Sept. 7, 1943. S. C. HOLSTON ET AL 2,328,905

TIMING MECHANISM

Filed July 11, 1941 2 Sheets-Sheet 1

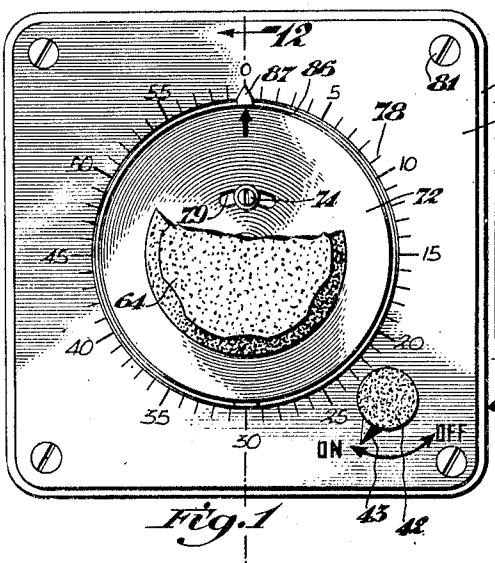


Fig. 1

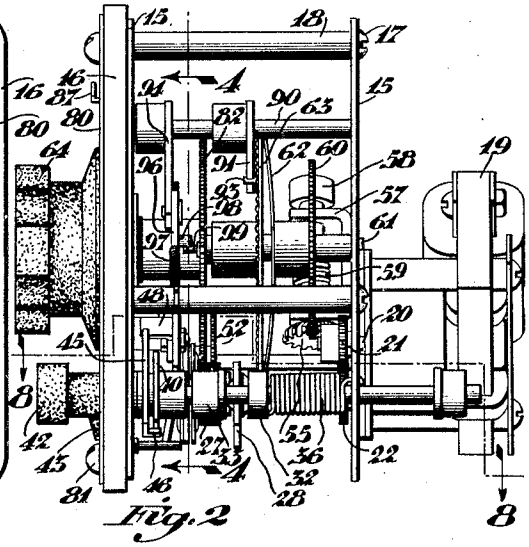


Fig. 2

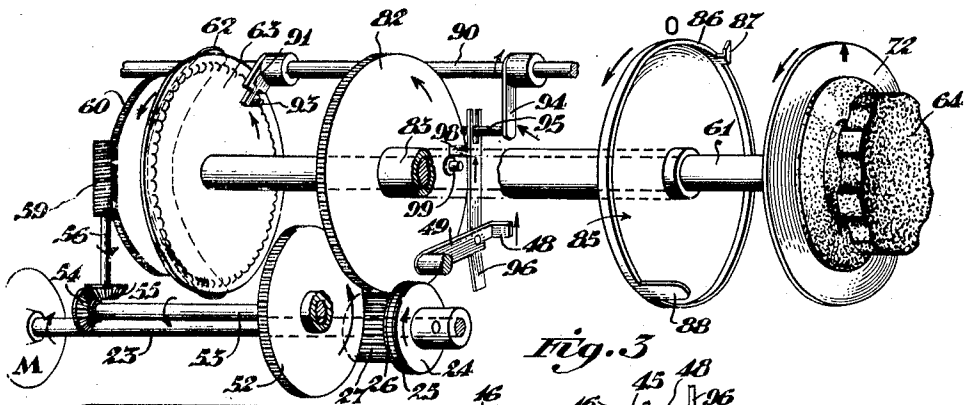


Fig. 3

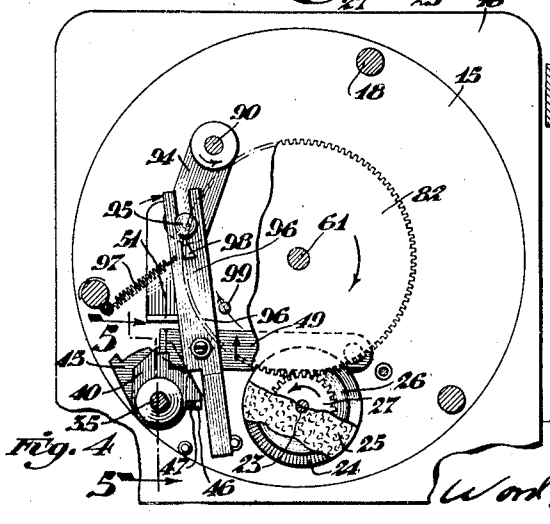


Fig. 4

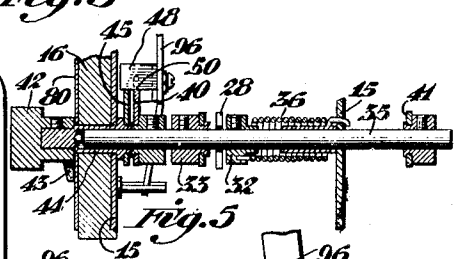


Fig. 5

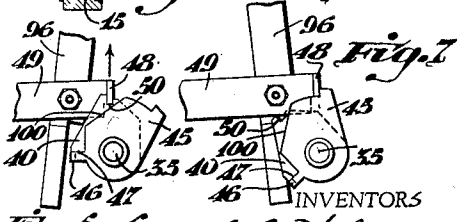


Fig. 6

Fig. 7

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TIMING MECHANISM

Filed July 11, 1941 2 Sheets-Sheet 2

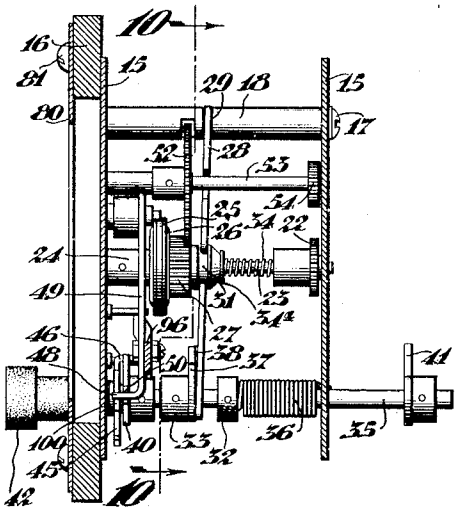


Fig. 8

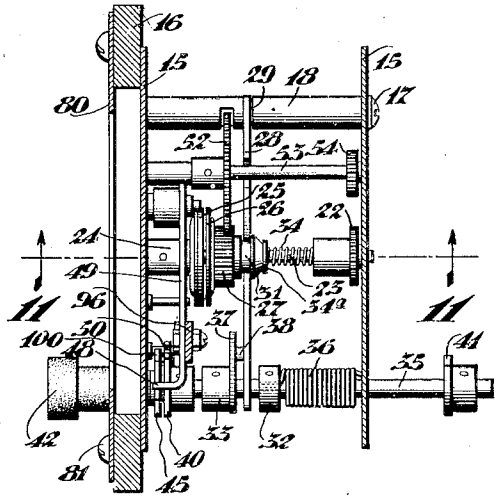


Fig. 9

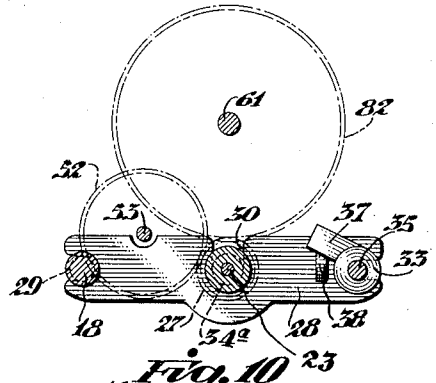


Fig. 10

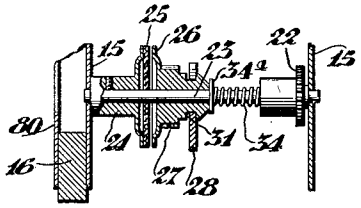


Fig. 11

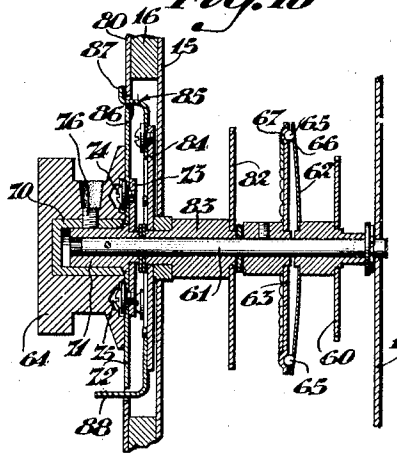


Fig. 12

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UNITED STATES PATENT OFFICE

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TIMING MECHANISM

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Application July 11, 1941, Serial No. 402,026

16 Claims. (Cl. 200—39)

This invention relates to timing mechanism and is particularly directed to an apparatus which may be set to run for a predetermined time, and which will, at the termination of the predetermined time, operate a switch for breaking the circuit to an electrical apparatus such as X-ray equipment, therapeutic machines, and permanent wave machines or the like.

