Sept. 6, 1966 H. T. SIMMONS ETAL 3,271,537

SEQUENTIAL TIMER

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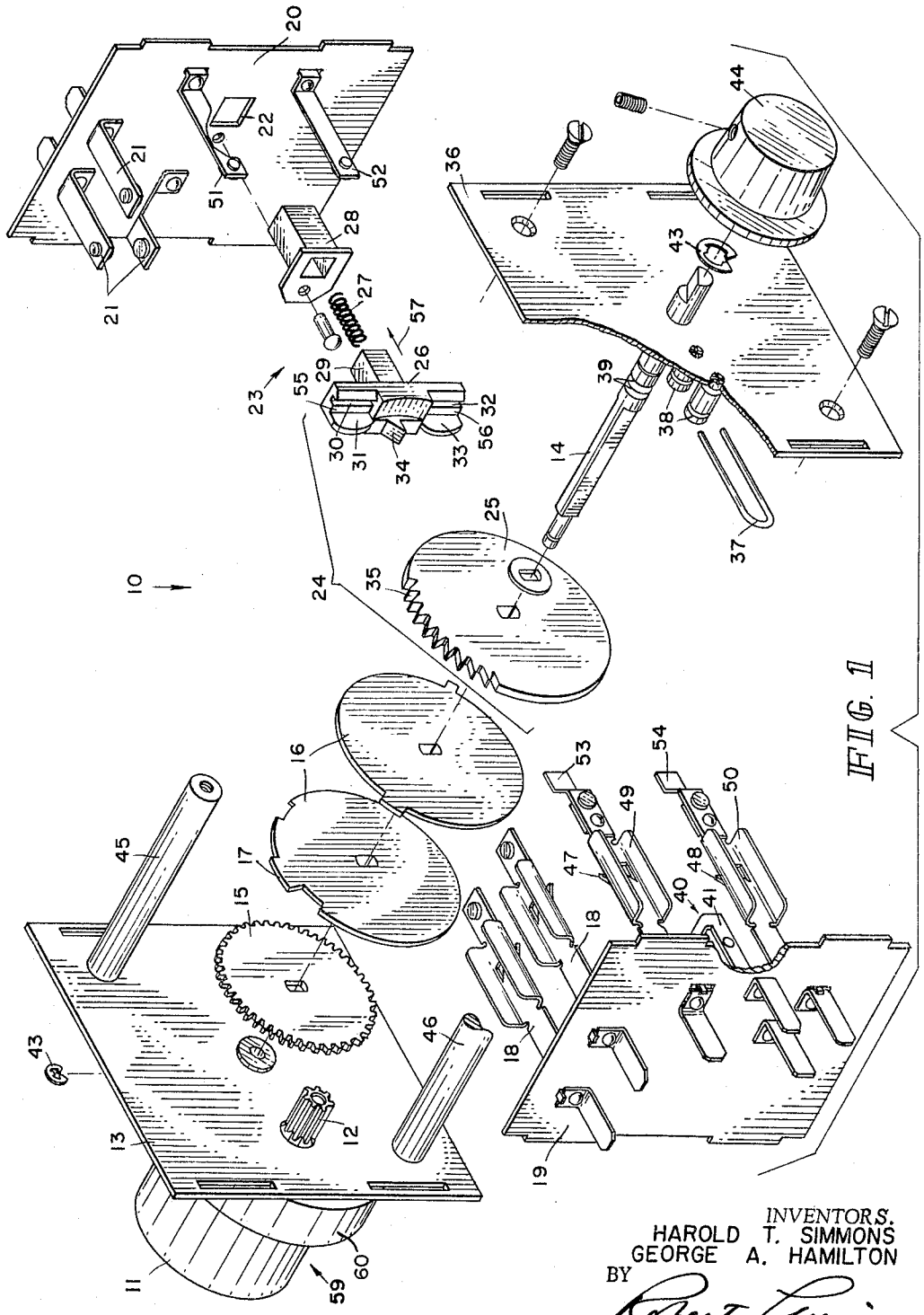


