Feb. 13, 1968 D. I. SAGINARIO ET AL 3,369,085

CYCLE TIMER WITH LATCHING SWITCH PLUNGER

Filed Feb. 7, 1966

FIG. 1

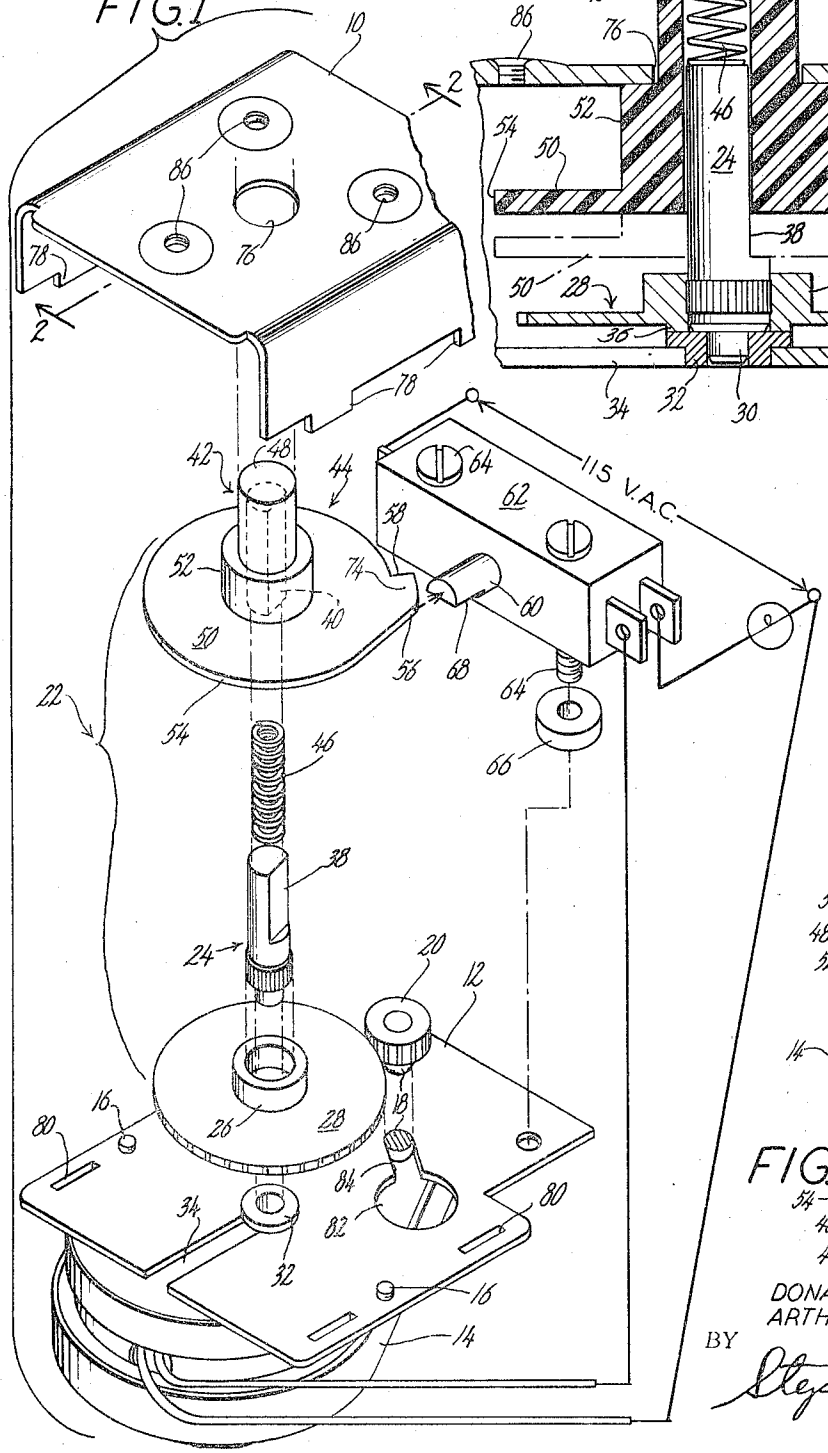


FIG. 2

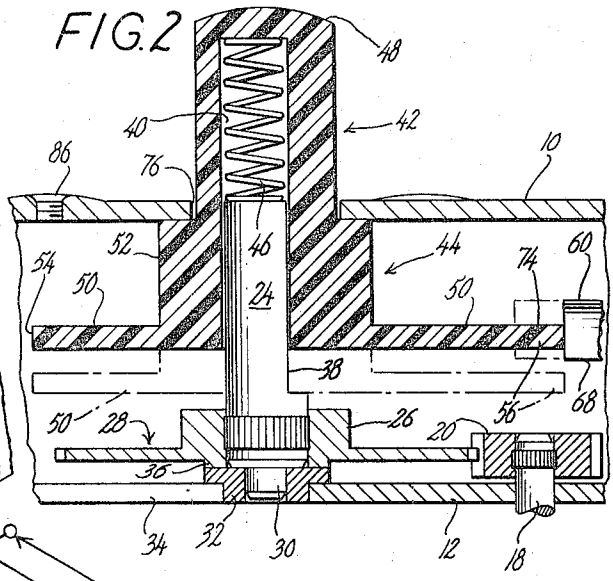


FIG. 3

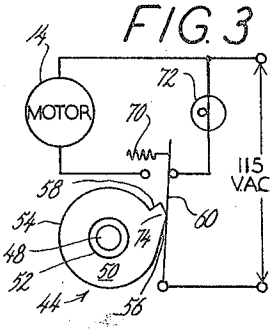
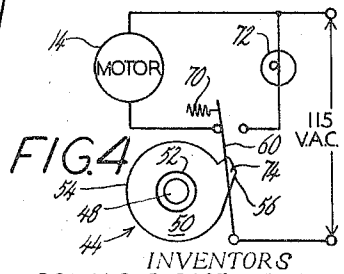


FIG. 4



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United States Patent Office 3,369,085 Patented Feb. 13, 1968

3,369,085

CYCLE TIMER WITH LATCHING SWITCH PLUNGER

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Filed Feb. 7, 1966, Ser. No. 525,545
5 Claims. (Cl. 200—35)

This invention relates to an extremely simple yet efficient cycle timer that executes a timed cycle when a start button is momentarily operated, then upon termination of the cycle, the timer is rendered inactive while an alternative function is performed.

The apparatus of this invention is ideally suitable when a relatively lengthy but prescribed period of elapsed time transpires to give indication, for example, that preventive maintenance should be accomplished. For such application, the timer may be utilized to give visual or audible warning that a filter should be replaced in an air conditioner or in a process bath after a definite period of filter use; or give indication that a fresh bath should be prepared after a definite number of hours that the bath is in use.

In the above instances if it is desirable to replace a filter or prepare a fresh bath every one hundred days, or precisely after twenty-four hundred hours, the timer is activated when the filtered apparatus (or bath) goes into use and thereafter the timer needs no further attention. At the end of the elapsed time period, the timer will be automatically deactivated and a continuous signal will be given, indicating that the thus monitored apparatus requires attention.

