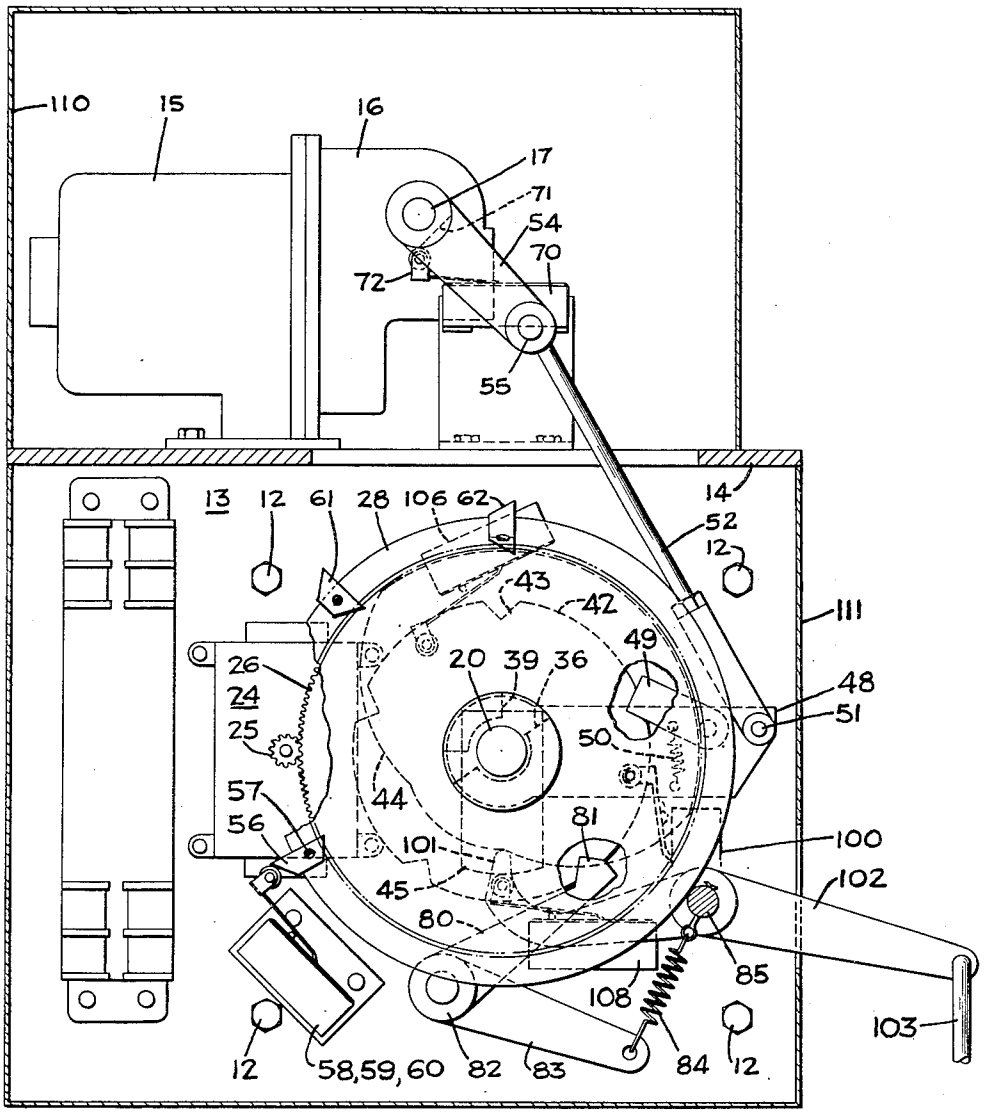
July 10, 1951 T. G. MUELLER 2,560,516

TIMING APPARATUS

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Fig. 1.



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Fig. 2.