FIG. 1

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SEQUENTIAL TIMER

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FIG. 2

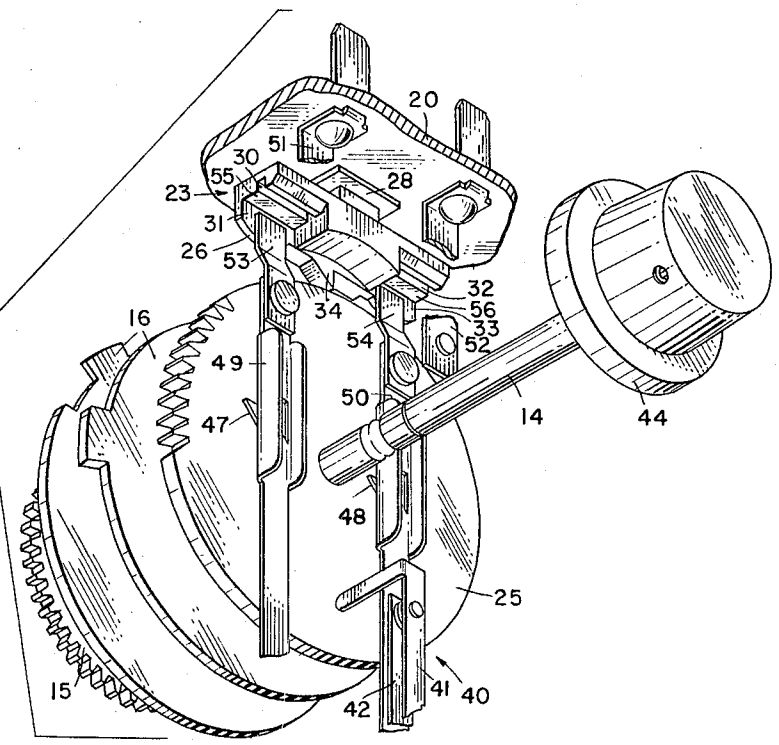
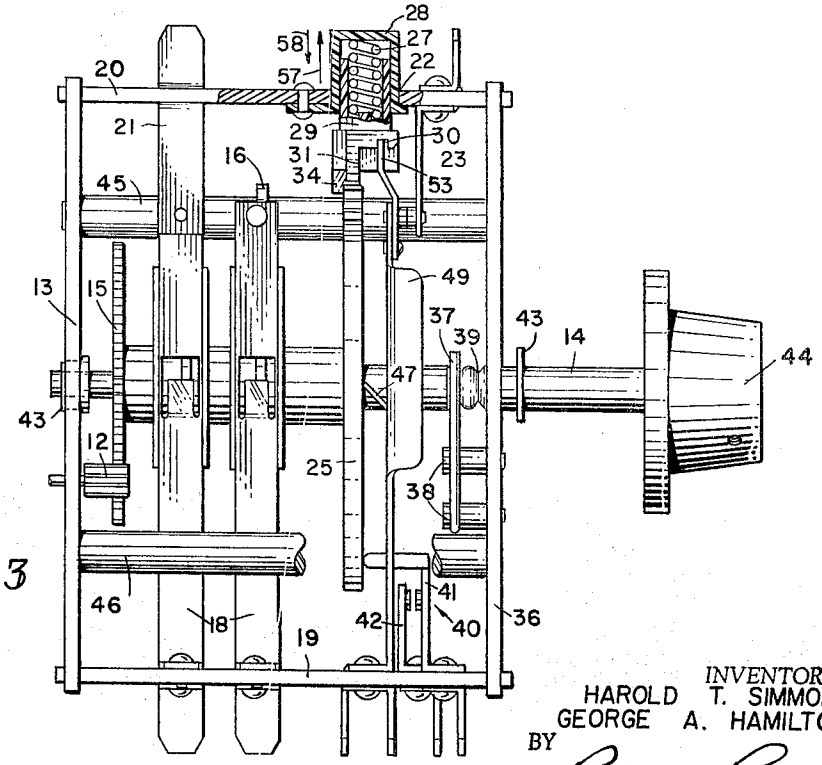


FIG. 3



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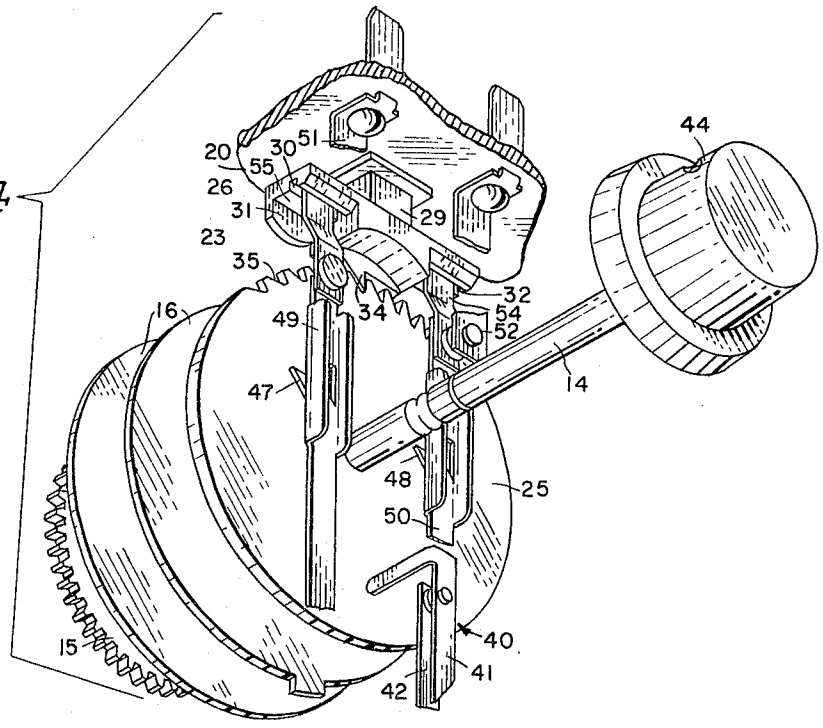
Sept. 6, 1966 H. T. SIMMONS ETAL 3,271,537

SEQUENTIAL TIMER

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FIG 4



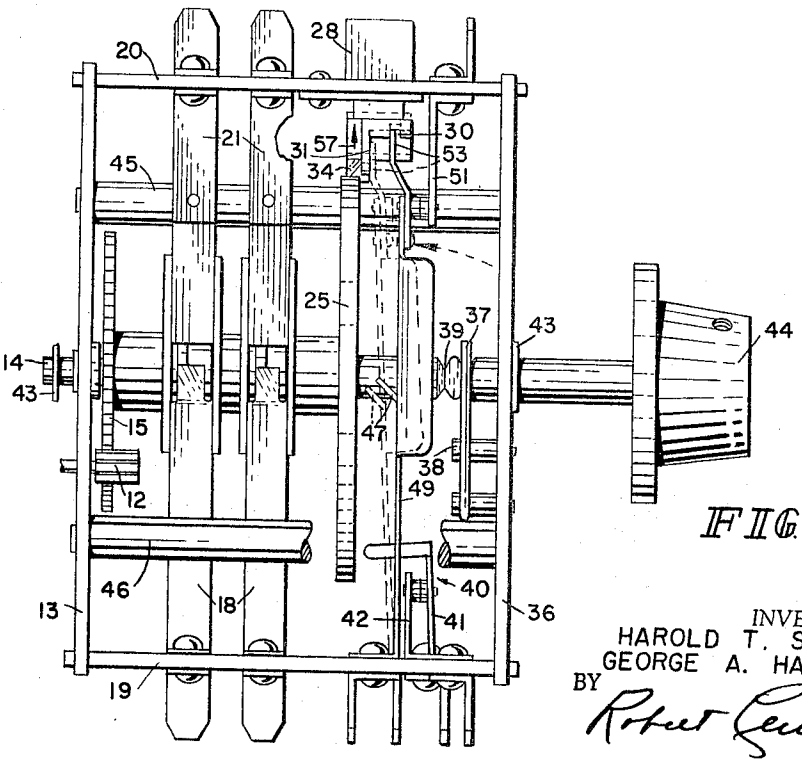


FIG 5

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United States Patent Office 3,271,537 Patented Sept. 6, 1966

3,271,537

SEQUENTIAL TIMER

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Filed Dec. 3, 1964, Ser. No. 415,697
17 Claims. (Cl. 200—38)

The present invention relates to a sequential timer used to control the operations of an electric appliance, more particularly to a sequential timer used with a washing machine or the like. The sequential timer includes a novel actuator assembly means or actuator mechanism adapted to provide a means and method of purging the drain lines of the washing machine regardless of the wash interval selected on the sequential timer.