For another example, the instant timer has utility as a control for the well known air-blown hand dryer found at public comfort stations; or for similarly operating apparatus. In this instance, the cycle period would be of short duration and would be accomplished by use of a prime mover that would effect a sixty or ninety second timing cycle. Accordingly, depression of the start button would concurrently activate the blower and start the timer and after exactly sixty or ninety seconds the blower and timer would be simultaneously disabled through simple electrical circuit connections.

Cycle timers to perform the functions set out above are very well known but resort to complex activating and resetting procedures, such as the use of multiple cams or relay controls for motor hold and disable, which add materially to their expense. Moreover, in prior cycle timers wherein a cam disc provided with a cut-out or depression is used as a control medium for a switch plunger, a second switch or cam is usually employed to set off a cycle. Thereafter the plunger rides out of the depression onto the constant periphery of the cam disc. Only then does the real timing of the cycle commence. In this type of timer it can readily be appreciated that if an exact sixty second cycle is desired, a motor and gear train are required to rotate the cam disc slower than one r.p.m. to account for the lost time that elapsed before the switch plunger rode out of the disc depression. For a lengthy and accurate cyclic excursion this type of timer is unsuitable.

Still another type of timer is provided with a switch operating member that is manually rotated off home position in one direction to enable a motor circuit, then the motor rotates that member in the opposite direction, to home position. When returned to home position, that member opens the motor circuit and terminates the cycle. This type of timer is for a simple function application and requires what is commonly termed a clutch motor which is substantially more expensive and not as functionally reliable as the simple uni-directional motor used in the instant application.