This general type of timing mechanism has been well known in the past and one example may be found in the patent to Flarsheim No. 1,864,487 issued June 21, 1932. Broadly speaking, the mechanisms consisted of an escapement mechanism; that is, a gearing arrangement driven by means of a clock spring or the like for moving the previously set dial in an anti-clockwise direction to return it to zero. On its return to zero, the dial driving mechanism was effective for tripping a device for operating the switch and for stopping the driving movement of the escapement mechanism.

More specifically, the present improvements relate to a timing mechanism in which it has been the object of the inventors to provide a wider range of timing use. The present improvements reside in the provision of a mechanism which will control apparatus; that is, time its operation, through periods ranging from one second to fifty-nine minutes. Quite obviously, the increase in range of use has produced certain problems in the construction of the mechanism for setting, driving, and tripping purposes.

In the first place, it has been the general object to provide a mechanism of this type which includes two setting dials, one of which may be set to the number of minutes desired, and the other of which may be set to the number of seconds required over any given number of minutes. For example, the minute dial may be set to, let us say, three minutes, and the second dial may be set to a predetermined number of seconds, let us say, fifteen, whereupon the mechanism will throw a switch after the elapse of three minutes and fifteen seconds. The gearing for time controlled mechanism may be in the form of gearing driven by means of a synchronous motor.

Accordingly, it has been a further object of the present inventors to provide a mechanism of the type in which a constantly driven escapement transmission is provided which is controlled for terminating the return movement of the dials at zero through the medium of a clutch or the like, which clutch is manually coupled initially to start the timing and automatically uncoupled when the dials reach zero.

It has been a still further object of the present inventors to provide a tripping mechanism in this combination, which tripping mechanism includes an element directly controlling the release of the switch actuating means, particularly, an element arranged to have a compound movement. One of its movements is brought about by actuation from the minute dial driving mechanism for setting up or locating the element for final tripping movement by means of the second dial driving mechanism.

In other words, the arrangement is such that the mechanism will not trip as the second dial passes through zero unless the minute dial is in a position indicating less than one minute. When the minute dial passes the graduation indicating one minute, it moves the control element in one plane to place it in position for engagement and operation by the second dial driving mechanism in another plane as this latter mechanism completes its final revolution.

It has been a still further object of the present inventors to provide a switch setting and operating dial so related to the tripping mechanism that the switch may be operated, despite the fact that the timing mechanism is still operating, to return the dials to zero and also wherein the switch on the machine being controlled may be operated with no interference from the timing mechanism even though it is connected to it. Thus, it is arranged so that the operator may quickly stop the operation at any time by returning the switch setting dial to "off" position. This is effective for stopping the dials and the operator is able to ascertain the elapsed time between the setting time and the time at which he manually shut off the switch; this, of course, being accomplished merely by considering the difference between the set position and the position indicated by the dials at their stopped position.

Other objects relate to the provision of a mechanism which is extremely accurate; that is, wherein the starting of the movement of the dials takes place instantly upon the operation of the switch and likewise wherein the switch is thrown and the mechanism stopped at the same identical moment that the dials return to zero.

Other objects and certain advantages of the present invention will be more fully apparent from the following description of the drawings in which:

Figure 1 is a front view of the improved timer switch-operating mechanism of this invention.

Figure 2 is a side view of the mechanism.

Figure 3 is an exploded diagrammatic perspec-

tive view, illustrating the mechanisms for operating the switch through the minute and second operated mechanisms.

Figure 4 is a sectional view taken on line 4—4, Figure 2, illustrating the switch mechanism in position, whereby the second timing mechanism is not effective for tripping in the particular revolution due to the fact that the mechanism has been set for a period over one minute.

Figure 5 is a sectional view taken on line 5—5, Figure 4, showing the details of the parts mounted on the switch-setting and operating shaft.

Figure 6 is a fragmentary view of the switch-tripping mechanism, showing it in set position prior to being tripped.

Figure 7 is a view taken similar to Figure 6, but showing the mechanism tripped.

Figure 8 is a sectional view taken on line 8—8, Figure 2, showing the mechanism after the switch has been closed and the timing mechanism set and with the clutch of the timing mechanism in connection.

Figure 9 is a view taken similar to Figure 8, showing the clutch released after the switch mechanism has been tripped.

Figure 10 is a sectional view taken on line 10—10, Figure 8, further detailing the clutch operating mechanism.

Figure 11 is a sectional view taken on line 11—11, Figure 9, further detailing the clutch.