Sequential timers are known and are successfully utilized to actuate electrical circuitry at predetermined intervals of time and to thereafter deactuate the electrical circuitry at the termination of a predetermined interval of time. Within the broad field of sequential timers as applied to the appliance field, there exists a need to provide a means of purging the drain lines of fluid regardless of the initial wash interval selected by the operator.

Several presently available sequential timers employ an initial purge cycle only if the full wash interval is selected. Several other presently available timing devices utilize no purge cycle because of the inability to employ a means that would allow the purging of the drain lines at the initiation of the washing cycle regardless of the time interval desired.

Several obvious benefits result from purging the drain lines at the initiation of a timed cycle, one of which is that the full fluid level in the washing machine is always at substantially the same level thereby affording uniform washing of fabrics regardless of when washed. A second obvious benefit is that the temperature of the wash fluid utilized is at a uniform temperature, that is, incoming fluid is not mixed with cool fluid left in the machine from a previous wash. Therefore, the need arises for a simple, efficient, accurate, and effective sequential timer having the means of purging the drain lines regardless of the length of the wash cycle selected by the operator. The purge of the drain lines is accomplished at the initiation of the wash cycle. The novel means of the present invention permits the operator to alter the time interval of the wash cycle, while still obtaining a purge of the drain lines prior to the initiation of the fill cycle of the washing machine. In using the present invention the operator is required to axially position a shaft prior to selecting the time interval of a second wash cycle. When the shaft is so positioned, a line switch of the sequential timer is "opened" thereby preventing actuation of electrical circuitry as the shaft is turned through arcuate positions that would actuate the electrical circuitry if the line switch was closed.

In sequential timers using a ramping means cooperatively associated with a shaft and a line switch to deactivate a line switch at the termination of a programmed cycle, an excessive amount of torque is required to actuate the ramping means to thereby "open" the line switch. The device of the present invention achieves the same result, but includes provision for controlling termination within any given step in the cycle and requires practically no torque. Present ramp means require excessive torque and out of necessity must use three or four timer steps to achieve the end result of opening a line switch.

By the accompanying drawings and specification, the novel means and method whereby the present invention fulfills the required purpose will be disclosed.

Therefore, it is an object of the present invention to provide a unique spring loaded actuator mechanism featuring a locking means which permit electrical contacts to be engaged and retained in an engaged position with no loading therefrom transferred to a control shaft throughout a major portion of the timed interval.

Another object of the present invention is to provide a spring load actuator mechanism including a means allowing variation in the initiation point of a timed cycle.

Still another object of the present invention is to provide a spring loaded actuator mechanism having an intermittently driven cam means cooperatively associated therewith which causes simultaneous termination of electrical circuits a predetermined interval of time after activation thereof.

Yet another object of the present invention is to provide a spring loaded actuator mechanism which includes means for assuring deenergization of energized circuits a predetermined interval of time after energization.

Another object of the present invention is to provide a novel spring loaded actuator mechanism having optimum reliability characteristics afforded by a compact construction having a minimum number of parts.

Still another object of the present invention is to provide a simple, efficient, and practical spring loaded actuator mechanism.

Yet another object of the present invention is to provide a spring loaded actuator mechanism occupying a minimum amount of space in the housing of a sequential timer.

Another object of the present invention is to provide a novel spring loaded actuator mechanism that requires a relatively small torque to initiate operation thereof.

The present invention in another of its aspects, relates to the novel features of the instrumentalities of the invention described herein for teaching the principal object of the invention and to the novel principles employed in the instrumentalities whether or not these features and principles may be used in the said object and/or in the said field.

With the aforementioned objects enumerated, other objects will be apparent to those persons possessing ordinary skill in the art. Other objects will appear in the following description, appended claims, and appended drawings. The invention resides in the novel combination, arrangement and cooperation of elements as hereinafter described and more particularly as defined in the appended claims.

The appended drawings illustrate the preferred embodiment of the present invention constructed to function in the most advantageous modes devised for the practical application of the basic principles involved in the hereinafter described invention.

In the drawings:

FIGURE 1 is a perspective view of the sequential timing including the spring loaded actuator mechanism.

FIGURE 2 is a perspective view of the sequential timer including the spring loaded actuator mechanism showing the actuator mechanism at its initial position.

FIGURE 3 is a side view of the sequential timer including the spring loaded actuator mechanism illustrating the actuator mechanism retaining movable contacts in an engaged position with fixed contacts.

FIGURE 4 is a perspective view of the sequential timer including the spring loaded actuator mechanism of FIGURE 3 having parts partially cut away.

FIGURE 5 is a side view of the novel spring loaded actuator mechanism illustrating the movement of the actuator mechanism in full and dotted lines.

Generally speaking the means and method of the present invention relate to a sequential timer or timing device for sequentially actuating a plurality of electrical circuits. The device includes a means for support and a shaft journalled by the support means. An intermittent drive means

is coupled to and intermittently drives the shaft. An actuator mechanism including a coded indicia means, more particularly a partially toothed cam means, is fixedly coupled to the shaft. The actuator mechanism also includes an actuator means and a plurality of contact carrying blades. The actuator means includes a plurality of steps cooperatively associated with the coded indicia of the coded indicia means. The plurality of contact carrying blade means are retained in an engaged position with the fixed contacts by one of the steps of the actuator means. Intermittent rotation of the coded indicia means displaces the actuator means thereby disengaging the plurality of contact blade means from engagement with the fixed contacts to another step of the actuator means.

