, also pivoted to the lever 89, effects a third function upon initiation of timing. The upper end of rod 92 is slidably received in the cradle 70 and is provided with a shoulder 93 to engage the cradle and tilt it counterclockwise against action of spring 94, as seen in Fig. 4, when the rod is raised. In this raised position of the cradle, the positions of the switch arms are controlled by the cradle. Upon lowering of the rod 92 upon initiation of the timing cycle, the cradle turns under action of spring 94, whereupon the switch arms rest upon the controller member 71, whereby their positioning is determined. At the end of the timed cycle, the member 71 is moved, as described previously, whereby the positioning of the switch arms may be shifted to a third relationship, in which positioning they are under control of member 71.

To buffer the action of the electrical control means, involving spring 84 and solenoid 77, an arm 94a is secured to the left end of rod 81 and is pivoted to plunger 95 arranged for sliding movement in dash pot 96 which is pivotally carried on pivot 97 secured to frame plate 17.

An illustrative set of switch arms is shown in Fig. 3, but it should be understood that extreme variation is possible in the switching arrangement. The switch arms 63 and 64 comprise a single pole single throw switch, which may be employed in controlling circuits within the times. Accordingly, very flexible control of this switch is provided, whereby to adapt the timer to diverse types of service. The contact member on switch arm 64 extends over that on switch arm 63. A notch 98 is provided in the forward edge of cradle 70 below arm 64, whereby, when the cradle is in controlling position, this switch may be closed (see Fig. 7). The cradle is also provided with an opening below arm 64 in which a pin 99 may be inserted, whereby this switch may be held open when the cradle is in controlling position (see Fig. 7). When the forward edge of cradle 70 is lowered out of controlling position, and the switch arms are responsive to member 71 in rearward position (see Fig. 8), the arm 63 rests upon upward extension 100 on member 71, whereby the arm 64 is supported by arm 63 clear of both cradle 70 and member 71. In forward or timed out position of member 71, to which it is moved at the termination of the timed period (see Fig. 9), the extension 100 is in a position forward of the arm 63, whereby the arm drops down behind the extension. The arm 64 drops into engagement with and is supported by rearward extension 101 on member 71. For some types of service, a rearward extension may be secured to the rear side of extension 100, which extension is level with the upper end thereof whereby to maintain this switch closed in timed out position. The pin 99 may be omitted whereby the switch is closed in the reset position of Fig. 7.

The remaining switch arms are in general employed for controlling external timed circuits, though for some services these switches may be employed for simultaneously controlling both internal and external circuits. As shown, the arms 65, 66, and 67, together with their associated contact members, constitute a single pole double throw switch. Removable pins 102, 103 may be provided in the cradle 70 under each of the arms 65 and 67, whereby in reset position each of these arms is supported. The contact member associated with arm 66 will then be in contact with that supported by arm 65 and out of contact with arm 67. An upward extension 104 is provided on member 71 whereby in timing position (see Fig. 8) arm 66 rests thereupon while arms 64 and 67 are free to move downward, thereby opening the circuit between arms 65 and 66 and closing that between arms 66 and 67. Rearward extensions 105 and 106 are provided on member 71 below arms 65 and 67 whereby, upon movement to timed out position (see Fig. 9), these arms will be supported and the arm 66 will be free to drop thereby reversing the contact positioning.

Other contact arrangements, as is well known, may be substituted for the single pole double throw switch, as, for instance, two single pole single throw switches.

A terminal block 107 of insulating material is supported at the lower edge of frame plate 15. Conventional electrical conduits 117, 118 connect the terminals 108 and 114 with the two sides of the motor 22. Conduits 119 and 120 connect terminals 108 and 112 with solenoid 77. Conduits 121 and 122 connect the contact elements on arms 63 and 64 with terminals 109 and 113, and conduits 123, 124, and 125 connect the contact elements on arms 65, 66 and 67 with the terminals 115, 110, and 116.

When the timer is arranged as shown in Fig. 10, with bridges on the pairs of terminals 109—110; 112—113; and 113—114, and with the pins 99, 102, and 103 in position and link 88 connected to pin 86, the circuit diagram of Fig. 11 illustrates the circuit conditioning in reset position. To initiate timing, external starting switch 126 is closed, whereupon power is communicated through the solenoid which, through connections, the operation of which has heretofore been described, moves the cradle out of controlling position, closing switch 63—64, and shifting contact arm 66 from arm 65 to arm 67, as shown in Fig. 12. Power is simultaneously communicated to motor 22 through switch 63—64, the solenoid 77 becoming a holding coil for switch 63—64, wherefore the starting switch 126 may be released. Upon the member 71 moving to timed out position, the circuit conditioning returns to that shown in Fig. 11. In this arrangement, the timer automatically resets, involving turning of the cradle into controlling position at the termination of the timed period.