Figure 12 is a sectional view taken on line 12—12, Figure 1, detailing the dials for setting the switch-operating timing mechanism.

The embodiment of the invention disclosed here, described generally, consists of a frame, the front panel of which includes the indicator panel, the minute dial, and the second dial. The timing mechanism consists of a gear train driven by means of a synchronous motor in this case. Obviously, a clock mechanism or other driving means may be employed. The dials are driven backwards by the mechanism, the second indicator rotating a full revolution to each minute, and the minute dial rotating one graduation to each complete rotation of the second dial. A clutch is interposed between the driving means and the gear train and is controlled by means of a trip mechanism.

The trip mechanism has a compound movement. When the timer is set for periods over a minute, the minute dial will, upon return to the one-minute position, set up the trip mechanism for subsequent tripping at zero by means of the second dial. When the trip mechanism is tripped by the second dial, it automatically releases a spring actuated switch control shaft which is effective for immediate switch operation at the mechanism being controlled, such as an X-ray or treatment apparatus.

Referring to the details of the drawing, the frame consists of circular plates 15 respectively front and back. A face plate 16 is secured to the front frame plate. The frame plates 15 are held in spaced assembly by means of screws 17 and spacer sleeves 18. In this particular case, three of these screws and spacer sleeves are utilized. The various shafts of the mechanism are supported upon and between the front and back plates 15—15. The synchronous motor 19 is secured to the back plate by means of screws or the like (not shown). The shaft 20 for the motor extends through the back plate 15 and carries a gear 21 (Figure 2) fixed to it on the inner side of the back plate. This gear meshes with another gear 22 (Figures 8 and 11). The gear 22 is fixed to a shaft 23 journalled in the respective plates 15—15.

A clutch element 24 is fixed to the forward end of the shaft 23 and carries a clutch plate or disc 25 cooperating with the clutch element 26 which includes the main driving gear 27. A clutch-operating arm 28 (Figure 10) has one end of bifurcated form engaged in a notch 29 in one of the spacer sleeves 18. A vertical slot 30 is provided in the clutch arm intermediate the length of the clutch arm which engages with the groove 31 of the clutch element 26. The other end of the clutch arm is bifurcated and is loosely engaged between a pair of collars 32 and 33 (Figures 8 and 9).

A coil spring 34, under compression between a washer 34a, engaged against the clutch element 26, and the hub of the gear 22, normally urges the clutch element 26 toward clutching position. Accordingly, the means controlling the outer end of the clutch arm is in the nature of a means releasing the clutch so that it may become engaged.

The clutch arm is actuated or swung on the pivot (afforded by the groove 29) by means of a shaft 35 carrying the collars 32 and 33. The collar 32 is pinned to the shaft and has one end of a wound spring 36 anchored to it. The other end of the spring 36 is anchored to the frame. The spring is under constant winding tension, tending to return the shaft when the shaft is released.

The other collar 33, also fixed to the shaft 35, includes an arm 37 having camming engagement with a lug 38 on the forward side of the clutch arm 28. When the shaft 35 is rotated to set the switch (on the machine being controlled), the arm 37 moves out of contact with the lug and permits the clutch to become engaged under spring pressure. The shaft 35 also carries a holding element 40 (Figures 4 to 7 inclusive) which, when engaged by the automatic trip when the dials are set, holds the switch shaft 35 in operative position. The outer end of the switch shaft carries an arm 41 which may be connected to the control switch of any unit, such as an X-ray apparatus or a treatment lamp. After the timer has been set through the minute and second dials, the switch shaft is rotated to close the circuit and start the timing mechanism in operation.

For this purpose, a manipulating knob 42 is provided at the front of the face plate (Figure 1) and includes a pointer 43, movable relative to the insignia, respectively "On" and "Off." The switch shaft 35 has its forward end supported or piloted into a shaft 44 to which this manipulating knob 42 is attached (Figure 5). This shaft 44 projects through the panel and the front frame plate of the device and carries an arm 45 on its inner end disposed in substantial abutment with the arm 40. The arm 45 includes a laterally extended lug 46 engaging an offset 47 of the arm 40. Thus, the return pressure of the coiled or wound spring 36 is taken by the arm 45, and the arm 45 is limited in its rotative movement by engagement of an offset thereof with the flange 48 of a pivoted arm 49 of the trip mechanism.