More particularly, the present invention pertains to a timing device including a means for supporting the timing device, the means including a pair of plates in spaced parallel relationship. A drive means is fixedly mounted on one of the plates. An escapement means is coupled to the drive means, said escapement means translating the constant motion output of the drive means to an intermittent motion output. A gear is coupled to the escapement means so as to be intermittently driven by the escapement means. An axially positionable, cam carrying shaft is journalled between the pair of plates. A plurality of cam means are fixedly coupled to the shaft. The cam means includes peripheral rise and fall contours. A plurality of follower switches ride on the periphery of the cam means. The follower switches are responsive to the rise and fall contours of the cam means thereby making and breaking electrical continuity to the plurality of electrical circuits according to a desired sequence. A partially toothed cam is fixedly coupled to the shaft. A spring load actuator means having a surface of predetermined configuration has that surface riding on the periphery of the partially toothed cam. The spring load actuator is responsive to the partially toothed contours of that cam. The actuator means includes at least two discrete steps. A plurality of contact carrying blade means are locked in engagement with fixed contacts by one of the steps of the actuator means as the shaft is axially positioned. Thereafter, the intermittent rotational displacement of the partially toothed cam displaces the actuator means thereby simultaneously disengaging the plurality of contact carrying blade means from engagement with the fixed contacts. The disengagement of the contact carrying blade means from the fixed contacts terminates actuation of at least two of the electrical circuits.

Referring now to the drawings, which illustrate the preferred embodiment of the present invention, the sequential timer means is generally indicated by numeral **10**. The vital components of the aforementioned sequential timer means include a drive motor **11** which is mechanically coupled to an escapement means **60** contained within housing **59**, containing both the drive means and the escapement means. The escapement means translates the constant rotary motion output of the drive motor to an intermittent, or step-by-step motion output. The output of the escapement means is coupled to pinion **12**. Housing **59** is fixedly secured to a rear mounting plate **13** by a plurality of suitable mounting means (not shown) such as bolts, rivets, or the like. The mounting means prevent horizontal and vertical displacement of the housing due to vibration, abusive handling or the like. The mounting means predeterminately locate pinion **12** with respect to gear **15**. The gear meshes with and is intermittently driven by the pinion in a counterclockwise direction with a step-by-step rotary motion. The constructional details of the escapement means have been held to a minimum since the escapement means utilized is a standard component.

A cam carrying shaft **14** is rotatably seated in the rear mounting plate by any suitable means. The cam carrying shaft extends outwardly from and projects through the axis of and therefore fixedly carries thereon gear **15**. Mounted in spaced parallel relationship on the cam carrying shaft is a plurality of cam means **16**. The shaft projects through the longitudinal axis of each of the individual cams in such a manner that each of the cams is fixedly coupled to and rotatable with the cam carrying shaft.

Each of the respective cam means **16** includes on the periphery thereof a cam track **17**. Each of the peripheral cam tracks includes coded indicia, such as rise and fall contours, which are utilized to displace a follower switch **18** to one of three predetermined positions. The position of an individual follower switch is dependent on the particular portion of a cam's contour on which the follower switch is riding. It is seen that an individual follower switch operatively associated with the periphery of an individual cam is located juxtaposition the periphery of that cam. As the shaft is intermittently rotated by the action of the escapement means, the respective follower switches riding on the operatively associated cam tracks are displaced to one of three predetermined positions, the switch positions determined by the contour of the particular cam track.

The plurality of follower switches **18**, having external terminals, are fixedly coupled to a terminal board **19** which is fabricated from any suitable insulative material. A terminal board **20**, fabricated from any suitable insulative material, has fixedly mounted thereon, a plurality of fixed contacts and terminals **21**. At least two of the fixed contacts are operatively associated with each of the follower switches. Fixedly mounted in aperture **22** of terminal board **20** is actuator means **23** of actuator mechanism **24**.

The actuator means is fabricated from phenolic or other suitable insulative material. The spring loaded actuator mechanism constitutes the unique feature of the present invention because of its construction and operation. The actuator mechanism includes the actuator means **23**, partially toothed cam means **25** and a plurality of contact carrying blade means **49** and **50**. The partially toothed cam means is fixedly coupled to the cam carrying shaft and is in spaced parallel relationship with cam means **16**.

The actuator means **23** includes a slotted substantially T-shaped actuator **26**, a coil spring means **27**, and a retaining means **28**. The retaining means has a recess that is so dimensioned that a stem portion **29** of the T-shaped actuator slidably interfits with the recess. Spring means **27** is positioned between stem portion **29** and the recess of the retaining means such that the spring means biases the substantially T-shaped actuator outwardly from the recess of the retaining means. The T-shaped actuator contains a slotted step **30** and a step **31** separated from a slotted step **32** and a step **33** by stem portion **29**. The various step portions of the T-shaped actuator are utilized to provide the means of actuating contact carrying blade means thereby making and breaking electrical continuity to electrical circuits. A substantially V-shaped projecting surface **34** projects from the T-shaped actuator and serves as the engaging surface with a toothed portion **35** of partially toothed cam **25**. It is seen that the V-shaped portion **34** interfits with one of the valley portions of the partially toothed cam. Any subsequent displacement of the partially toothed cam would cause the V-shaped portion of the T-shaped actuator to ride up the ramped portion of the individual tooth with which the V-shaped projection was interfitting thereby displacing the T-shaped actuator toward terminal board **20**.

Front plate **36** provides a forward support for the cam carrying shaft. The front plate also serves as a means for retaining a means for axially positioning the cam carrying shaft. A "hairpin" spring means **37** is fixedly coupled to a pair of mounting studs **38**. The mounting studs are fixedly coupled to the front mounting plate by any suitable means such as by rivets, welding, or the like. The "hairpin" spring is mounted in a plane that is per-

pendicular to the longitudinal axis of the cam carrying shaft. Extremities or fingers of the "hairpin" spring engage one of the plurality of circumferential grooves cut in the periphery of the timer shaft. The fingers are spring biased against the shaft thereby maintaining the shaft in a desired axial position. To alter the axial position of the cam carrying shaft, the shaft is pushed or pulled, depending on the desired result or the initial axial position, to thereby alter or change the axial position of the shaft.