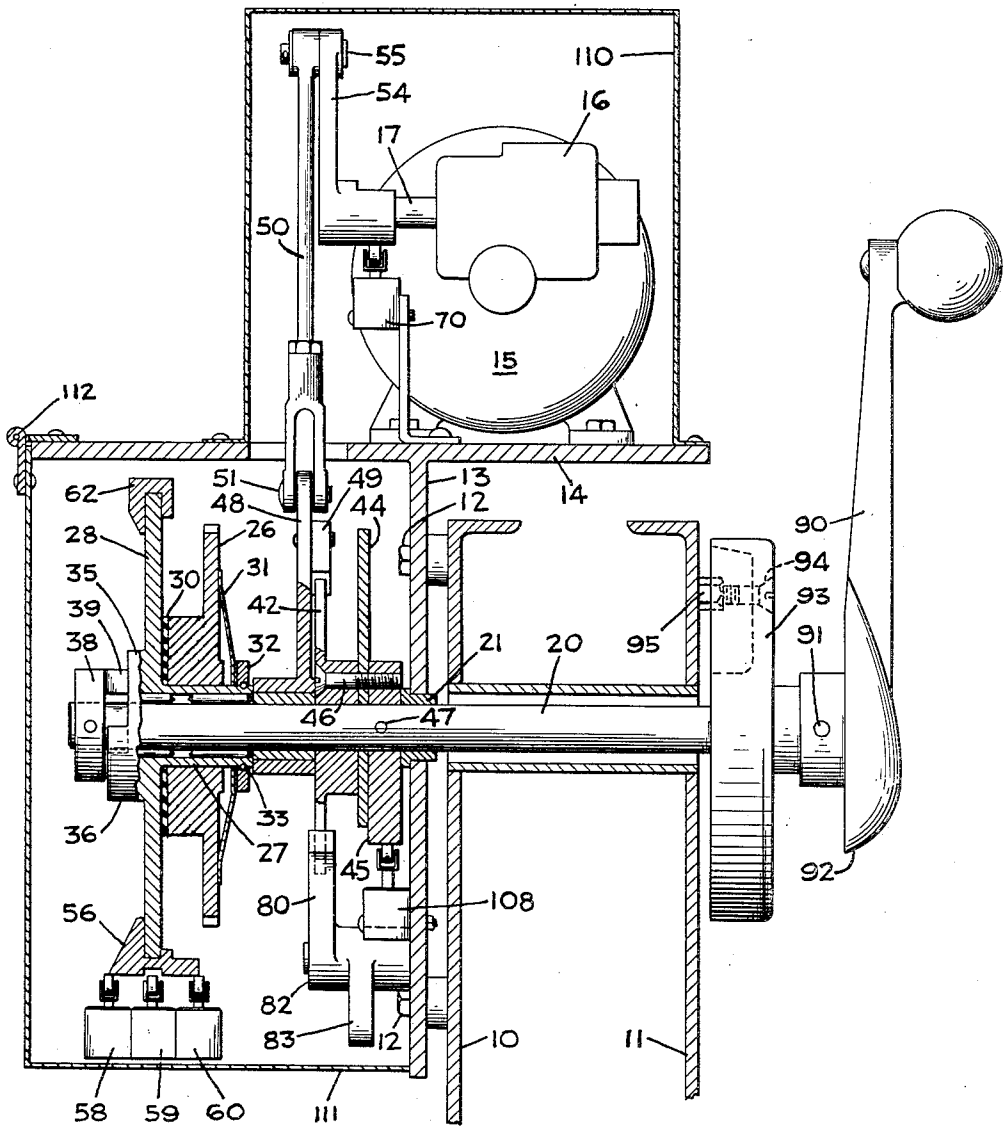
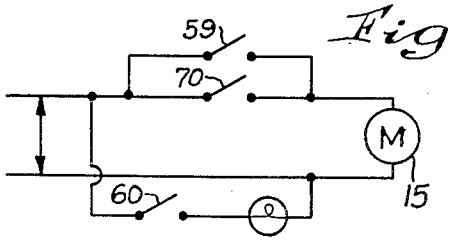


Fig. 3.



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TIMING APPARATUS

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11 Claims. (Cl. 161—1)

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This invention relates to interval timing apparatus and particularly to means for automatically timing successive multiple time intervals of varying duration.

Various interval timers have heretofore been proposed for automatically controlling the sequence and duration of operations in so-called dry cleaning machines, laundry machines, and other apparatus where automatic sequence operation takes place. In general, these devices have inadequate provision for selectively varying the various time intervals of a given sequence. Most commonly it is necessary, in order to adjust one given time interval, to reset all of the succeeding time interval controlling elements. In some devices of the prior art it is possible to adjust only one given interval of a sequence. In still other prior art proposals, it is possible to omit certain selected sequences if desired, but no ready means of adjusting the time intervals is provided.