Now, when the knob is rotated in the "on" direction, the lug 46 swings the arm 40 to a position where the downwardly urged pivoted lever 49 moves down into a notch 50 in the upper edge of the arm 40. In other words, the pivoted arm snaps into position and the shaft is locked against rotation until release by displacement of the pivoted arm 49 upwardly. The pivoted element can

never be moved upwardly to clear the stop lug of the arm 45 due to the provision of a stationary stop element 54 (Figure 4) fixed to the forward plate of the device.

In order to understand the tripping mechanism, actuating the pivoted arm 49, and its operation, it seems proper at this time to describe the timing mechanism which controls the tripping. Returning to the gear 27, it is pointed out that this gear is normally stationary; that is to say, when the dials are at zero, the drive proceeds to the gear 22, the shaft 23, and the clutch element 24.

When the clutch is engaged by moving the knob 43 to "on," assuming the dials are set for timing, the gear 27 is driven. Two gears mesh with this gear 27—one for the minute dial and one for the second dial. The gear which drives the minute dial is indicated at 52. It is fixed on a shaft 53 journalled in the frame plates. This shaft 53 carries a gear 54 meshing at right angles with a gear 55 fixed to a transverse shaft 56. The shaft 56 is journalled in a bracket 57 and is held against axial displacement by means of a collar 58 fixed on the opposite end of the shaft to the end carrying the gear 55. The bracket 57 is of U-form having the gear and collar disposed against the outer sides of its respective arms. A worm 59 is fixed to this shaft 56 between the arms of the bracket and meshes with a worm gear 60 loosely rotatably mounted on the dial shaft 61.

The hub of the gear 60 carries a diametrically disposed flexible driving arm 62. The driving arm is disposed adjacent to the driven disc 63 of the minute dial. This disc is fixed to the shaft 61 and therefore, is fixed to the manipulating knob 64 at the front of the dial plate (Figure 12). The coupling means between the coupling arm and the disc 63 consists of balls 65 disposed in apertures 66 in the respective ends of the coupling arm 62. These balls cooperate with circularly arranged depressions 67 in the disc 63.

The arrangement constitutes a coupling of detent form for connecting the ends of the coupling bar to the disc. It is apparent that the disc may be rotated relative to the arm to permit the setting of the dial relative to the driving gear 60. That is to say, the balls will snap from one depression to another as the minute dial is adjusted. The spring tension in the driving arm, however, is sufficient to maintain a driving connection to the disc when the drive from the synchronous motor is connected through the clutch and therefore, the disc will be rotated backwards to return the minute dial to zero.

The details of the manipulating knob and its connection to the disc 63 are best shown in Figure 12. The composition knob 64 includes a metal bushing 70 engaged over the hub 71 of the minute-indicating dial 72. Specifically, this dial 72 is fastened to the hub by means of a hub plate 73, screws 74 being engaged through the dial into the hub plate. The hub of the dial is fastened to the shaft 61. The connection of the knob to the hub is accomplished both by means of the engagement of the screws 74 in recesses 75 in the inner face of the manipulating knob and by means of a set screw 76 engaged in the manipulating knob and against the hub of the dial.

As will be seen from Figure 1, this dial includes an arrow which is set to indicate the minutes relative to the graduations 73 on the indicator plate. Just as on the face of a clock, these graduations indicate both the minutes and the seconds, there being 60 graduations. Accordingly, the timer can control operations up to 59 minutes or operations as short as one second. For the purposes of initially adjusting the dial relative to the indicator panel, the screws 74 pass through arcuate slots 79 in the dial plate 72. This dial plate is disposed so that its outer face is flush with the outer face of the indicator panel or plate 80. The indicator plate is held against the face plate by means of screws 81. Thus, it is possible for the operator to set the minute indicator dial through the knob and the drive will pick it up at any set position to return it to zero.

The drive for the second dial is more direct, for in this case, the gear 27 is in direct mesh with a large gear 82 including a hub 83 loosely mounted on the shaft 61. The hub 83 of the gear 82 (Figure 12) carries a hub plate 84 which in turn carries the second indicator dial 85 fixed to the hub plate in the same manner as the minute dial. The second dial includes a forwardly turning circumferential flange 86 extended between the periphery of the minute dial and the margin of the opening in the indicator plate. It includes an indicator point 87 turned radially outwardly so as to overlie the graduations on the indicator plate. It also includes a manipulating extension 88 extended outwardly a sufficient distance to be grasped for manipulation. For convenience and as shown on the front of the dials and the indicator plate, the indicator for minutes is red and that for seconds is black. Appropriate directions identify these indicators.

