# United States Patent

**Voland et al.**

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## [54] CAM-OPERATED TIMER WITH IMPROVED ELECTRICAL RESET MEANS


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[52] **U.S. Cl.** ..... **200/38 C,** 200/38 FA

[51] **Int. Cl.** ..... **H01h 7/08,** H01h 43/10

[58] **Field of Search** ..... 200/38, 39, 153.11, 153.12, 200/153.13, 38 FA, 167 R



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[57] **ABSTRACT**

An energy storage means is coupled to the cam-programming means of a timer such that when the timer has completed its sequence, the cam-programming means can be automatically returned to its sequence-starting point. An electromechanical means energizes the motor drive means of the timer in response to the axial displacement of a shaft which carries the cam-programming means. The cam-programming means includes timer-sequencing delay means and timer interval load sequencing means.


**13 Claims, 6 Drawing Figures**

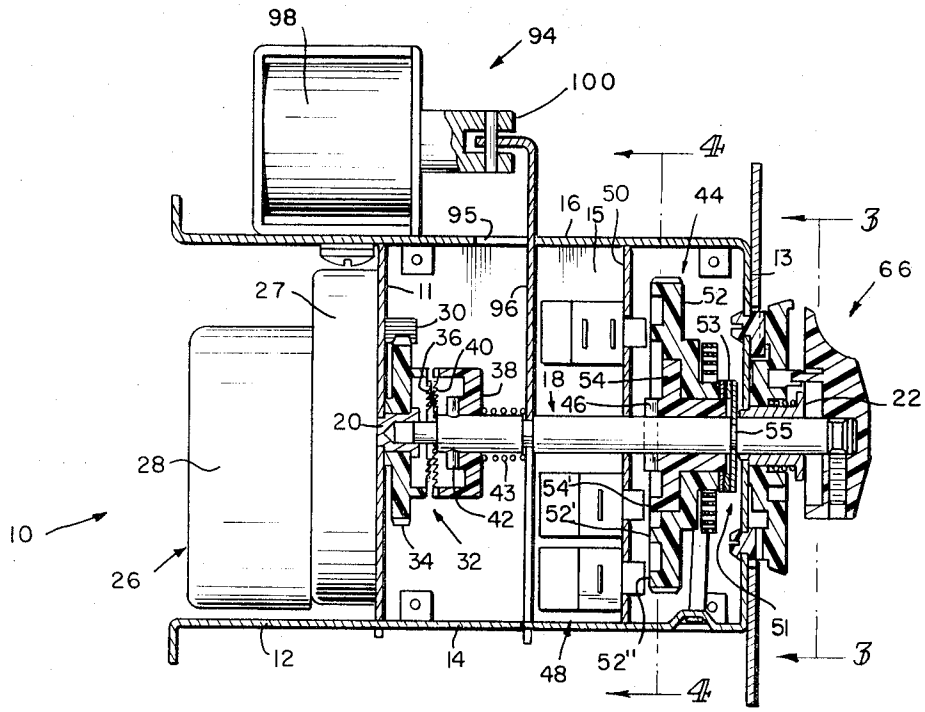


FIG. 1

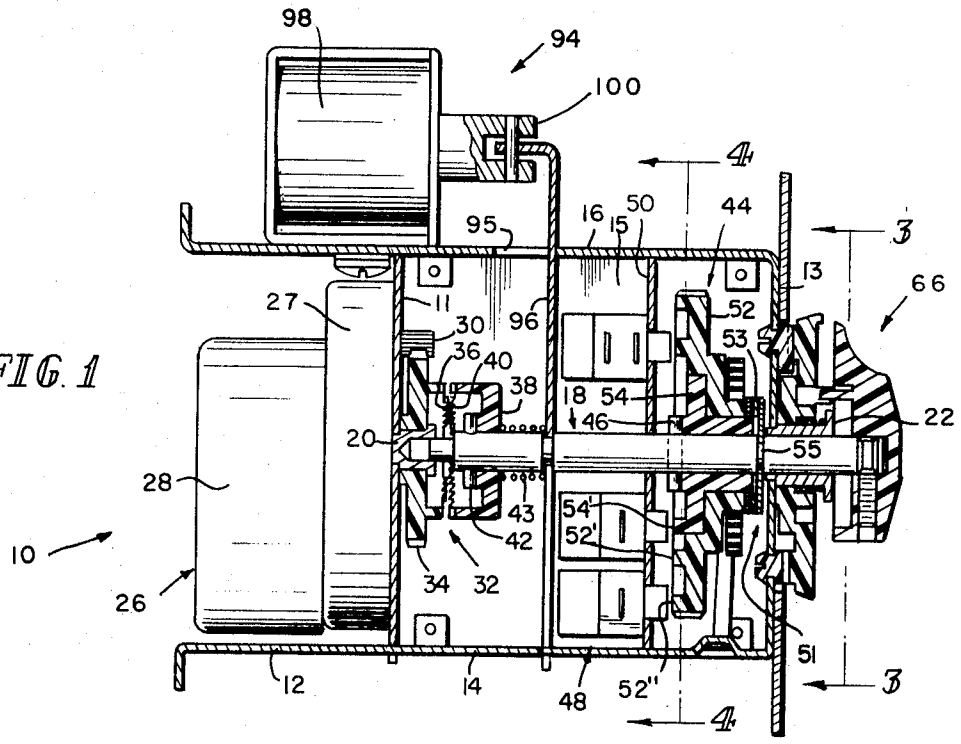
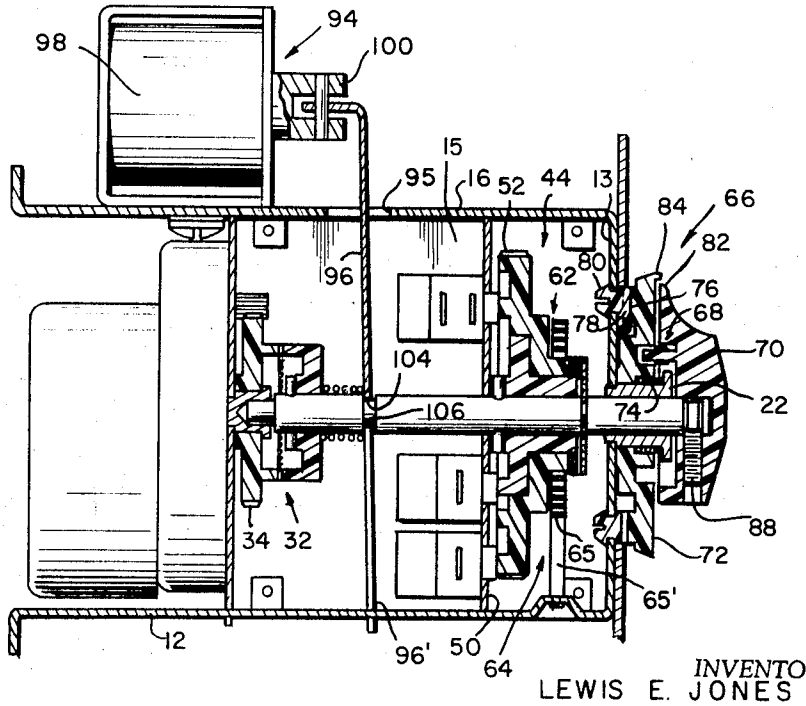