According to the present invention, a simple and highly practical apparatus is provided whereby any desired one of a number of sequential time intervals may be readjusted without disturbing the adjustment or operation of all of the preceding and succeeding time intervals. For instance, if a given time interval of the sequence is set for a certain time interval, and it is readjusted to change that time interval, the following time interval will begin, as before, immediately at the conclusion of the adjusted time interval, and such following time interval will be of the same duration as before. This occurs without any attention to the succeeding time interval mechanism on the part of the person making the adjustment. The same is true of any further succeeding time intervals of the sequence.

The present apparatus is such that, by following the principles set forth therein, a timer may be constructed for controlling any desired number of time intervals, each time interval having a maximum time duration, and each time interval being adjustable for any period of duration from zero to such maximum, without any attention to the other time intervals of the sequence. Various mechanical modifications may be made in the apparatus shown in the drawings and described herein by way of example without departing from the principles of the invention or the scope thereof as defined in the appended claims.

In the drawings:

Fig. 1 is an elevational view of one form of the apparatus of the present invention with portions of the casing shown in cross-section for added clearness;

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Fig. 2 is a cross-sectional view at right angles to Fig. 1 in a vertical plane through the main operating shaft, but with the parts in other positions of their cycle of operation for added clearness; and

Fig. 3 is a schematic circuit diagram of the apparatus.

In the drawings like characters of reference denote like parts throughout, and the numerals 10 and 11 designate spaced wall portions of a machine with which the timing apparatus is to be used, such as a dry cleaning or laundering machine. Secured to the wall 10 by means of screws 12 is a vertical supporting plate 13 for the apparatus of the present invention. At its upper edge plate 13 has rigidly associated therewith a horizontal plate portion 14 which supports an electric driving motor 15, the latter having associated therewith a speed reducing gear box 16 whose output shaft is designated 17.

In Figs. 1 and 2 the numeral 20 designates the main operating shaft of the timing apparatus and shaft 20 has bearing in plate 13 as at 21 in Fig. 2. Referring to Fig. 1, the numeral 24 designates a clock mechanism which includes a drive pinion 25 for driving a clock wheel 26. Clock wheel 26, referring to Fig. 2, is freely rotatable on a sleeve-like hub 27 which is part of a disc 28, the latter having anti-friction bearing on shaft 20.

As stated, the inner periphery of clock wheel 26 is freely rotatable on the external periphery of the sleeve portion 27 of disc 28. However, a friction disc 30 is interposed between the abutting radial faces of the hub of clock wheel 26 and disc 28, and clock wheel 26 is urged resiliently toward disc 28 by means of a spring plate 31 which is retained against axial displacement on sleeve 27 by means of a collar 32 and a locking ring 33. Disc 28 is accordingly carried along with clock wheel 26 unless positively prevented from so doing in a manner which will presently appear.

Disc 28 has an outer hub formation 35 which includes a semi-circular projection 36. Shaft 20 projects beyond hub 35 and has fixed thereto a collar 38 which includes a quarter circular inward projection 39. It will be noted from Fig. 1 that the clock wheel and disc assembly is free to rotate relative to shaft 20 and collar 38, the projections 36 and 39 being in non-abutting positions.

To facilitate description, and bearing in mind that any number of intervals of any desired maximum duration may be readily arranged for, let us assume that the apparatus set forth by way

of example is desired to accommodate a maximum of five time intervals each of which may be of a maximum duration of twenty-four minutes. With this arrangement the speed of operation of clock drive pinion 25 would be such as to rotate clock wheel 26 once in two hours. A twenty-four minute interval would produce angular travel of clock wheel 26 and disc 28 of 72°, or less than the 90° total gap or possible lost motion between projections 36 and 39. Projections 36 and 39 are illustrated in Fig. 1 in a mid-point in their operation, as will presently appear.

The indexing mechanism for clock wheel 26 and disc 28 will now be described. Referring particularly to Fig. 2, an index wheel 42 has five peripheral notches 43 and is fixed for rotation with shaft 20. Index wheel 42 is fixed laterally to a pair of cams 44 and 45 by means of a screw 46 and cam 45 is pinned to shaft 20 as at 47. The cams 44 and 45 will be alluded to later herein.