Now, when the synchronous motor is coupled through the clutch, it is obvious that the gear 27 drives both the minute train and the second train. Just as in the case of a clock, the second dial makes a complete revolution to each movement of the minute dial from one graduation to the next. Each of these trains includes tripping means active upon the tripping mechanism heretofore described.

The tripping mechanism consists of the following arrangement: A shaft 90 is journalled in and between the front and rear frame plates. This shaft carries an arm 91 disposed adjacent the disc 63 and adapted to be engaged by means of a pin 93 on the margin of the disc. As the minute dial returns to zero, it will be effective for engaging the arm 91 and rotating the shaft. To utilize this movement, the shaft carries another arm 94. This arm 94 has a pin 95 on its outer or lower end engaged in the bifurcated upper end of a tripping lever 96, which lever has a compound action. This lever 96 is pivotally connected at its lower end to the outer or swinging end of the pivoted lever arm 49. It is normally urged downwardly, so as to urge the pivoted arm downwardly, by means of a coil spring 97 under tension between one of the spacer sleeves and the upper end of the tripping lever. The tripping lever includes a lug 98 at its upper end, which lug is adapted to be disposed in the path of movement of a pin 99 carried by the second dial driving gear 82.

Now, when the minute hand returns to zero, it is effective for swinging the tripping lever inwardly so as to dispose the lug 98 in the path of movement of a pin 99. Since this can only occur after the minute hand passes the one minute indication and returns to zero, it is obvious that the pin 99 will, on all previous revolutions, clear the lug 98. However, on the last revolution, after the lug has been set up by the return

of the minute dial toward zero, the lug will be engaged by the pin 99, and the tripping lever will be moved upwardly; that is, the bifurcation will slide relative to the pin 95. This will lift the pivoted arm from the notch 50 in the arm 40, and the wound spring 36 will be effective for snapping the switch to open position.

By virtue of the arrangement shown here, it is possible to operate the switch on the mechanism independently of the timer, for quite obviously, when the mechanism is at zero, the pivoted arm is held upwardly out of the path of movement of the arm 40. Moreover, in the event that the operator wishes to stop the treatment or operation being controlled prior to return of the dials to zero, this can be done by turning the knob 42 to "off" position. This trips the tripping mechanism manually (Figures 6 and 7) by engagement of the cam surface 100 of the arm 45 with the flange 48 of the pivoted lever 49, moving the lever out of the groove 50 and thus releasing the shaft.

Operation

Let us assume that the operator wishes to control the particular machine for an operation lasting one minute and ten seconds. With this in mind, the minute indicator; that is, the arrow on the dial 72, is set to the first graduation. The second indicator; that is, the point 87, is set to the tenth graduation.

With the timer dial thus set, the operator moves the starting knob 42 to the "on" position. This movement places the tripping mechanism in the position shown in Figures 4 and 6. That is to say, the pivoted lever 49 is urged down into the notch 50 in the upper edge of the arm 40 by means of the spring 97 acting on the tripping lever 96. This same movement; that is, the spring-urged movement, is effective for pulling the lever 96 outwardly to swing the lug 98 out of the path of movement of the pin 99. This latter movement is possible since the pin 93 has been moved to a position just clear of the lever 91.

Specifically, rotation of the shaft 35 through the knob 42 moves the lever 41 to throw the machine control switch into "on" position. The arm 40 is moved and the shaft rotated through the engagement of the lug 46 with the offset 47 of the arm 40, the shift taking place from the position shown in Figure 7 to that shown in Figure 6.

Rotation of the shaft 35 is effective, as described before, for clutching the drive from the synchronous motor to the gear 27, specifically, by swinging the clutch lever 28 by engagement of the arm 37 with the lug 38. Thus, instantly when the switch is closed, the timing mechanism begins to drive the indicating dials back to zero. As the second indicator passes zero, the pin 99 will clear the lug 98 (Figure 4) and tripping will not take place. Just after this, the pin 93, coming into engagement with the lever 91, swings the lever 96 inwardly to bring the lug 98 into the path of movement of the pin 99.

Therefore, as the second indicator comes around to zero the second time, the pin 99 will engage the lug 98 and will raise the lever 96, swinging the pivoted lever upwardly out of the notch 50; whereupon, the spring 36 will be effective for snapping the switch arm 41 back to normal "off" position for shutting off the machine. Instantly, the clutch is disengaged since the shaft 35 swings the arm 37 against the lug 33 which swings the clutch lever and pulls the clutch 26 out of engagement with the clutch plate 25.