FIG. 2




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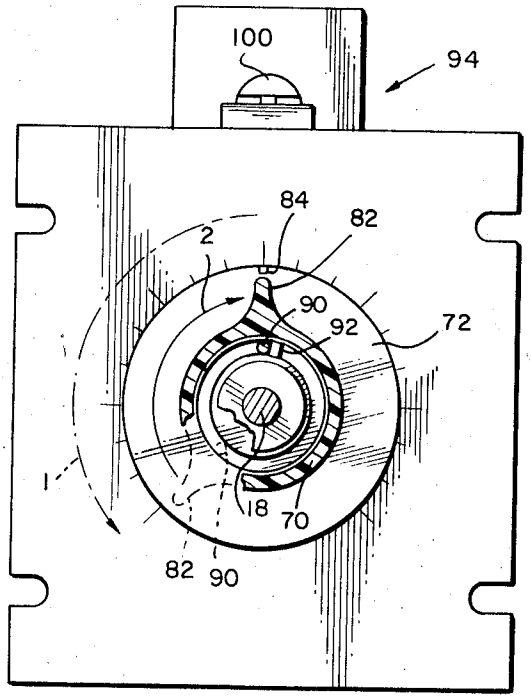



FIG. 3

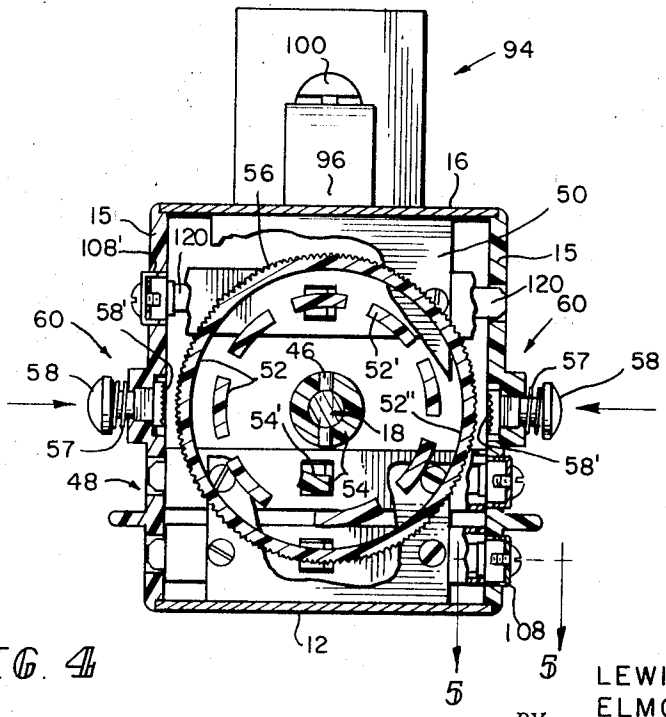



FIG. 4

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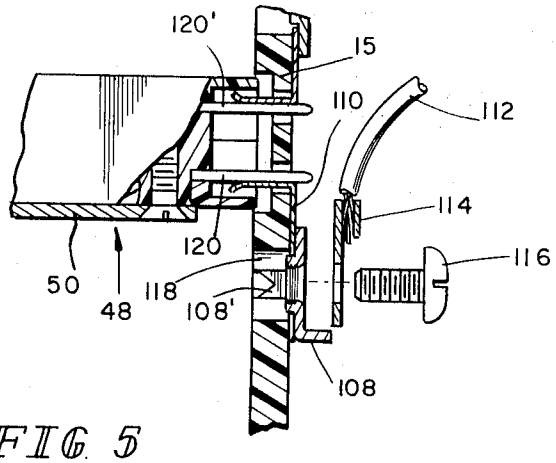



