United States Patent

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[72] Inventor **James A. Drachi**
Manchester, Conn.

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[73] Assignee **M. H. Rhodes Inc.**
Hartford, Conn.

[54] **AUTOMATIC CYCLE TIMER WITH MANUAL DEFEAT FEATURE**
7 Claims, 3 Drawing Figs.

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[51] **Int. Cl.** **H01h 7/08,** H01h 43/10
[50] **Field of Search** 307/141.4, 141, 141.8; 200/35, 38, 39; 74/3.54, 3.56

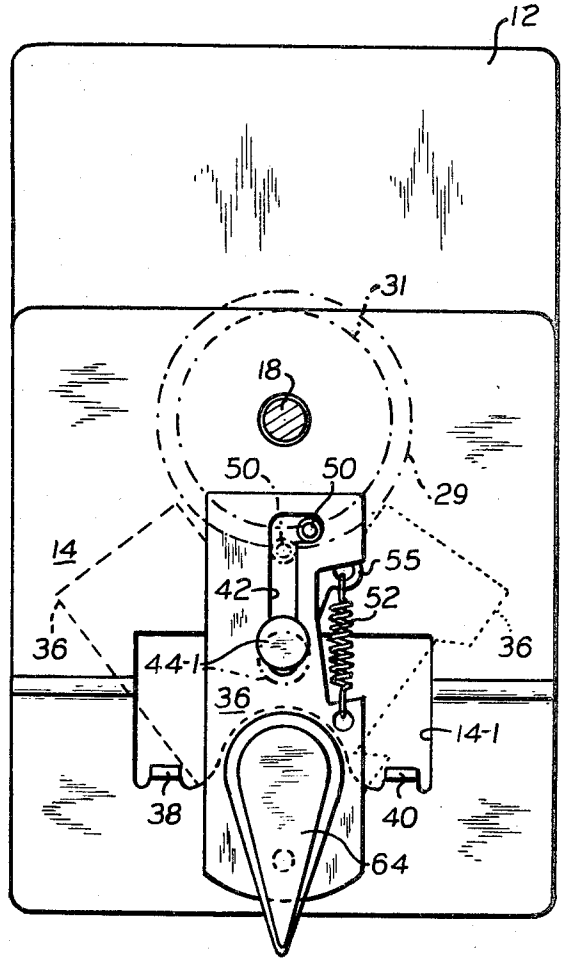
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Primary Examiner—Robert K. Schaefer
Assistant Examiner—J. R. Scott
Attorney—Hubbell, Cohen and Stiefel

ABSTRACT: An automatic cycle timer has a switch for controlling an external appliance. The switch is opened and closed automatically at predetermined times by a drive mechanism powered by an electric motor which has its own energizing circuit not controlled by the switch for the external appliance. The drive mechanism includes a reduction gear train which revolves a pair of cams, one for closing and the other for opening the switch. The cams do not engage the switch button directly, but instead move an actuator element which rides toggle fashion in an L-shaped slot formed in a mode selector element. When the mode selector is in a neutral position, the actuator determines the condition of the switch and the operation of the cycle timer is fully automatic; i.e. under the control of the motor-driven mechanism. But when the mode selector element is manually switched to another position it closes the switch, and in still another position it opens the switch, in either case without regard to the position of the actuator or the motor-driven mechanism. Thus manual manipulation of the mode selector takes precedence over automatic operation, but the operation of the motor is not thereby interrupted.



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FIG. 1.

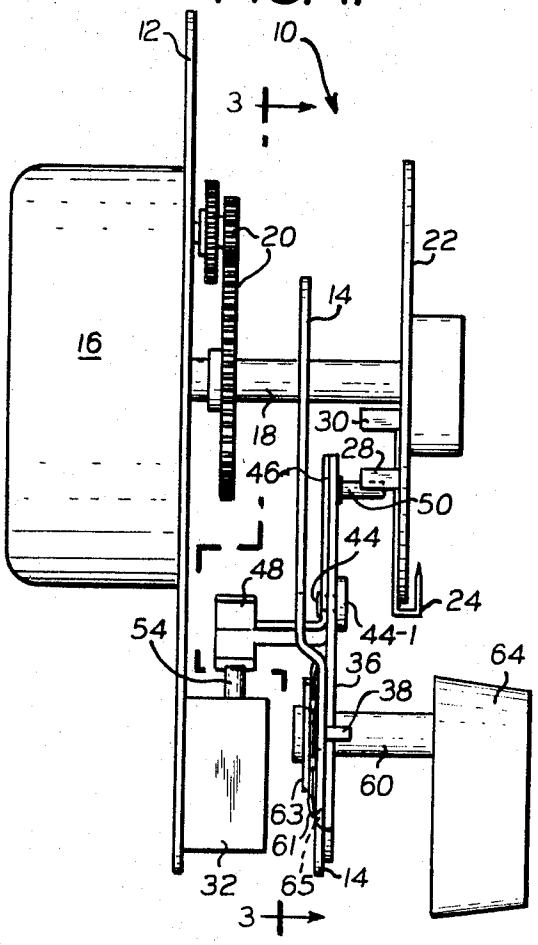


FIG. 2.