The numeral 48 designates an indexing pawl supporting rock arm which is freely rotatable on shaft 20 and has pivoted thereto an indexing pawl 49 which is biased toward index wheel 42 by a tension spring 50 connected at its opposite ends to pawl 49 and rock arm 48. The outer end of rock arm 48 is pivoted at one end to a link 52 as at 51 and the other end of link 52 is pivotally attached to a crank 54 as at 55, crank 54 being fixed to the output shaft 17 of the speed reducing gear box 16.

Referring to Fig. 1, the numeral 56 designates a block which is detachably secured to the periphery of disc 28 by means of a set screw 57 and is adjustable along such periphery. As shown in Fig. 1 block 56 serves as a cam element and is in actuating registry with the operating members of a bank of three normally open micro-switches 58, 59 and 60. In Fig. 2 these micro-switches and block 56 are shown in full elevation and cross-section, respectively, for added clarity of illustration, rather than in their actual oblique positions as shown in Fig. 1.

In addition to block 56, which it will be noted is grooved so as not to operate switch 59, disc 28 carries four other blocks spaced about its periphery in adjusted positions to serve as additional cam elements. Two such other blocks are designated 61 and 62 in Fig. 1, the latter appearing also in Fig. 2. These other four blocks, as distinguished from block 56, are all in line with and of a size to engage the operating member of normally open micro-switch 59 when they come into registry with it, without disturbing micro-switches 58 and 60.

When one of the four micro-blocks 61, 62, etc., engages the operating member of switch 59 to close the same it closes the operating circuit for motor 15, causing crank 54 to rotate in a counterclockwise direction.

This operation of motor 15 takes place at the end of given time intervals as determined by the adjusted setting of blocks 61, 62, etc. Let us assume that the block 61 is set at the proper position to determine a twelve minute time interval, and that, by counterclockwise timed movement of disc 28 it has just come into engagement with the operating member of micro-switch 59 to close the same.

For convenience and clearness of illustration blocks 36 and 39 are shown in Fig. 2 in the positions they occupy at the beginning of a time interval when block 36 occupies a lowermost position and block 39 abuts thereagainst at the left-hand side as viewed in Fig. 1. However, in Fig. 2 the crank and indexing arm are shown at a position about half-way through an automatic indexing operation, again to clarify the illustration of the parts.

Referring to Fig. 1, when the indexing elements are in their rest position between indexing operations, crank 54 extends straight down from shaft 17. Fig. 1 illustrates the position of crank 54 after an automatic indexing operation has begun and proceeded for about 45°. During this beginning portion of the automatic indexing operation, crank 54 imparts no indexing movement to rock arm 48 or indexing pawl 49. In Fig. 1 the numeral 70 designates a normally open micro-switch which is connected in parallel with micro-switch 59, both being in series in the operating circuit of motor 15. When crank 54 extends straight down in the rest position of the indexing mechanism, a flattened portion 71 of the hub of crank 54 permits the operating member 72 of micro-switch 70 to be in an upper switch-open position.

Assuming that block 61 was set to define a twelve minute interval which has just terminated, referring to Fig. 1, and that block 61 has just come into engagement with the operating member of switch 59 to terminate such period by initiating an automatic indexing operation to commence the succeeding time interval, the block 36 driven by clock wheel 26 will have rotated in a counterclockwise direction as viewed in Fig. 1 away from block 39 a distance of 36° at the time that block 61 comes into engagement with the operator which closes micro-switch 59 and, accordingly, the operating circuit for motor 15.

This energizes motor 15 and crank 54 rotates in a counterclockwise direction as viewed in Fig. 1 and the hub of crank 54 engages operator 72 to close micro-switch 70 and provide a parallel operating circuit for the motor. The motor will, therefore, continue in operation after block 61 leaves the operator of micro-switch 59 and continues until a full rotation has been made by crank 54 and the flattened portion 71 is again at the under side of crank 54 and thus permits micro-switch 70 to open.

As the indexing plate is moved through a 72° angle during indexing, by operation of pawl 49 on index plate 42, shaft 20 moves through a like angle since the index plate is fixed thereto. This moves quarter-circular block 39 through a like angle, and, after traveling 36° to catch up to block 36, it then rotates the latter in a counterclockwise direction for 36° and thus rotates disc 28 positively through a 36° angle against the resistance of the friction disc 30, the clock disc 26 being held stationary by the clock mechanism.