The apparatus of the instant invention, presently to be described more in detail, is characterized by its utmost simplicity and precise timing capability without resorting to a special timing motor, intricately calibrated cam, or complex activating and resetting procedures. Briefly outlined, a single switch actuator is employed to control, alternately, a motor enabling circuit and an indicating circuit through control of a single switch plunger. The switch actuator or composite control member is a spring-biased, push button and cam unit that is coupled with a drive wheel which, in turn, is driven by the usual motor pinion. When the control member is at home position, a radial extension of the cam unit periphery is arranged to axially displace the switch plunger. More specifically, when the control member is at home position the switch plunger is displaced in opposition to its normal spring-set condition to hold the motor circuit open and the indicating circuit closed. When the push button and thus the control member is momentarily depressed, the switch plunger is liberated by spring action to cause activation of the motor circuit and de-activation of the indicating circuit. The push button can now be released but the control member is prevented from being immediately restored by the spring bias as the radial extension of the control member is temporarily latched in the depressed position by the liberated switch plunger. However, the control member is now rotated by the energized motor as the motor is enabled immediately after the switch plunger is liberated. When the radial extension is rotated beyond the switch plunger the control member is spring-elevated to radial alignment with the switch plunger. Then, after a prescribed cyclic excursion, the control member returns to home position whereat the radial extension thereof again axially displaces the switch plunger and opens the motor circuit. The cycle is completed and the indicating circuit enabled to attract notice of this condition. The operation is simple and accurate.

Accordingly, it is the main object of this invention to provide an accurate long or short cycle timer that employs a minimum of parts and is extremely simple to manufacture and operate.

Another object is to provide in such a timer a single control member for alternately enabling and disabling a pair of electrical circuits.

A further object is to provide a cycle timer with capability of immediate cycle start and accurate cycle shut-off under control of a single member that is associated with a simple switch unit.

A still further object is to provide a basic timer that can be mass produced and used in a wide variety of diverse timing applications.

Other objects and advantages will be apparent from the following detailed description of the preferred embodiment illustrated in the accompanying drawings of which:

FIG. 1 is an exploded perspective view illustrating the elements of the novel timer and diagrammatically showing the electrical connections therefor;

FIG. 2 is a sectional representation of the assembled timer viewed substantially along lines 2—2 of FIG. 1 and illustrating in full lines the control member and a portion of the switch plunger at home position, the dot and dash position depicting the control member and switch plunger off home position;

FIG. 3 is a diagrammatic showing of the electrical circuit for the timer and the control therefor corresponding to the full line showing of FIG. 2; and

FIG. 4 is a view similar to that of FIG. 3 but showing the control member and switch plunger moved to the dot and dash position of FIG. 2.

Referring now to the drawings and particularly to FIG. 1, the cycle timer mechanism is mounted between an upper plate 10 and a lower plate 12. A drive motor 14

for the timer mechanism is mounted to the underside of plate 12 as by a pair of tabs (not shown) that are formed outwardly from the motor housing and receive a pair of screws 16 that thread into plate 12. A motor output shaft 18 accommodates a drive pinion 20 that is force-fitted thereon, as shown. Motor 14 is of the inexpensive, synchronous type that is commercially available and incorporates the major portion of a gear reduction train that rotates the drive pinion 20. The drive pinion 20 rotates the timing assembly 22 of the invention in a desired or constant direction (clockwise in FIG. 1) when the motor is connected to a source of A.C. power. The details of the motor drive are very well known and need not be fully explained for an understanding of the present invention.

With reference now to the novel timing mechanism, a knurled shaft 24 is force-fitted into a hub 26 which forms part of a drive wheel 28, herein termed the last gear of the gear train. Shaft 24 has a reduced or turned down end 30 (FIG. 2) that journals in a bushing 32 which is press-fitted into an elongate slot 34 provided in lower plate 12. A flange 36 of hub 26 lightly bears on the upper surface of bushing 32 as drive wheel 28 is rotated. Shaft 24 is flattened as at 38 whereby it is clutchingly received in the open end of a recess 40 formed in a projection 42 of a composite element 44. Such arrangement provides a solid coupling and simplifies assembly. Recess 40 is of greater length than the flatted portion of shaft 24 for accommodating a compression spring 46 that fits between the closed end of recess 40 and the top surface of shaft 24.