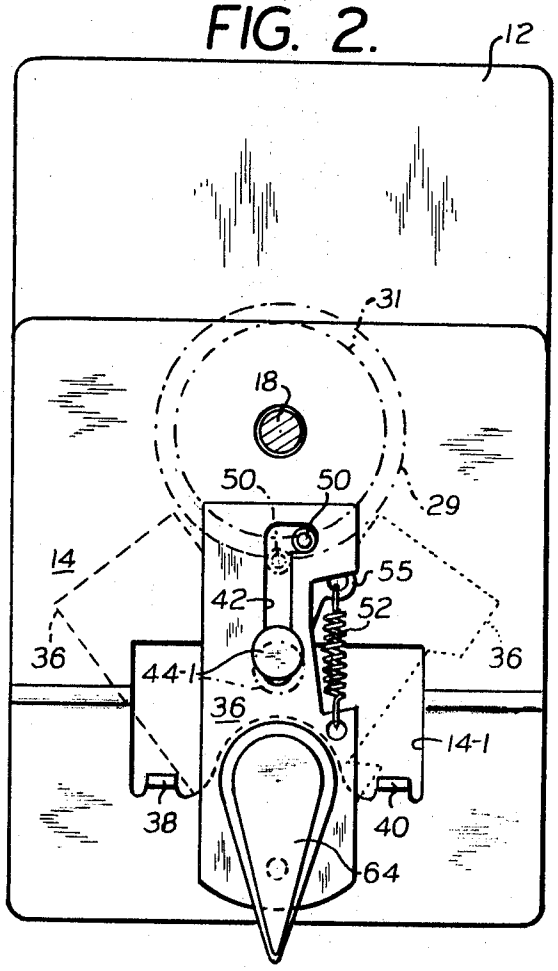
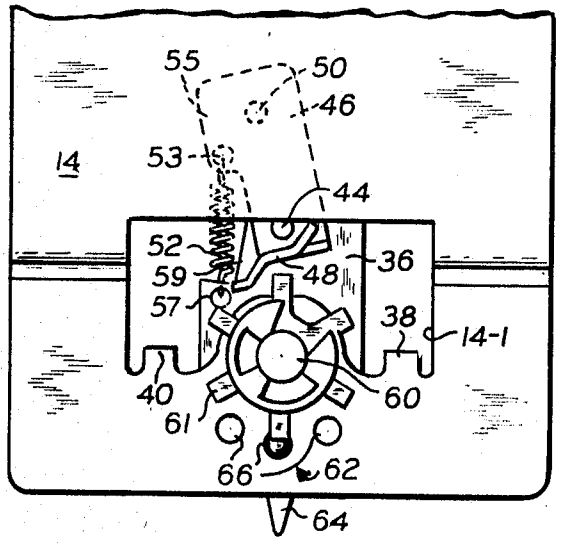


FIG. 3.



INVENTOR
JAMES A. DRAGHI
BY
Cobbell, Cobbell & Seidel
ATTORNEYS.

AUTOMATIC CYCLE TIMER WITH MANUAL DEFEAT FEATURE

FIELD OF THE INVENTION

The present invention relates to cycle timers for automatically controlling electrical appliances, and is particularly concerned with a timer of this kind in which automatic operation can be overridden manually.

THE PRIOR ART

The prior art is aware of many automatic devices which turn on and off electrical appliances at predetermined times in a timing cycle. An example is a cycle timer of the type which comprises an electric motor driving a clock and a mechanism for turning a switch on or off at predetermined times indicated by the clock readout. A typical application for such a device is turning the lights of a building on in the evening and off again the following morning when the building is unoccupied, for the purpose of discouraging burglary.

Devices of this type which were known to the prior art worked satisfactorily when they were allowed to function in the automatic mode. However, when it was necessary to override manually the automatic operation of such a cycle timer, the only way to accomplish this in some devices is by interrupting the operation of the clock motor. This had the undesired effect of stopping the clock so that the indicated time fell behind the actual time of day. Subsequently, it was necessary to reset the clock before putting the cycle timer back in automatic operation.