It will be apparent that the timer may be turned off at any time and then turned on without disturbing the set running time of the timer. That is to say, the time during which the switch is turned on accumulatively, is equal to the set time. This result occurs due to the fact that the operation of the switch cuts off the power to the dials.

Moreover, there is substantially no backlash in the drive to the dials. There are just two meshing gears between the clutch and the dials. Since the drive is constant on the gears up to the clutch, any looseness in this part of the drive up to the clutch is constantly taken up by the driving force. When the clutch is thrown in, the drive is picked up at once without loss of motion.

Having described our invention, we claim:

1. In a timing mechanism, a minute dial, a second dial, driving means for said dials respectively, an indicator panel for said dials, a switch control means, a tripping mechanism for said switch control means, and said tripping mechanism including means acted upon by said minute dial driving means as it moves from the first graduation toward zero and thereafter by the second dial driving means for tripping the tripping mechanism.

2. In a timing mechanism, an indicator panel, a driving means, a minute dial, a second dial, said dials movable relative to the indicator panel, a transmission extending from the driving means to said dials for driving them in reverse direction to return them to zero after they have been set, said transmission driving said second dial one complete revolution to each movement of the minute dial between graduations, switch operating means, a clutch in said transmission, a trip mechanism for said switch operating means and said clutch, said trip mechanism including an element movable in two planes, said element being moved in one plane by means of said minute dial as it approaches zero from the first graduation, said movement placing said element in the path of movement of the second dial, and said second dial including means adapted to move said element in another plane as it reaches zero for tripping the trip mechanism for operating the switch operating means and declutching the clutch.

3. In a timing mechanism, a driving means, a minute dial, a second dial, an indicator panel including graduations for indicating the movement of said dials, a transmission extending from the driving means to said dials for driving them in reverse direction to return them to zero after they have been set, said transmission driving said second dial one complete revolution to each movement of the minute dial between graduations, a switch shaft adapted to be rotated to close a switch, a trip mechanism for returning said shaft to open the switch, said trip mechanism including an element movable in two planes, said element being moved in one plane by means of said minute dial as it approaches zero from the first graduation, said movement placing said element in the path of movement of the second dial, and said second dial adapted to move said element in another plane as it reaches zero for permitting return of the switch shaft and opening of the switch.

4. In a timing mechanism, a switch operating shaft, a second dial, a minute dial, means for adjusting said dials to a predetermined position, a synchronous motor for driving said dials in re-

verse direction to return them to starting position, a clutch for disconnecting said motor from said dials, a tripping mechanism for controlling said switch shaft, means for declutching said clutch actuated by said tripping mechanism, said tripping mechanism including means actuated by said minute dial driving mechanism for shifting the tripping mechanism from one position to another and means on the second dial driving transmission for engaging said tripping mechanism in said last-named position, whereby it trips said tripping mechanism to release said switch shaft to permit it to return to switch "off" position and declutches said clutch.

5. In a timing mechanism, a switch operating shaft, a second dial, a minute dial, means for adjusting said dials to a predetermined position, a synchronous motor for driving said dials in reverse direction to return them to starting position, a tripping mechanism for controlling said switch shaft, said tripping mechanism including means actuated by the minute dial driving mechanism for shifting the tripping mechanism from one position to another and means on the second dial driving transmission for engaging said tripping mechanism in said last-named position, whereby it trips said tripping mechanism to release said switch shaft to permit it to return to switch "off" position.

6. In a timing mechanism, a second dial, an indicating panel for said dial, a driving mechanism for said second dial, a switch operating shaft, manual means for setting said shaft to close the switch, a tripable mechanism adapted to lock and hold the shaft in switch-closed position, said tripable mechanism including a spring-urged shaft locking element normally held in locking position, said dial driving mechanism including a gear having a pin adjacent its outer periphery, said spring-urged element including a lug engaged by said pin as the second dial reaches zero for unlocking the shaft and permitting the switch to open.

7. In a timing mechanism, a switch operating shaft, a tripping mechanism for holding said switch operating shaft in switch closing position, a manipulating knob for moving said switch operating shaft to switch closing position, a transmission, a synchronous motor for driving said transmission, a clutch in said transmission, means on said switch shaft controlling said clutch, said transmission including gearing for driving a minute dial and gearing for driving a second dial, a slip coupling in said minute dial driving gearing, a minute dial driven thereby, a manipulating means for setting said minute dial relative to said slip coupling, said slip coupling being effective for driving said minute indicating dial, a second indicating dial driven by said second dial driving gearing, said tripping means including a lever having a compound movement, means on the minute driving dial for moving said lever in one direction and means on the second driving gearing for engaging said lever to move it in another direction, said lever connected to said switch shaft for tripping the shaft, whereby said means on said second driving gearing permits the shaft to open the switch.