Another application, illustrating the versatility of this timer, involves the use of bridges between terminals 109—110; and 113—114, the positioning of link 88 on pin 87, and the use of pins 99 and 103. In this arrangement, the switch 126 is normally open, and in timed out position the switches 63—64 and 66—67 are open and the switch 65—66 is closed (see Fig. 13). To reset the timer, the switch 126 is closed, whereupon all the switch arms are responsive to the cradle and all switches are open (see Fig. 14). Upon deenergization of the solenoid by opening switch 126, spring 84 moves the remainder of the con-

trol mechanism to engage the clutch. At the same time, the switches 63—64 and 66—67 are closed, switch 65—66 remaining open, as shown in Fig. 15. Termination of the timed cycle changes the circuit conditioning to that shown in Fig. 13.

In the embodiment of the invention shown in Fig. 16, the motor and clutch assembly 24—28 is identical to that shown in Fig. 6. The gear 30 engages and drives the gear 37 on shaft 36, upon which is secured a gear 38' to rotate with gear 37. The shaft 48' extends from the plate 19, in which it is mounted for rotation, through the front plate, and is provided with a knob 52 and pointer 50 to indicate its position. The indicating member 47, as in the form shown in Fig. 6, comprises a pointer 56 and gear 57 secured together with the gear in mesh with gear 38'. The indicating member engages a shoulder on shaft 48' to prevent forward movement of the shaft. The timing unit 46 is the same as shown in Fig. 6 except that it rotates and translates directly on shaft 38' instead of on a sleeve secured to the indicating member. The timing disc 49', which cooperates with timing disc 60, is rigidly mounted upon a frame member 127, thereby making the timed out position fixed instead of adjustable. The gear 37 meshes with a gear 128 supported by a sleeve 129 immediately forward of the brake construction. A pin 130 extends forwardly from the front face of gear 128 and engages a pin 131 fixed in and rotatable with shaft 48'. Accordingly, in this form, the reset position is adjustable by the knob 52. A spring 132, secured to pin 131 and gear 128, returns the movable clutch member, shaft 36, and gear 128 to reset position upon disengagement of the clutch.

With the clutch disengaged, and the timing discs out of cooperative engagement, the knob 52 is adjusted to the desired position as indicated by the scale. As the gear 128 is free to move under action of spring 132, the pins 130 and 131 remain in engagement and, therefore, through the gears 37 and 33', the timing and indicating units move with the knob. Accordingly, in reset position, the two pointers will be in alignment. Upon actuation which engages the clutch and which moves the timing unit rearwardly to slide upon timing disc 49', the three gears 57, 59, and 123 rotate synchronously. Rotation will continue until the pointer 56 is in line with the zero on the scale, whereupon the timing unit will translate upon shaft 48', as previously described.

While in both forms of the invention, the reset and timed out positions are relatively rotatively adjusted by the knob, in the first form it is the timed out position which is adjusted and in the second the reset position. In the first form, the indicating pointer 56 reads on the scale directly in the time of the cycle elapsed, while in the second the pointer reads in the time yet to elapse. It is thus to be seen that, in the first form, the pointer starts timing from zero, in the second form, from a position in line with pointer 50, and that the motor must rotate oppositely in the two forms.

As shown in Figs. 6*a* and 6*b*, this mechanism may be, and preferably is, provided with means for insuring release of the clutch when the timing unit 46 moves longitudinally of sleeve 55 carrying the boss 61 into the opening 62 of disc 49. This comprises a support 135 carried by a rigid part of the structure, having a pivot 136, on which is pivotally mounted a lever 137, of which the end 138 engages the collar 32, and the end 139 engages a flat face of gear 59. Therefore, as the arms 72 move the unit 46 longitudinally along the sleeve 55 toward disc 49, the lever 137 is rocked about its pivot 136, and end 138 pushes collar 32 forwardly, pulling clutch plate 29 out of engagement with plate 26. This frees the clutch 24 and permits rotation of clutch member 29 independently of motor 22. Consequently, the knob 52 may be turned to set the hand 50 without rotating the rotor of the motor.

As shown in Figs. 6, 17, and 18, the opening 62 is preferably not uniform in dimensions, being provided with a step 62*a* which permits the boss 61 to enter opening 62 part way and then pause before entering all the way. When boss 61 aligns with opening 62, then, through the pressure of springs 74 and arms 72, unit 46 will be moved until boss 61 engages step 62*a*. Also, arms 72 push support 71 forward slightly, releasing switch support 65 ahead of 63 because of the notch 66*a* cut in the end of 66. This permits the switch 65, 66 to close momentarily before 63 is released from 64 by the continued rotation of element 46, the former being held up by the rest 130 until the boss 61 enters all the way into the opening 62. When this happens, the levers 72 turn about their pivot 73 as far as unit 46 will permit them to turn. This pushes member 71 forward, releasing switch element 63 and permitting it to withdraw from switch element 64. This breaks the circuit to the timing motor 22 and causes reset.

When the above description is considered in the light of prior constructions, it is to be seen that this invention is limited to neither of the specific forms disclosed; wherefore, it should be understood that the scope of this invention is defined only by the subjoined claims.