SUMMARY AND OBJECTS OF THE INVENTION

A general object of this invention is to provide a cycle timer which overcomes the disadvantages of prior art devices, particularly one which permits the controlled appliance to be turned on or off manually without interrupting the timing cycle. Another objective of the invention is to provide a cycle timer having two different moveable elements, one of which is moveable automatically in response to the phase of the timing cycle to close or open a switch, and the other of which is moveable manually to open or close the same switch regardless of the position of the first-mentioned element. Still another objective of the invention is to provide a novel structural interrelationship between these two elements so that they perform their individual movements under automatic and manual control respectively, while still preserving their functional relationships, so that the device can at any time be shifted between manual and automatic operation. Additional features of the invention will become apparent from the following detailed description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of a cycle timer in accordance with the present invention.

FIG. **2** is a front elevational view of the same cycle timer.

FIG. **3** is a sectional view, taken along the lines **3–3** of FIG. **1**, looking in the direction of the arrows.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The cycle timer **10** of this invention comprises a main mounting plate **12** and an auxiliary mounting plate **14** which is secured in spaced relation to the main mounting plate **12** by conventional means (not shown). A conventional synchronous timing motor **16** is mounted at the rear of the main plate **12**, and drives an output shaft **18** through a conventional reduction gearing **20**. At the outer end of the output shaft **20** is a time indication or readout disc **22** which is rotated once per timing cycle by the shaft. In a typical application where the cycle timer **10** is to be used for turning house lights on and off once per day, the period of rotation of the time readout disc **22** is twenty four hours.

Numeral **24** refers to the schematic representation of a pair of ratchet and pawl mechanisms which are adjustable about the periphery of the circular readout disc **22**, and which carry with them switch-operating cams **28** and **30**. Cam **28** is operative to open an electrical switch **32** mounted on the front surface of plate **12** at a time which depends upon its adjusted location around the periphery of disc **22**, and the other cam **30** is similarly operable to close the switch **32** at another time which is also dependent upon its adjusted location relative to the disc **22**. The cam **28** is located at a somewhat greater radial distance from the shaft **18** than is the cam **30**. The paths followed by the cams **28** and **30** are shown respectively by dotted lines **29** and **31** in FIG. **2**.

The switch **32** is operated by means of a button **54** which projects from the top surface thereof. That button is depressed to close the switch, or released to open the switch, by means of a tab **48** which projects rearwardly through an opening **14–1** formed in the auxiliary plate **14**. The tab **48** is affixed to an actuator member **46** which in turn is moveably mounted upon a mode selector element **36**. The mode selector **36** is pivotally mounted on the auxiliary plate **14**.

There are two alternative ways in which the actuator member **46** can be displaced so as to move the tab **48** into or out of engagement with the switch button **54**. In the automatic operating mode of the timer **10**, the actuator member **46** is automatically displaced relative to the mode selector element **36** by the cams **28** or **30**. In the manual operating mode, on the other hand, the entire mode selector element **36** is manually displaced relative to the auxiliary plate **14**, carrying the actuator member **46** with it.

In order to accomplish this, the actuator member **46** is mounted upon the mode selector element **36** for both translational and rotational movements relative thereto.

Specifically, a first pin **44** projects forwardly from the actuator member **46** and passes through a slot **42** formed in the mode selector element **36**. The slot **42** has the shape of an inverted L, and the pin **44** rides vertically in the lower end of the vertical leg of the L. An enlarged head **44–1** is formed upon the pin **44**, to prevent withdrawal of the pin from the slot **42**. The connection between the actuator member **46** and the mode selector element **36** formed by the pin **44** and the slot **42** allows the actuator member **46** to perform both the necessary translational movement, in which the pin **44** rides vertically in the slot **42**, and the necessary rotational movement, in which the actuator member **42** rotates about the axis of the pin **44**, relative to the mode selector element **36**.

A second pin **50** also projects forwardly from the actuator element **46** and through the upper end of the L-shaped slot **42**. The engagement of the pin **50** against the boundaries of the slot **42** defines two limits of the combined translational and rotational movement of the actuator member **46**. One such limit is reached when the pin **50** moves linearly up into the vertex of the L-shaped slot **42** and then rotates as far as possible towards the outer end of the horizontal leg of the slot. This position, which is illustrated by the solid lines of FIG. **2** represents one of the switch-actuating positions of the actuator member **46**, specifically the position for disengaging the tab **48** from the switch button **54** and thus opening the switch **32**. The opposite switch-actuating position, in which the tab **48** depresses the button **54** to close the switch **32**, occurs when the pin **50** rides back across the horizontal leg and into the vertex of the L-shaped slot **42**, and both pins **50** and **44** then ride down the vertical leg of the slot until the pin **44** strikes the lower end thereof. The latter situation is represented by the broken lines of FIG. **2**.