A suitable line switch **40** is utilized to actuate the sequential timer. Any one of several different types of line switches may be used. One suitable type of line switch is illustrated in FIGURES 2 and 3. The line switch illustrated has a first contact carrying means **41** biased out of engagement with a second contact carrying means **42** by the partially toothed cam **25**. The disengagement of the contact carrying means "opens" an electrical circuit connected between the sequential timer and an electrical source (not shown) when the cam carrying shaft is axially positioned as shown in FIGURES 2 and 3. The axial position of the cam carrying shaft shown in FIGURE 3 will be referred to hereinafter as the first axial position. When the shaft is in a second axial position as shown by the solid line of FIGURE 5, the partially toothed cam no longer biases the first contact carrying means out of engagement with the second contact carrying means. The resilient action of the first contact carrying means allows the first contact carrying means to engage the second contact carrying means. Upon engagement of the contact carrying means, an electrical circuit between the electrical source (not shown) and the sequential timer is closed, thereby electrically energizing the sequential timer. It is emphasized that the disclosed line switch means is only one of several different types of line switch means that could be used in cooperative association with the axial shaft positioning means of the present invention and as such its description is merely intended to facilitate the description of the present invention.

It is seen that the rear mounting plate and the front mounting plate are in spaced parallel relationship. Apertures centrally located in each of the respective mounting plates serve to seat the cam carrying shaft. The cam carrying shaft projects through each of the apertures. A ring **43** is positioned on frontmost side of each of the mounting plates so as to interfit with a circumferential groove of the shaft juxtaposed each of the mounting plates. The rings prevent axial displacement of the cam carrying shaft beyond desired axial limits. Fixedly connected to an extremity of the cam carrying shaft, as illustrated in FIGURE 1, is a control knob **44**. The control knob may have printed thereon any suitable means indicia which indicates the axial position of the cam carrying shaft.

As disclosed hereinbefore, the facility for mounting the switches and terminals thereof are provided by terminal boards **19** and **20**, which are fabricated from any suitable insulative material. The respective engagements of these boards with the front mounting plate and the rear mounting plate in conjunction with spacer posts **45** and **46** provides structural integrity and the alignment necessary for the proper cooperative relationship between the cam means and the follower switches and the partially toothed cam means and the actuator means of the sequential timer.

With the structural relationship of the various components in mind and by continued reference to the several figures of the drawings, the following analysis of the operation of the present invention will serve further to amplify the novelty of the present invention. With the line switch open as illustrated in FIGURES 2 and 3 the sequential timer is in the deenergized position. The cam carrying shaft is rotated to the desired circumferential location corresponding to a desired wash time interval within the wash portion of the timing cycle. The rotational displacement of the cam carrying shaft also serves to rotate the cam means **16** and the partially toothed cam means **25** through the same number of degrees. The partially toothed cam means may be advanced to any desired time interval within the wash portion of the timing cycle. The partially toothed cam is illustrated as having 10 teeth which represent each one of the ten minutes of the usual wash time interval of the timing cycle. If it is desired to make the wash interval of longer time duration alterations are made to the appropriate cam of cam means **16** and in addition the number of teeth are increased to correspond to the number of minutes contained within the wash portion of the timing cycle. To decrease the time duration of the wash portion of the timing cycle, the appropriate cam of cam means **16** has its periphery altered so that the desired wash time interval is now programmed by the cam means. The partially toothed cam means has its number of teeth reduced to correspond to the number of minutes contained within the wash portion of the timing cycle.

To set the sequential timer the control shaft is axially pulled out so that the flat surface of the partially toothed cam of the cam means abuts tabs **47** and **48** of the respective resilient contact carrying blade means **49** and **50**. Further axial movement by the cam carrying shaft displaces the resilient, contact carrying blades such that the contact of contact carrying blade **49** engages fixed contact **51** and the contact of contact carrying blade **50** engages fixed contact **52**. The engagement of the aforementioned contacts serves to provide a means whereby the timer motor is coupled directly to the electrical source and the drain circuit is actuated. Engaging tip **53** carried by contact carrying blade **49** and engaging tip **54** carried by contact carrying blade **50** are displaced in a forward direction by the partially toothed cam. The longitudinal width of the partially toothed cam is sufficiently wide so that the V-shaped projecting surface rides on the peripheral surface of the partially toothed cam regardless of the axial position of said cam or the cam carrying shaft. It is seen that the V-shaped projecting surface would be riding on the non-toothed portion of the cam since the normal termination point of a timed cycle of the sequential timer is such that the V-shaped projection is riding on the non-toothed portion of the cam. In such a position the T-shaped actuator is displaced in the direction of arrow **57** thereby compressing spring means **27** storing energy therein. This location of components is illustrated in FIGURE 2.

Forward axial displacement of the cam carrying shaft causes tip **53** to underlie slotted step **30** of the T-shaped actuator and tip **54** to underlie slotted step **32** of the T-shaped actuator. The respective tips do not interfit with their respective slotted steps for the T-shaped actuator is so biased that the tips are not of sufficient length to reach the respective slotted steps of the T-shaped actuator. The partially toothed cam continues to bias the actuator means in the direction of arrow **57**. The cam carrying shaft is then rotated manually so as to program a portion of the wash cycle. It is seen that the T-shaped actuator is no longer biased in the direction of arrow **57** by the non-toothed portion of the partially toothed cam but rather that the V-shaped portion of the T-shaped actuator is now interfitting with a valley portion of the partially toothed cam. The T-shaped actuator is displaced to the interfitting position by the release of the stored energy of the coil spring means in the direction of arrow **58**. Slotted step **30** interfits with engaging tip **53** and slotted step **32** interfits with engaging tip **54** due to the downward displacement of the actuator means to an interfitting position therewith. The slotted steps retain their respective tips at a predetermined locked position as illustrated in FIGURE 3. As a result of the engaging tips interfitting with their respective slotted steps, the contact carried by the contact carrying blade **49** is held in engagement with fixed contact **51** and the contact carried by blade **50** is

held in engagement with fixed contact **52**. The V-shaped projection **34** of the T-shaped actuator interfits with one of the valleys of the partially toothed cam **25**. It is seen that if the tooth valleys did not exist the V-shaped projection would continue to ride on the partially toothed cam's periphery in such a position that the slotted steps would not interfit with their respective engaging tips but would rather the slotted steps would overlie the engaging tips without locking the tips in position as shown in FIGURE 3. As illustrated in FIGURE 3, the partially toothed cam biases line switch **40** to an "open" condition.