FIG. 5

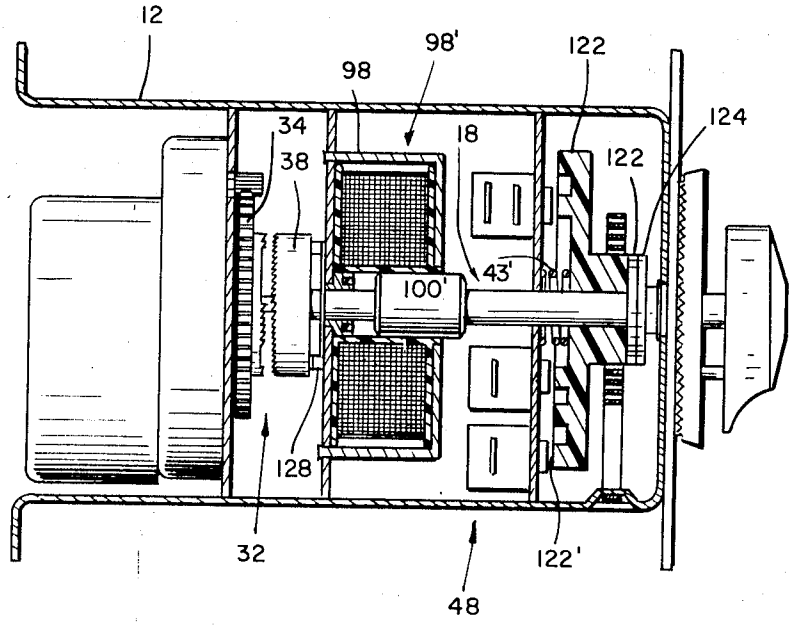



FIG. 6

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# CAM-OPERATED TIMER WITH IMPROVED ELECTRICAL RESET MEANS

This invention relates to time sequence mechanisms; and more particularly to time sequence mechanisms having reset means and having a cam-programming means which will give a time delay function as well as an interval load sequencing function.

Within the broad field of time switch mechanisms there exists a multiplicity of machine control applications wherein a particular time cycle must be faithfully reproduced in response to the command of the machine operator. Examples of such control requirements can be found in a host of commercial, industrial and domestic devices and appliances. A typical industrial application would be in industrial spot-welding machines, for example.

In such applications, there is a demand for obedient repetition of a particular desired timing program, the initiation of each cycle being ideally executed with a minimum degree of manual effort. In most of these, and related applications, however, there must also be provided a means for altering the cycle time period according to the requirements of the operator while still maintaining the feature of ready repeatability.

In certain other applications, it is also required that there be a means for providing an interval load sequencing cycle, as well as a time delay sequence. As used herein, the term "delay sequence" is meant to mean those operations wherein the timer is performing; that is, the timing mechanism is timing, but the load responsive thereto is not energized. Further, for the purpose of this disclosure, the term "interval sequence" is meant to mean that the load is energized while the timer is running or timing. An example of the latter would be in an ordinary washing machine appliance, wherein various cycles such as wash, rinse and tumbling, are carried out at intervals and when the last sequence is completed the timer is shut off. An example of the former would be in the molding industry where a mold must be heated for a certain length of time in order to put the mold up to temperature before a sequential pressing operation is carried out. Thus there is a delay before load sequencing begins.

Accordingly, it is an object of the present invention to provide a timer having reset means.

Another object of the invention is to provide a timer having a cam-programming means which will give a time delay sequence and an interval load sequence.

A further object of the invention is to provide a timer having a reset means which includes energy storage means coupled to the cam-programming means.

Yet another object of the invention is to provide a timer having a reset means which includes an indicator means and a stop means such that the starting point of the timer sequence can be set and permanentaly maintained.

Another object of the invention is to provide in conjunction with the reset means an electromechanical timer-starting means.

Still a further object of the invention is to provide a timer having an electromechanical starting means which includes a solenoid responsive to an axial displacement of the cam-carrying shaft.

Still a further object of the invention is to provide a timer having a reset means which includes an indicator means comprising a pair of cooperating axially displaceable rotatable dial means coupled to the cam-carrying shaft.

Another object of the invention is to provide a timer having reset means wherein the reset means includes cooperating dial means with one of the dial means being spring biased and having ratchet teeth adapted to engage rigidly held ratchet means.