The result is that, regardless of the time intervals for which block 61 and the other blocks are set, disc 28 rotates through a full 72° angle during each cycle of time interval and indexing to present disc 28 to the starting position for the next succeeding cycle regardless of the time interval for which the preceding cycle was set. In other words, during each cycle of timing and indexing disc 28 has a total movement of 72° made up of movement by clock wheel 26 and subsequent movement by index plate 42, shaft 20 and block 39, regardless of how much of that movement is derived from clock wheel 26 as determined by the time setting of the blocks 61, 62, etc.

In Fig. 1, the numeral 80 designates a detent

arm which has a portion 81 which registers with one of the openings 43 of index plate 42 when the latter is in rest position between indexing operations. Indexing arm 80 is part of a bell crank 82, the other arm 83 of which is urged in a counterclockwise direction by an extension spring 84 fixed to its outer end and anchored to a stub shaft 85.

Referring to Fig. 2, the numeral 90 designates a manual crank which is pinned to shaft 20 as at 91 for manually setting index plate 42 to any desired position. The position of the index plate is shown by the lower end 92 of crank 90 which comprises a pointer which cooperates with an appropriately graduated or marked control drum or dial 93 which is mounted on shaft 20 but fixed against rotation therewith by means of a screw 94 which threads into a nut 95 welded or otherwise securely fixed to wall portion 11 of the machine.

The structure and operation thus far described is all that is essential to and inherent in the present invention. The manner in which the adjustable time intervals may be employed in various adaptations may vary widely. The following additional appurtenances are set forth in a broad general way merely to illustrate how the time interval measuring apparatus may be employed in controlling sequential operation in a given instance set forth by way of example.

A full cycle of operation of the timer of the present invention will now be described, by way of example, in conjunction with its application to a conventional dry cleaning machine. In such a machine there are five conventional time periods, the first of which is the filtering or washing period; the second, a drain period for draining the solvent; the third, an extraction period when the drum holding the articles being cleaned is rotated at high speed to extract the solvent; the fourth, an idle period made necessary by the length of time that it takes the high speed extractor motor to slow down; and the fifth and last, a reclaiming period during which a fan blows through the drum to recover the remaining solvent from the articles.

As a full cycle of operation is ended at the end of the reclaiming period, block 56 closes switches 58 and 60, the former of which effects stoppage of the entire dry cleaning machine in a conventional manner and the latter of which lights a signal light to indicate that the entire dry cleaning operation is concluded. The machine thus stops with the parts in the position indicated in Fig. 1, excepting that crank arm 54 will extend straight downwardly from its operating shaft 17. To re-commence operation, an operator manually operates crank 90 to the filter or wash position of dial 93 which, in effect, rotates index plate 42 through 72° to the next index point from that shown in Fig. 1.

This permits stop switch 58 and signal switch 60 to reopen, and the clock mechanism 24 is energized through its connection with the electrical portion of the dry cleaning machine proper, and the first of the five time periods of dry cleaning commences, namely, the filter or wash period. In Fig. 1 the numeral 109 designates a normally open switch which controls the pump of the dry cleaning machine, and movement of cam 45 from its illustrated position through 72° in a counterclockwise direction, as viewed in Fig. 1, by means of the manual indexing just described, closes pump switch 100.

Cam 44 has a follower 101 which is part of a

rocker arm 102 rotatable on stub shaft 85. The other end of rocker arm 102 is pivotally connected to a depending link 103 which controls the drain valve of the dry cleaning machine and is illustrated in Fig. 1 in the closed position of the drain valve. The manual indexing referred to does not change the closed condition of the drain valve because of a dwell of suitable extent on cam 44.

After the filter period is ended, as indicated by the engagement of block 61 with the operator of index switch 59, an automatic indexing operation takes place through operation of motor 15 as previously described. This not only brings disc 28 to the proper position for starting the second time period against the resistance of friction disc 30, but also moves cam 45 from the operator of pump switch 100, whereupon the pump stops, and the drain valve opens by virtue of the rise of cam 45 which acts upon follower 101 during this indexing operation to raise link 103.