To initiate the programmed cycle of the sequential timer, cam carrying shaft **14** is manually displaced in an inward axial direction. The inward movement of the cam shaft serves to activate a plurality of electrical and mechanical functions. Gear **15** is likewise displaced inwardly until it engages in mesh with pinion **12**. The motor **4** by means of the escapement means has its constant speed output translated by the escapement means to an intermittent or step-by-step output. The intermittent output of the escapement means is transferred to gear **15** by the pinion. It is seen that the ratchet wheel is fixedly coupled to the cam carrying shaft, therefore the intermittent motion of the gear is transferred to the cam carrying shaft and thus to any means carried on the shaft such as the cam means and the partially toothed cam. As disclosed hereinbefore, the sequential timer is now in the position as shown by the solid lines of FIGURES 4 and 5. The contacts of the contact carrying blades are retained in an engaged position with their respective fixed contacts by the T-shaped actuator, and the line switch **40** is closed. This position is maintained for a period of time as determined by the time interval between escapements. The time interval can be any desired interval, however, normally it is one minute as is the case in the present invention.

Actuation of the cam carrying shaft by the escapement means causes the T-shaped actuator and the resilient, contact carrying blades to assume the position of the dotted lines as shown in FIGURE 5. The intermittent, arcuate displacement of the cam carrying shaft is equal to the distance between the teeth of the partially toothed cam. The initial intermittent rotation of the cam carrying shaft causes the V-shaped projection **34** to ramp up the slope of the tooth with which it was interfitting. The resulting camming action causes slotted step **30** and slotted step **32** to move outwardly and beyond the furthest extremity of engaging tip **53** and engaging tip **54** respectively. The resilient contact carrying blade **49** and the resilient contact carrying blade **50**, both of which have been maintained in a biased position thereby storing energy, now are freed from their respective restrained positions. The energy stored thereby is released causing the contact carrying blade **49** to be displaced toward step **31**, and thereafter to become lodged on and retained by step **31** of the T-shaped actuator. The release of the energy stored by contact carrying blade **50** displaces the blade to a lodged position on step **33** of the T-shaped actuator. The movement of the contact carrying blades causes the contacts to disengage their respective fixed contacts thereby terminating of the electrical circuit associated therewith. The resulting position of the T-shaped actuator and the contact carrying blades are illustrated by the dotted lines of FIGURE 5.

While the invention is illustrated and described in its preferred embodiment, it will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of this invention and as set forth in the appended claims.

Having thus described our invention, we claim:

1. A time controlled switching mechanism comprising: mounting means, an axially displaceable cam carrying shaft rotatably journalled in said mounting means; coded indicia means carried by said shaft; a plurality of contact carrying blades carried by said mounting means; fixed contacts spaced from said contacts of said blades and connected to said mounting means; and displaceable actuator means carried by said mounting means and having discrete steps and engaging said coded indicia of said coded indicia means, one of said steps engaging with said blades so as to bias said blades in engagement with said fixed contacts as said shaft is axially displaced, rotational displacement of said coded indicia means causes said actuator means to be displaced from an engaged position with said blades so that said blades disengage with said fixed contacts.

2. A time controlled switching mechanism comprising: a mounting means; an axially displaceable shaft rotatably journalled in said mounting means; and an actuator mechanism including a biased actuator means, a plurality of contact carrying blades, and a coded indicia means, said coded indicia means fixedly coupled to said shaft, said actuator means having a plurality of steps and engaging said coded indicia of said coded indicia means and responsive to said indicia, said plurality of contact carrying blade means locked in engagement with fixed contacts by one of said steps of said actuator means as said shaft is axially displaced, rotation of said coded indicia means displacing said actuator means thereby simultaneously disengaging said plurality of contact carrying blade means from engagement with said fixed contacts to another step of said actuator means.

3. A time controlled switching mechanism comprising: mounting means; an axially displaceable cam carrying shaft rotatably journalled in said mounting means; coded indicia means carried by said shaft; a plurality of contact carrying blades including a free end carried by said mounting means; fixed contacts spaced from said contacts of said blades and connected to said mounting means; and displaceable actuator means carried by said mounting means and having discrete steps and engaging said coded indicia of said coded indicia means, one of said steps engaging with said free end of said blades so as to bias said blades in engagement with said fixed contacts as said shaft is axially displaced, rotational displacement of said coded indicia means causes said actuator means to be displaced from an engaged position with said blades so that said blades disengage with said fixed contacts.

4. A time controlled switching mechanism comprising: mounting means; an axially displaceable cam carrying shaft rotatably journalled in said mounting means; cam means having contoured surfaces carried by said shaft; a plurality of contact carrying blades including a free end carried by said mounting means; fixed contacts spaced from said contacts of said blades and connected to said mounting means; and displaceable actuator means carried by said mounting means and having discrete steps and riding on said contoured surfaces of said cam means, one of said steps engaging with said free end of said blades so as to bias said blades in engagement with said fixed contacts as said shaft is axially displaced, rotational displacement of said cam causes said actuator means to be displaced by said contoured surfaces thereby displacing said actuator means from an engaged position with said blades so that said blades disengage with said fixed contacts.