Composite element 44 may be of an easily formed but relatively hard plastic such as Delrin and serves as a unitary push button 48 and control member 50. A collar 52 also forms part of the element 44 so that when spring 46 urges element 44 to its upward limit, collar 52 abuts the underside of plate 10, as illustrated by the full lines in FIG. 2, to thereby establish a first level for the control member 50.

In the preferred embodiment, control member 50 is in the form of a cam disc that has a substantially circular periphery, generally indicated at 54, which is interrupted by a radial extension thereof, indicated at 56 and herein termed the home portion of member 50. Radial extension 56 is terminated by a drop-off 58 that returns to the circular periphery 54. At the upward, or first level positon, the periphery of member 50 is radially aligned with a plunger 60 that forms part of an ordinary single pole, double throw, snap-action switch 62. The cross-sectional dimension of member 50, taken through its axis of rotation, is such that the circular peripheral portion 54 is always out of contact with plunger 60 but, as soon will become evident, the radial extension or home portion 56 of member 50, which has a greater cross-sectional diameter than portion 54, is adapted to influence the position of switch plunger 60 and thus the electrical circuits.

Switch 62 is mounted on lower plate 12, as by screws 64, and is shimmed by washers 66 (only one of which is shown in FIG. 1) to insure that the exposed, central end of plunger 60 and the periphery of member 50 are radially aligned when the latter is in the upper position or at the first level. Switch plunger 60 is the usual reciprocal type and is of generally circular construction. In this instance, however, plunger 60 is provided with a flat 68 at its engageable end, as shown in FIG. 1. Flat 68 is adapted to engage extension 56 to temporarily hold control member 50 in the depressed position or at a second level when the control member is moved off home position at the start of a cycle. The reason for such latching is an important aspect of this invention and will be set out in detail below.

As diagrammatically shown in FIGS. 3 and 4, switch plunger 60 is moveable between first and second positions and urged to what is termed herein the first position by a spring 70, which is shown schematically as a tension spring for simplicity of illustration. In the FIG. 3 position, the composite element 44 is at the upper level and control member 50, integral therewith, is at a home angular position whereat radial extension 56 holds switch plunger 60 in the second position. In such position it can be readily seen that the motor circuit is disabled and a circuit to perform another function is enabled. Again for simplicity of illustration, the enabled circuit of FIG. 3 includes a lamp 72 which indicates that the timer is at home position or that a cycle has been terminated.

To initiate a cycle, the push button 48 is momentarily depressed whereupon element 44 and control member 50 are lowered to the dot and dash position of FIG. 2 or to the second level. When the push button 48 is depressed off home position it is clearly evident in FIG. 4 that spring 70 moves plunger 60 to the first position (dot and dash showing of FIG. 2) and completes the motor circuit and opens the indicating circuit. Thus a cycle is instituted and control member 50 commences clockwise rotation. When pressure is removed from push button 48, spring 46 attempts to elevate control member 50 to the first level. However, an upper disc-face surface 74 of radial extension 56 engages the flatted portion 68 of plunger 60 and latches member 50 at the second level. The motor continues to rotate member 50 at the second level, so that when the drop-off 58 of extension 56 passes beyond plunger 60, spring 46 elevates element 44 and member 50 therewith until collar 52 engages the underside of plate 10. Member 50 is now at the first level and, as periphery 54 is clear of plunger 60, member 50 is rotated toward home position. Toward the end of the cycle, the radial extension 56 of periphery 54 takes up the pre-travel of plunger 60 without incident and, when member 50 arrives near home position (close to the extremity of extension 56), plunger 60 suddenly snaps from the FIG. 4 to the FIG. 3 position. As can be seen in FIG. 3, the motor circuit is opened and the indicator circuit is closed. The timer is at the home angular position and indication of this condition is made evident. It should be noted that transfer of plunger 60 from the FIG. 4 to the FIG. 3 position should be accomplished before the extremity of extension 56 rotates to fully engage the end of the plunger. Such arrangement insures switch transfer and obviates holding the plunger length and control member to close tolerances.

Switch 62 is of the usual over-center, snap action type wherein the spring leaf that carries the single pole is slightly flexed during plunger pre-travel before the pole is transferred from the normally made contact. Reliable operation of the instant timer has been obtained with use of a snap-action switch having a plunger rated for a pre-travel of .040 inch and a similar over-travel (when transferred from the FIG. 4 to the FIG. 3 position). The particulars of such type switch are very well known. The diagrammatic showing is merely demonstrative.