8. In a timing mechanism, a minute dial, a second dial, driving means for said dials respectively, an indicator panel for said dials, a switch control means, a tripping mechanism for said switch control means, said tripping mechanism including means acted upon by said minute dial driving means as it moves from the first graduation toward zero and thereafter by the second dial driving means, and a coupling means for coupling said driving means to said dials, said coupling means controlled by said tripping mechanism.

9. In a timing mechanism, a second dial, an indicating panel for said dial, a driving mechanism for said second dial, a switch operating shaft, means for setting said shaft to close the switch, a tripping mechanism adapted to lock and hold the shaft in switch closed position, said tripping mechanism including a spring-urged element normally held in shaft locking position, said dial driving mechanism including a gear having means engaging said spring-urged element as the second dial reaches zero for unlocking the shaft and permitting the switch to open.

10. A time switch comprising, a compound lever, a trip controlled by said compound lever, a pair of rotatable elements, a drive motor, means driven by said motor for rotating one of said elements at a rate corresponding to one revolution per hour and the other of said elements at a rate corresponding to one revolution per minute, the said compound lever being movable in one direction so as to be conditioned for release of said trip and being movable in a different direction thereafter for actual release of said trip, the first-mentioned of said elements containing means for coacting with said compound lever to condition said compound lever for release of said trip, and means driven by the second-mentioned of said elements for engaging said compound lever to effect release of the trip after it is in said condition to be tripped.

11. A time switch comprising a compound lever, a trip controlled by said compound lever, a pair of rotatable elements, a drive motor, means driven by said motor for rotating one of said elements at a rate corresponding to one revolution per hour and the other of said elements at a rate corresponding to one revolution per minute, the said compound lever being movable in one direction so as to be conditioned for release of said trip and being movable in a different direction thereafter for actual release of said trip, the first-mentioned of said elements containing means for coacting with said compound lever to condition said compound lever for release of said trip, means driven by the second-mentioned of said elements for engaging said compound lever to effect release of the trip after it is in said condition to be tripped, a clutch controlling the drive from the motor to said wheels, and a clutch actuating means operable from said trip for disconnecting the drive when the trip is released.

12. A time switch, comprising a dial adapted to be set to a predetermined amount from zero, means for driving said dial backwards to return it to zero including an electric motor and a gear transmission extending to the dial, a clutch in said transmission, a switch control means, an arm connecting said switch control means to said clutch for clutching and declutching said clutch as the switch is turned on and off, and tripping means operated by said transmission for shutting off said switch when the dial reaches zero.

13. A time switch, comprising a dial adapted to be set to a predetermined amount from zero, means for driving said dial backwards to return it to zero including an electric motor and a gear transmission extending to the dial, a clutch in said transmission, said clutch being located adjacent the dial with but one set of gears interposed between the clutch and dial, a switch

control means, an arm connecting said switch control means to said clutch for clutching and declutching said clutch as the switch is turned on and off, and tripping means operated by said transmission for shutting off said switch when the dial reaches zero.

14. In a timing mechanism, a trip, a plurality of time indicating instrumentalities adapted conjointly to operate said trip, means for setting said time indicating instrumentalities to provide a measurable interval of time prior to the operation of said trip, means for driving the instrumentalities at different speeds in the direction to operate said trip, and mechanism operated by the slower moving time indicating instrumentality adjacent to the trip to condition the trip to be operated by the faster moving time indicating instrumentality.

15. In a timing mechanism, two rotary time indicating instrumentalities, mechanism for driving said time indicating instrumentalities at different speeds so that one makes a plurality of revolutions to a single revolution of the other, and a trip mechanism adapted to be conditioned by the slower moving time indicating instrumentality adjacent to its zero position so that said trip is operated by the faster moving time indicating instrumentality at its zero position.

16. In a timing mechanism, two rotary time indicating instrumentalities, a motor driven mechanism for driving said time indicating instrumentalities at different speeds so that one makes a plurality of revolutions to a single revolution of the other, a clutch for connecting said motor and mechanism, and a trip mechanism for operating a switch and declutching said clutch, said mechanism adapted to be conditioned by the slower moving time indicating instrumentality adjacent to its zero position so that said trip is operated by the faster moving time indicating instrumentality at its zero position.

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