Having now described my invention, I claim:

1. A snap action timing mechanism, comprising cooperating timing means, one of which is rotatable and normally spring biased in one rotative direction, one of said timing means being mounted for reciprocation, said timing means cooperating to allow reciprocation thereof in one rotative position of the rotatable timing means and to prevent reciprocation in other rotative positions thereof, spring means to effect reciprocation when said elements are in said position allowing reciprocation, means for limiting spring biased movement of said spring biased timing means, said limiting means and the timing means other than said spring biased means being relatively adjustable to vary the degree of movement of the spring biased means from the limited position to the position allowing reciprocation, and chronometric driving means for rotating said rotatable means against the bias thereof whereby to measure predetermined time periods.

2. A snap action timing mechanism, comprising cooperating timing means, a shaft upon which one of said timing means is mounted for rotation thereabout and reciprocation therealong, spring means normally to bias said rotative means in one rotative direction, spring means to bias said rotative means in one reciprocative direction, a pair of limiting means, one of which cooperates with said rotative means to limit spring biased rotation thereof, and the other of which in one rotative position of said timing means allows spring biased reciprocation thereof and in other rotative positions thereof prevents such spring biased reciprocation, one of said limiting means being normally fixed and the other cooperating with said shaft upon rotation of said shaft to

vary the degree of movement of said rotative means between the limiting positions, and means for effecting rotation of said rotative means between said limiting positions in the opposite direction from that produced by the spring means.

3. A timer comprising a shaft, a timing element mounted for rotation on and reciprocation along said shaft, a spring for biasing said timing element for rotation in one direction, means for limiting spring bias rotation of said timing element in one direction, a timing motor operatively connected to rotate said timing element in the opposite direction, a second means for limiting rotation of said timing element when driven by said motor, said timing element and said second limiting means cooperating to allow reciprocation of the timing element in a position thereof limited by said limiting means, means for indicating the rotative position of the element in all positions thereof along the shaft, means to synchronize rotation of the element and of the indicating means, and means to rotate the element.

4. A timer comprising a shaft fixed against longitudinal movement, a timing element mounted for rotation about and reciprocation along said shaft, said timing element being rotatable between limiting positions for determining desired time intervals, means for reciprocating said timing element relatively to said shaft when in one of its limiting positions, means mounted in fixed position along said shaft for rotation with said shaft for indicating the rotative position of said timing element at all times, and means synchronously to rotate said timing element and said indicating means.

5. A timer comprising a manually adjustable rotatable shaft, a timing element mounted for relative rotation on and for reciprocation along said shaft, said timing element being rotatable between limiting positions for determining desired time intervals, means for reciprocating said timing element in one of its limiting positions, said shaft and said timing element cooperating to effect relative adjustment of the limiting positions upon manual adjustment of said shaft to vary the time interval, means mounted for rotation on said shaft for indicating the rotative position of said timing element at all times, and means synchronously to rotate said timing element and said means for indicating.

6. A timer comprising a shaft, a timing element mounted for rotation on said shaft and for reciprocation therealong, limiting means cooperating with said timing means for limiting rotation thereof in opposite directions, indicating means mounted for rotation on said shaft for indicating the relation rotative position of said element in all positions thereof along said shaft, said timing element and said indicating means each comprising a gear, and drive means for rotating said timing element comprising a shaft, a gear secured to said shaft which engages the timing element gear in all positions of the element along the shaft, and a gear secured to the shaft which engages the gear of the indicating means, whereby the timing element and the indicating means are synchronously rotated upon rotation of said drive means.

7. In a snap action timer, the combination comprising a shaft, a pair of timing elements carried by the shaft, one of which is secured thereto and the other of which is rotatable with respect thereto, one of said pair being reciprocable therealong, one of said pair having a face perpendicular to the shaft and having an opening therein, and the other having a projection extending toward said face, spring means to bias the reciprocable element toward the other element, said projection normally riding on said face to prevent movement together of the elements, and said projection cooperating with said opening to allow reciprocation of said reciprocable element toward the other element, means for rotating the rotatable element in opposite directions, coaction of said projection and opening limiting rotation in one direction, and means for limiting movement in the opposite direction, said shaft being rotatable whereby to adjust the relative positioning of the element secured to the shaft and the limiting means.

8. A switching mechanism comprising cooperating switch elements, controlling means for controlling the relative positioning of said elements, and upon actuation to effect change of the relative positioning of said switch elements, holding means to hold said elements non-responsive to said controlling means and to control the relative positioning of said elements when so held, a pair of timing elements, one of which is rotatable from an initial limiting position to a time determining position, means for reciprocating one of said elements when said rotatable element is in determining position, means operatively connecting the reciprocable element and said controlling means for actuating the latter upon reciprocation of the former, and means for reciprocating said one of said elements in the opposite direction and for simultaneously moving said holding means to holding position.

9. In a timer, the combination comprising a shaft, a timing means rotatable on and translatable along the shaft, spring means and chronometric means for rotatively driving said timing means in opposite directions between limiting positions, a gear secured to said timing means, a face plate, indicating means positioned on the side of said face plate opposite said timing means, a gear secured to said indicating means to rotate therewith, and unitary gear means in mesh with each of said gears.

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