A biasing spring **52** is connected between the actuator member **46** and the mode selector element **36** so as to control the relative positions of these two elements in a specific manner. One end of the biasing spring **52** is hooked through an opening **53** formed in an ear **55** projecting from the actuator member **46**, while the opposite end of the biasing spring is hooked through an opening **57** formed in the mode selector element **36**. The edge of the mode selector element **36** is re-

lieved at location 59 to accommodate the biasing spring 52. The biasing spring 52 is arranged to exert both a downward translational force and a clockwise torque (as seen in FIG. 2) about the axis of pin 44, upon the actuator element 46 relative to the mode selector 36.

As a result, the actuator member 46 snaps overcenter between its two switch-actuating additions. In one of these positions the torque exerted by the biasing spring 52 holds the pin 50 against the end of the horizontal leg of L-shaped slot 42, while the lower edge of the horizontal leg of that slot 42 prevents the actuator member 46 from moving downwardly in response to the translational force exerted by the biasing spring 52. In the other position, the translational force of the spring 52 holds the pin 44 against the lower end of the vertical leg of slot 42, while the pin 50 is engaged against the side edge of the vertical leg of the slot 42 to prevent the actuator member 46 from responding to the torque. The exact centerpoint of the overcenter motion of the actuator element 46 is reached when the pin 50 has ridden slightly past the vertex of the L-shaped slot 42 and a short distance down the vertical leg thereof.

For automatic operation of the cycle timer 10, the mode selector element 36 is positioned as shown by the solid lines of the drawings, and the position of the actuator member 46 relative thereto is automatically controlled by the cams 28 and 30 in response to the timed cycle of the motor 16 and disc 22. Specifically, when the pin 50 is at the outer end of the horizontal leg of slot 42, the cam 30 in its passage through the lower arc of its circular track 31 engages a projection, preferably an extension of pin 50, which protrudes from the actuator 46 and extends through slot 42 forwardly of the mode selector 36. As a result, the cam 30 drives the pin 50 toward the vertex of the slot 42, and the surface of the cam 30 is angled so that it also drives the pin 50 a short distance down the vertical leg of the slot, past the overcenter point, until the biasing spring 52 takes over and snaps the actuator member 46 into its other position.

On the other hand, when the pin 50 is located a short distance down the vertical leg of the slot 42, the larger radius of circular track 29 causes the other cam 28 to engage the projection of pin 50 at the lower arc of the track. This cam is angled to drive the pin upwardly into the vertex of the slot 42. From the vertex, which is past the overcenter point, the spring 52 thereafter snaps the actuator member 46 into its opposite switch-actuating position.

The cams 28 and 30 can control the switch 32 automatically in this way only when the mode selector 36 is in its solid line position. Whenever the operator decides to override the automatic operation of the device by closing the switch 32 manually, he grasps a control knob 64 which is affixed to a shaft 60, the shaft in turn being secured to the mode selector element 36. By rotating the knob 64, shaft 60 and mode selector element 36 counterclockwise to the position of the dashed lines of FIG. 2, the operator manually brings the tab 48 down against the button 54 to close the switch 32, regardless of the position of the actuator member 46 relative to the mode selector 36. Conversely, when the operator manually rotates the knob 64, shaft 60 and mode selector 36 clockwise to the position of the dotted lines of FIG. 2, the tab 48 is rotated away from button 54, allowing the switch 32 to open regardless of the position of the actuator member 46 relative to the mode selector element 36.

Thus the mode selector element 36 is manually rotatable from its upright position, in which the cooperation between the actuator element 46 and the switch button 54 is determined solely by the cams 28 and 30, to its counterclockwise position of FIG. 2 in which the switch button 54 is always depressed, and its clockwise position of FIG. 2 in which the switch button is always released.

In order to define these three operating positions of the mode selector 36, there is provided a detenting mechanism 62. This includes an annular, dish-shaped spring element 61 (e.g. a Belleville washer) which surrounds the shaft 60 and is compressed between the rear surface of the auxiliary plate 14 and a retaining clip 63 engaged in a groove formed in the shaft 60. Compression of the spring 61 between members 14 and 63 serves to bias the mode selector element 36 against the front surface of the plate 14. As a result, a dimple 65 which is struck rearwardly from the mode selector element 36 protrudes toward the auxiliary plate 14 and cooperates with three apertures 66 formed in the auxiliary plate 14 to detent the mode selector 36 in each of its respective positions. When the mode selector 36 is moved between these positions, the dimple 65 rides up out of one of the apertures 66, compressing the spring element 61, until it is able to drop back into another one of the apertures 66 when the mode selector 36 reaches another of its positions.