In assembling the timer, bushing 32 is fixed in lower plate 12. Knurled shaft 24 is force-fitted into hub 26 of the driven wheel 28 so that the end 30 of shaft 24 journals in bushing 32. Spring 46 is entered in recess 40 and element 44 is fitted over shaft 24. Upper plate 10 is then entered over the timer assembly with projection 42 extending through a circular opening 76 in plate 10. A plurality of tabs 78 depending from plate 10 are aligned with a plurality of mating slots 80 provided in lower plate 12. The lower portions of tabs 78 are then staked or bent off at the underside of plate 12 and, thus fixed, plate 10 engages collar 52 and causes slight compression of spring 46. Switch 62 is now mounted on plate 12 and shimmed so that periphery 54 of control member 50 is radially aligned with the approximate axial center of plunger 60. Element 44 is now freely rotated to insure that the end of plunger 60 is spaced from periphery 54 and that the plunger is transferred from the motor enabling circuit condition (FIG. 4) to the indicator circuit condition

(FIG. 3) before the extremity of extension **56** engages the end of plunger **60**.

The above unit constitutes a sub-assembly that may be mass-produced and stocked. Depending on the application (long, short or intermediate timer) an appropriate timing motor and drive pinion assembly are mounted to the underside of plate **12**. More specifically, pinion **20** is passed through a generous opening **82** and motor output shaft **18** is keyed in an angular extension **84** of opening **82** until the threaded bores in plate **12** can receive screws **16** which secure the motor in place. Threaded bores **86** in upper plate **10** serve to positionally secure the assembled timer when in use.

It can now be appreciated that a simple timing apparatus capable or wide applicability has been provided. In the embodiment disclosed, the control member for the switch plunger is in the form of a disc that has a single radial extension. It will occur to those skilled in the art that a plurality of angularly offset extensions may be provided on the control member to effect a plurality of sequential applications. Moreover, a second switch may be associated with the upper or lower planar surface of the control member to perform a separate binary function during latching and liberation of that member.

It will thus be seen that the objects set forth above, including those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings should be interpreted as illustrative and not in a limiting sense.

Having described our invention, what we claim as new and desire to secure by Letters Patent is—

1. In a cycle time, the combination comprising:

a switch means for instituting and terminating a timed cycle, said switch means having a plunger which is moveable between a first position and a second position and biased to said first position;

a control member for determining said positions of said plunger, said control member being mounted for movement between first and second levels and for rotational movement at both of said levels, biasing means for urging, said control member to said first level,

means including a home position of said control member for transferring said plunger to said second position when said control member is at said first level and at a home angular position,

means for latchingly engaging said control member when the latter is moved to said second level for preventing said control member from returning to said first level while permitting said plunger to return to said first position,

an electrically operated timing mechanism, connected to said switch means, said timing mechanism having means for rotating said control member from said home angular position to effect said transferring movement of said switch plunger; and

means on said control member for automatically releasing said latching means in response to rotation of said member from said home angular position whereby said control member is delayedly restored by said biasing means to said first level during said cycle to effect termination of said cycle when said member is returned to said home angular position.

2. The combination according to claim **1** wherein said plunger when in said second position disables said timing mechanism and enables a circuit to perform another function.

3. A mechanism according to claim **1** wherein:

said timing mechanism has a shaft fixed thereto disposed along an axis;

said control member has a projection extending therefrom aligned with said shaft and said axis and adapted to receive said shaft to effect rotation of said member;

a biasing spring contained in a recess in said projection between the closed end of said projection and said shaft whereby said member is constantly urged to said first level; and

said control member is mounted so that its axis of rotation is perpendicular to the line of movement of the plunger between the first and second positions.

4. The combination according to claim **1** wherein said means for latchingly engaging said control member is formed by said switch plunger.

5. A mechanism according to claim **1** wherein said control member for determining said positions of said plunger includes a disc having a substantially circular periphery which is radially spaced from said plunger in either position of said plunger, a home portion comprised of a radial extension of said periphery and adapted to move said plunger to said second position when said control member is at said first level, and a disc-face surface engageable by said plunger to provide said latching action when said control member is at said second level.

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