After the drain period is terminated by the arrival of stop 62 at index switch 63, a second automatic indexing operation takes place and this brings the timer to the beginning of the extraction operation, cam 45 closing a normally open extractor motor operating switch 106, the drain valve remaining open.

The next automatic indexing operation at the end of the extraction period, occasioned by the engagement of a further block (not shown) with the operator of stop switch 59, brings the timer to the beginning of an idle period, the extractor motor stopping by reason of the removal of cam 45 from the operator of switch 106, and the drain valve remaining open. At the conclusion of this idle period, which is provided to permit the extractor motor to slow down and stop, a fourth automatic indexing occurs which again closes the drain valve through the falling off of the profile of cam 44 and the consequent re-lowering of link 103.

This also engages the cam 45 with the operator of a fan motor switch 108 to cause operation of the dry cleaning machine fan during the reclaiming period. After the reclaiming period ends by engagement of block 56 with stop switch 58 and signal switch 60, the entire machine shuts down, stopping the fan motor along with the other appurtenances despite the continued closure of micro-switch 108 until the timer is again hand-indexed to starting position.

It is to be understood that the foregoing description of dry cleaning machine operation is not intended to be a full disclosure of the dry cleaning machine but is merely an example of many adaptations of the timing apparatus of the present invention to a wide variety of particular timing problems.

In the drawings the numeral 110 designates a housing element which is removably secured to the top surface of horizontal plate portion 14 to house the driving motor 15 and its appurtenant parts, and numeral 111 designates a further casing element hinged to an edge of plate portion 14 as at 112 for removably encasing the remaining parts of the timing apparatus.

What is claimed is:

1. Timing apparatus comprising a supporting shaft, an index plate fixed for rotation therewith, timing means rotatable relative to said shaft and having a plurality of circumferentially spaced elements, switch means operable by said elements and motor means operable to move said index plate a predetermined angular distance through operation of said switch means, said spaced ele-

ments being circumferentially adjustable independently of each other and being adapted to act upon said switch means successively to register the termination of successive time periods of independently adjusted duration, clock means having yieldable driving engagement with said timing means to advance the same substantially continuously at a constant rate through a pre-selected portion of the angular distance of the next succeeding indexing operation as determined by the adjustment of one of the spaced elements of the timing means, and lost motion drive means between said shaft and said timing means whereby the latter is moved through the remainder of such angular distance during the succeeding indexing operation to condition the timing means for timing a succeeding time interval.

2. Timing apparatus comprising a supporting shaft, indexing means fixed for rotation therewith, timing means rotatable relative to said shaft and having a plurality of circumferentially spaced elements, switch means operable by said elements and motor means operable to move said indexing means a predetermined angular distance through operation of said switch means, said spaced elements being circumferentially adjustable independently of each other and being adapted to act upon said switch means successively to register the termination of successive time periods of independently adjusted duration, clock means having yieldable driving engagement with said timing means to advance the same substantially continuously at a constant rate through an angle less than the angular distance of the next succeeding indexing operation, the extent of said lesser angle being determined by the adjustment of one of the spaced elements of the timing means, and lost motion drive means between said shaft and said timing means whereby the latter is moved through the remainder of such angular distance during the succeeding indexing operation to condition the timing means for timing a succeeding time interval.

3. Timing apparatus comprising a supporting shaft, an index plate fixed thereon and divided angularly to provide a number of index increments, timing means rotatably mounted on said shaft and having an adjustable switch operating element for each of said increments, switch means operable by said elements and motor means operable to move said index plate through an indexing increment by operation of said switch means, said spaced elements being circumferentially adjustable independently of each other and being adapted to act upon said switch means successively to register the termination of successive time periods of independently adjusted duration, clock means having yieldable driving engagement with said timing means to advance the same substantially continuously at a constant rate through a pre-selected portion of an indexing increment angle as determined by the adjustment of one of the switch operating elements of the timing means, and lost motion drive means between said shaft and said timing means whereby the latter is moved through the remainder of the indexing increment angle during the succeeding indexing operation to condition the timing means for timing a succeeding time interval.