5. A time controlled switching mechanism comprising: mounting means; an axially displaceable cam carrying shaft rotatably journalled in said mounting means; partially toothed cam means carried by said shaft; a plurality of contact carrying blades including a free end carried by said mounting means; fixed contacts spaced from said contacts of said blades and connected to said mounting means; and displaceable actuator means carried by said mounting means and having at least two discrete steps and means riding on said partially toothed means, one of said steps engaging with said free end of said blades so as to bias said blades in engagement with said fixed contacts as said shaft is axially displaced, rotational displacement of said cam causes said means to ride up one of said teeth thereby displacing said one step

of said actuator means from an engaged position with said blades so that said blades disengage with said fixed contacts and engage with said second step.

6. A time controlled switching mechanism comprising: mounting means; an axially displaceable cam carrying shaft rotatably journalled in said mounting means; partially toothed cam means carried by said shaft; a plurality of contact carrying blades including a free end carried by said mounting means; fixed contacts spaced from said contacts of blades and connected to said mounting means; and a spring biased actuator means carried by said mounting means and having at least two pairs of two discrete steps, said pairs of discrete steps separated by means riding on said partially toothed means, one of said steps of said pairs of steps engaging with said free end of said blades so as to lock said blades in engagement with said fixed contacts as said shaft is axially displaced, rotational displacement of said cam causes said means to ride up one of said teeth thereby displacing said one step of said actuator means from a locked position with said blades so that blades disengage with said fixed contacts and engage with said second step.

7. A time controlled switching mechanism comprising: mounting means; an axially displaceable cam carrying shaft rotatably journalled in said mounting means; partially toothed cam means carried by said shaft; a plurality of contact carrying blades including a free end carried by said mounting means; fixed contacts spaced from said contacts of said blades and connected to said mounting means; and a spring biased actuator means carried by said mounting means and having at least two pairs of two discrete steps, said pairs of discrete steps separated by means riding on said partially toothed means, one of said steps of said pairs of steps including a slot engaging with said free end of said baldes so as to lock said blades in engagement with said fixed contacts as said shaft is axially displaced, rotational displacement of said cam causes said means to ride up one of said teeth thereby displacing said slotted step of said actuator means from a locked position with said blades so that said blades disengage with said fixed contacts and engage with said second step.

8. A time controlled switching mechanism comprising: mounting means; an axially displaceable cam carrying shaft rotatably journalled in said mounting means and rotated in accordance with a determined program cycle; partially toothed cam means carried by said shaft; a plurality of contact carrying blades including a free end carried by said mounting means; fixed contacts spaced from said contacts of said blades and connected to said mounting means; and a spring biased actuator means carried by said mounting means and having at least two pairs of two discrete steps, said pairs of discrete steps separated by means riding on said partially toothed means, one of said steps of said pairs of steps including a slot engaging with said free end of said blades so as to lock said blades in engagement with said fixed contacts as said shaft is axially displaced, rotational displacement of said cam causes said means to ride up one of said teeth thereby displacing said slotted step of said actuator means from a locked position with said blades so that said blades disengage with said fixed contacts and engage with said second step, said second step being substantially flat.

9. A timing device for sequentially actuating a plurality of electrical circuits comprising: means for supporting said timing device; an axially displaceable shaft journalled in said support means; intermittent drive means, said shaft coupled to and intermittently driven by said drive means; and an actuator mechanism including an actuator means, a plurality of contact carrying blades, and coded indicia means fixedly coupled to said shaft, said actuator means having a plurality of steps and engaging with said coded indicia of said coded indicia means and responsive to said indicia, said plurality of contact carrying blade means biased in engagement with fixed contacts by one of said steps of said actuator means as said shaft is axially displaced, intermittent rotation of said coded indicia means displacing said actuator means thereby disengaging said contact carrying blade means from engagement with said fixed contacts to another step of said actuator means.

10. A timing device for sequentially actuating a plurality of electrical circuits comprising: means for supporting said timing device; an axially displaceable cam carrying shaft journalled in said support means; intermittent drive means, said cam shaft coupled to and intermittently driven by said drive means; and an actuator mechanism including spring biased actuator means, a plurality of contact carrying blades, and coded indicia means fixedly coupled to said shaft, said actuator means having a plurality of steps and engaging said coded indicia of said coded indicia means and responsive to said indicia, said plurality of contact carrying blade means locked in engagement with fixed contacts by one of said steps of said actuator means as said shaft is axially displaced, intermittent rotation of said coded indicia means displacing said actuator means thereby simultaneously disengaging said plurality of contact carrying blade means from engagement with said fixed contacts to another step of said actuator means.

11. A timing device for sequentially actuating a plurality of electrical circuits comprising: a means for supporting said timing device; an axially displaceable cam carrying shaft journalled in said support means; intermittent drive means, said cam shaft coupled to and intermittently driven by said drive means; and an actuator mechanism including spring biased actuator means, a plurality of contact carrying blades, and a partially toothed cam, said cam fixedly coupled to said shaft and having a partially toothed periphery, said actuator means having a plurality of steps and engaging said periphery of said partially toothed cam and responsive to said contours, said plurality of contact carrying blade means retained in engagement with fixed contacts by one of said steps of said actuator means as said shaft is axially displaced, intermittent rotation of said partially toothed cam displacing said actuator means thereby disengaging said contact carrying blade means from engagement with said fixed contacts to another step of said actuator means.

12. A timing device for sequentially actuating a plurality of electrical circuits comprising: means for supporting said timing device; an axially displaceable cam carrying shaft journalled in said support means; an intermittent drive means, said cam shaft coupled to and intermittently driven by said drive means; and an actuator mechanism including a spring biased actuator means, a plurality of contact carrying blades, and a partially toothed cam, said cam fixedly coupled to said shaft and having a partially toothed periphery, said actuator means having a plurality of steps and riding on said periphery of said partially toothed cam and responsive to said contours, said plurality of contact carrying blade means retained in engagement with fixed contacts by one of said steps of said actuator means as said shaft is axially displaced, intermittent rotation of said partially toothed cam displacing said actuator means thereby simultaneously disengaging said plurality of contact carrying blade means from engagement with said fixed contacts to another step of said actuator means, said disengagement terminating actuation of at least two of said electrical circuits.