In order to limit rotation of the mode selector 36, lugs 38 and 40 are formed integrally with the auxiliary plate 14 and project upwardly into the opening 14–1 on either side of the mode selector 36. When the side edges of the mode selector strike either of these lugs 38 or 40, the mode selector has reached the respective limits of its rotational movement.

It will now be appreciated that the cycle timer of this invention can be manually controlled by rotating the made selector to opposite positions in which the switch is closed or open, regardless of the position to which the actuator has been moved under automatic control of the motor-driven cams. Moreover, when such manual operation of the device is undertaken to override the automatic actuation of the switch, this has no effect upon the motor 16, which continues to operate without interrupting the timing cycle of the device. As a result, the time readout disc remains in phase with the time of day, and does not need to be reset after each manual override operation. This result, moreover, is accomplished by means of a unique toggling cooperation between the actuator member and the mode selector.

Since the foregoing description and drawings are merely illustrative, the scope of protection of the invention has been more broadly stated in the following claims; and these should be liberally interpreted so as to obtain the benefit of all equivalents to which the invention is fairly entitled.

The invention I claim is :

1. A manually overridable automatic cycle timer comprising: a switch, a motor, means for supplying energy to said motor independently of the condition of said switch, a switch actuator, a mode selector mounting said actuator for movement relative to said mode selector between a first position in which said actuator operates said switch and a second position in which said actuator does not operate said switch, means driven cyclically by said motor for automatically moving said actuator at least from one of said positions to the other of said positions relative to said mode selector at a predetermined phase of the cycle thereof, and means mounting said mode selector to be manually moveable from a first position in which said actuator is so engaged by said automatic means to at least a second position in which said actuator is not so engaged by said automatic means, whereby manually to override the effect of said automatic means on said switch, said actuator being moveable with said mode selector to said second position to operate said switch whether said actuator is in its first or second position relative to said mode selector, said mode selector being further moveable to a third position in which said actuator does not operate said switch whether said actuator is in its first or second position relative to said mode selector, said mode selector comprising an L-shaped slot, said actuator being pivoted on said mode selector and comprising a pin disposed within said slot for movement in response to pivotal movement of said actuator in one angular direction in said slot when said actuator is pivoted toward its first position and in the other angular direction in said slot when said actuator pivots toward its second position, and further comprising an overcentering spring connected between said actuator and said mode selector for biasing said actuator respectively toward said two positions, and means for mounting said actuator on said mode selector for translational motion in addition to said pivotal motion.

2. A timer as in claim 1 wherein said actuator comprises a projection, said automatic means comprises a pair of cams operatively connected to said motor for cyclical rotation thereby along different paths, one of said cams being arranged to engage said projection when said pin is in one leg of said L and to drive said projection in a direction to snap said actuator overcenter in one direction and the other of said cams being arranged to engage said projection when said pin is in the other leg of said L, and to drive said projection in the direction to snap said actuator overcenter in the opposite direction.

3. A timer as in claim 1 wherein said actuator comprises a projection, said automatic means comprises a pair of cams, and further comprising a rotatable disc operatively connected to said motor for rotation thereby, means for mounting said cams on said disc for movement with said disc along paths at different radial distances from said disc center, one of said cams being shaped to drive said projection in the direction to move said pin first along a first leg of said L to the vertex of said L- and then along a second leg of said L away from said vertex, the other cam being shaped to drive said projection in the direction to move said pin along said second leg of the L to said vertex.

4. A timer as in claim 3, wherein the means mounting said actuator on said mode selector for translational and pivotal motion relative thereto comprise a second pin extending from said actuator and riding in said slot, said second pin being formed with an enlarged head to prevent its withdrawal from said slot.

5. A timer as in claim 4, wherein said switch comprises an operating button, said actuator has an operating tab projecting therefrom for depressing said operating button whenever said mode selector is in its second position and for depressing said operating button when said mode selector and said actuator are both in their respective first positions, said operating tab being spaced from said operating button when said mode selector is in its third position or when said actuator is in its second position.

6. A timer as in claim 5 further comprising means for detenting said mode selector in each of said three positions thereof.

7. A timer as in claim 6 further comprising: a mounting plate, means rotatably mounting said mode selector upon said plate, and wherein said detenting means comprises interengaging male and female elements for detaining said mode selector in each of its positions relative to said mounting plate, said timer further comprising resilient biasing means for yieldably urging said mode selector toward said plate, whereby said mode selector can be transferred from one position to another.