4. Timing apparatus comprising a supporting shaft, an index plate fixed thereon and divided angularly to provide a number of index increments, timing means rotatably mounted on said

shaft and having an adjustable switch operating element for each of said increments, switch means operable by said elements and motor means operable to move said index plate through an indexing increment by operation of said switch means, said spaced elements being adapted to act upon said switch means successively to register the termination of successive time periods, clock means having yieldable driving engagement with said timing means to advance the same substantially continuously at a constant rate through a pre-selected portion of an indexing increment angle as determined by the switch operating elements of the timing means, and lost motion drive means between said shaft and said timing means whereby the latter is moved through the remainder of the indexing increment angle during the succeeding indexing operation to condition the timing means for timing a succeeding time interval.

5. Timing apparatus comprising a supporting shaft, an index plate fixed for rotation therewith, switch means and motor means operable upon actuation of said switch means to move said index plate a predetermined angular distance, timing means rotatable relative to said shaft and having a plurality of circumferentially spaced adjustable switch actuating elements, said switch elements being adapted to actuate said switch means successively at the termination of successive time periods of independently adjusted duration to initiate an indexing operation, clock means normally driving said timing means to advance the same substantially continuously at a constant rate through any pre-selected part of the angular distance of the next succeeding indexing operation as determined by the adjustment of one of the spaced elements of the timing means, and lost motion drive means between said shaft and said timing means whereby the latter is moved through the remainder of such angular distance during the succeeding indexing operation to condition the timing means for timing a succeeding time interval.

6. Timing apparatus comprising a supporting shaft, an index plate fixed for rotation therewith, switch means and motor means operable upon actuation of said switch means to move said index plate a predetermined angular distance, timing means rotatable relative to said shaft and having a plurality of circumferentially spaced adjustable switch actuating elements, said switch elements being adapted to actuate said switch means successively at the termination of successive time periods of independently adjusted duration to initiate an indexing operation, clock means normally driving said timing means to advance the same substantially continuously at a constant rate through a part of the angular distance of the next succeeding indexing operation until said switch means is actuated by operation of one of the switch actuating elements of the timing means, and lost motion drive means between said shaft and said timing means whereby the latter is moved through the remainder of the angular distance of the indexing operation during the succeeding indexing operation to condition the timing means for timing a succeeding time interval.

7. Timing apparatus comprising a continuously rotating clock element, a timing element and means yieldably holding the same for rotation by said clock element, indexing means, adjustable means on said timing element operable to terminate a time interval by actuating said

indexing means for moving the timing element to a set predetermined position for starting a succeeding time interval regardless of the position of adjustment of the period terminating means against the resistance of said yieldable means, and means operable by said indexing means upon indexing thereof to control any desired condition extraneous of the timer proper.

8. Timing apparatus comprising a continuously rotating clock element, a timing element and means yieldably holding the same for rotation by said clock element, indexing means, adjustable means on said timing element operable to terminate a time interval by actuating said indexing means for moving the timing element to a set predetermined position for starting a succeeding time interval regardless of the position of adjustment of the period terminating means against the resistance of said yieldable means, and a cam operable by said indexing means upon indexing thereof to control any desired condition extraneous of the timer proper.

9. Timing apparatus comprising a continuously rotating clock element, a timing element and means yieldably holding the same for rotation by said clock element, indexing means, adjustable means on said timing element operable to terminate a time interval by actuating said indexing means for moving the timing element to a set predetermined position for starting a succeeding time interval regardless of the position of adjustment of the period terminating means against the resistance of said yieldable means, and switch means operable automatically upon indexing to control any desired condition extraneous of the timer proper.

10. Timing apparatus comprising a continuously rotating clock element, a timing element and means yieldably holding the same for rotation by said clock element, indexing means, adjustable means on said timing element operable to terminate a time interval by actuating said indexing means for moving the timing element to a set predetermined position for starting a succeeding time interval regardless of the position of adjustment of the period terminating means against the resistance of said yieldable means.

11. Timing apparatus comprising a continuously rotating clock element, a timing element and means yieldably holding the same for rotation by said clock element, a switch and adjustable means on said timing element operable to terminate a time interval by operating said switch to control any desired condition extraneous of the timer proper, and means operable upon closure of said switch by said adjustable means at the end of an adjusted time interval for moving the timing element to a set predetermined position for starting a succeeding time interval regardless of the position of adjustment of the period terminating means and against the resistance of said yieldable means.

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