13. A timing device for sequentially actuating a plurality of electrical circuits comprising: a means for supporting said timing device, said means including a pair of plates in spaced parallel relationship; a drive means fixedly mounted on one of said plates; an escapement means coupled to said drive means, said escapement means intermittently driving gear means; an axially displaceable shaft journalled between said pair of plates, said cam

shaft coupled to and intermittently driven by said gear means; a plurality of means fixedly coupled to said shaft, said means including peripheral rise and fall contours; a plurality of follower switches riding on the periphery of said means and responsive to the contours thereof thereby making and breaking electrical continuity to said plurality of electrical circuits according to a desired sequence; a cam having a contoured periphery fixedly coupled to said shaft; an actuator means riding on said periphery of said contoured cam and responsive to said contours, said actuator means including steps; and a plurality of contact carrying blade means retained in engagement with fixed contacts by one of said steps of said actuator means as said shaft is axially displaced, intermittent rotation of said contoured cam displacing said actuator means thereby disengaging said contact carrying blade means from engagement with said fixed contacts.

14. A timing device for sequentially actuating a plurality of electrical circuits comprising: a means for supporting said timing device, said means including a pair of plates in spaced parallel relationship; a drive means fixedly mounted on one of said plates; an escapement means coupled to said drive means, said escapement means intermittently driving gear means; an axially displaceable cam carrying shaft journalled between said pair of plates, said cam shaft coupled to and intermittently driven by said gear means; a plurality of cam means fixedly coupled to said shaft, said cam means including peripheral rise and fall contours; a plurality of follower switches riding on the periphery of said cam means and responsive to the contours thereof thereby making and breaking electrical continuity to said plurality of electrical circuits according to a desired sequence; a cam having a partially toothed periphery fixedly coupled to said shaft; an actuator means riding on said periphery of said partially toothed cam and responsive to said contours, said actuator means including at least two discrete steps; and a plurality of contact carrying blade means retained in engagement with fixed contacts by one of said steps of said actuator means, as said shaft is axially displaced, intermittent rotation of said partially toothed cam displacing said actuator means thereby disengaging said contact carrying blade means from engagement with said fixed contacts.

15. A timing device for sequentially actuating a plurality of electrical circuits comprising: a means for supporting said timing device, said means including a pair of plates in spaced parallel relationship; a drive means fixedly mounted on one of said plates; an escapement means coupled to said drive means, said escapement means intermittently driving gear means; an axially displaceable cam carrying shaft journalled between said pair of plates, said cam shaft coupled to and intermittently driven by said gear means; a plurality of cam means fixedly coupled to said shaft, said cam means including peripheral rise and fall contours; a plurality of follower switches riding on the periphery of said cam means and responsive to the contours thereof thereby making and breaking electrical continuity to said plurality of electrical circuits according to a desired sequence; a cam having a partially toothed periphery fixedly coupled to said shaft; an actuator means riding on said periphery of said partially toothed cam and responsive to said contours, said actuator means including at least two discrete steps; and a plurality of contact carrying blade means locked in engagement with fixed contacts by one of said steps of said actuator means as said shaft is axially displaced, intermittent rotation of said partially toothed cam displacing said actuator means thereby disengaging said contact carrying blade means from engagement with said fixed contacts, said disengagement terminating actuation of at least two of said electrical circuits.

16. A timing device for sequentially actuating a plurality of electrical circuits comprising: a means for supporting said timing device, said means including a pair of plates in spaced parallel relationship; a drive means fixedly mounted on one of said plates; an escapement means coupled to said drive means, said escapement means intermittently driving gear means; an axially displaceable cam carrying shaft journalled between said pair of plates, said cam shaft coupled to and intermittently driven by said gear means; a plurality of cam means fixedly coupled to said shaft, said cam means including peripheral rise and fall contours; a plurality of follower switches riding on the periphery of said cam means and responsive to the contours thereof thereby making and breaking electrical continuity to said plurality of electrical circuits according to a desired sequence; a cam having a partially toothed periphery fixedly coupled to said shaft; a spring biased actuator means riding on said periphery of said partially toothed cam and responsive to said contours, said actuator means including at least two discrete steps; and a plurality of contact carrying blade means locked in engagement with fixed contacts by one of said steps of said actuator means as said shaft is axially displaced, intermittent rotation of said partially toothed cam displacing said actuator means thereby disengaging said contact carrying blade means from engagement with said fixed contacts, said disengagement terminating actuation of at least two of said circuits.

17. A timing device for sequentially actuating a plurality of electrical circuits comprising: a means for supporting said timing device, said means including a pair of plates in spaced parallel relationship; a drive means fixedly mounted on one of said plates; an escapement means coupled to said drive means, said escapement means intermittently driving gear means; an axially displaceable cam carrying shaft journalled between said pair of plates, said cam shaft coupled to and intermittently driven by said gear means; a plurality of cam means fixedly coupled to said shaft, said cam means including peripheral rise and fall contours; a plurality of follower switches riding on the periphery of said cam means and responsive to the contours thereof thereby making and breaking electrical continuity to said plurality of electrical circuits according to a desired sequence; a cam having a partially toothed periphery fixedly coupled to said shaft; a spring biased actuator means having a surface of predetermined configuration riding on said periphery of said partially toothed cam and responsive to said contours, said actuator means including at least two pairs of two discrete steps, said pairs of discrete steps separated by said surface riding on said partially toothed cam; and a plurality of contact carrying blade means locked in engagement with fixed contacts by a slotted one of said steps of said actuator means as said shaft is axially displaced, intermittent rotation of said partially toothed cam displacing said actuator means thereby simultaneously disengaging said contact carrying blade means from engagement with said fixed contacts and engaging with said second step, said disengagement terminating actuation of at least two of said circuits.

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