A further object of the invention is to provide a reset timer having cam-programming means which includes at least two cams with one of the cams being independently adjustable from the other.

Yet another object of the invention is to provide a timer having a cam-programming means which includes time delay sequencing means and interval load sequencing means with at least one of the means being independently adjustable from the other.



In addition to the above enumerated objects, the present timer includes a terminal board as part of its housing, the terminal board including electrical terminals which provide a quick, positive coupling with mating electrical terminals.

These and other objects of the invention and the nature thereof will become apparent from the following description in connection with the accompanying drawings.

In the drawings;

FIG. 1 is a cross section of the timer of the present invention;

FIG. 2 is a view similar to FIG. 1 showing another operating mode of the timer;

FIG. 3 is a view taken along the line 3–3 of FIG. 1;

FIG. 4 is a view taken along the line 4—4 of FIG. 1;

FIG. 5 is a view taken along the line 5—5 of FIG. 4; and

FIG. 6 is a cross section showing another embodiment of the timer.

Generally speaking, the present invention provides a timer which includes cam-programming means and electrical switch means responsive to the cam-programming means, timer reset means resetting the cam-programming means at a predetermining starting point after completion of a program sequence, an electromechanical means energizing the timer in response to displacement of a shaft carrying the cam-programming means. The cam-programming means includes timer-sequencing delay means and timer interval load sequencing means.

Referring now to the drawings, and more particularly to FIGS. 1–4, there is shown a timer **10** which employs the principles of the invention. Included as part of the timer is a housing **12** which includes sidewalls **14** and **16** and end walls **11** and **13**. Also included as part of the housing are terminal boards **15** and **17** (FIG. 4). A shaft means **18** is rotatably journalled in bushings **20** and **22**. Shaft means **18** is rotatably displaceable in response to a drive means **26**. Drive means **26** could, for example, include a synchronous motor **28** and a speed-reducing means encased in cover **27**. Shaft means **18** is rotatably driven in response to the motor through motor pinion **30** and clutch means **32**. Clutch means **32** includes a gear means **34** having ratchet teeth **36**, and clutch face **38** which has ratchet teeth **40**. Clutch face **38** is fixedly held to shaft means **18** through pin **42**. Shaft means **18** is axially displaceable and is spring biased through coil spring **43**. Axial displacement of the shaft means **18** engages clutch face **38** with gear means **34** such that the shaft means can be rotationally driven in response to synchronous motor **28**.

A cam-programming means **44** is carried by shaft means **18** and is fixedly held thereto through suitable means such as a pin **46**. At least one electrical switch means **48** is carried by a frame member **50** which is attached to the housing **12** of the timer. The electrical switch means are responsive to the cam-programming means **44**. Electrical switch means **48** include typical single-throw electrical contact switches well known in the art.

Cam-programming means **44** includes cams **52** and **54** which serve as a time delay sequencing means and an interval load sequencing means respectively. Cam **52** includes coded indicia **52'** and **52''**, while cam **54** includes coded indicia **54'**. The coded indicia cooperates to activate electrical switch means **48**.

As shown, cam **54** is fixedly held to the shaft means **18** through pin **46**. Cam **52** is frictionally fitted to the cam **54** such that it can be rotated in accordance with the rotation of cam **54** but can, if desired, be rotated independently of cam **54** such that its timing sequence can be independently adjusted. To this end, as shown in FIGS. **1** and **4**, there is provided a holding means **60** which will provide a means for holding cam **52** in a fixed position such that cam **54** can be rotated in accordance with a manual rotation of the shaft means **18**. Holding means **60** includes a spring-biased pin **58** having teeth **58'** adapted to engage peripheral teeth **56** of cam **52**. Pin **58** is spring biased through coil spring **57**. To aid in biasing cam **52** against cam **54**, there is provided a spring-biasing means **51**. Spring-biasing means includes a spring washer **53** which is fixedly held in place by washer **55**.

As previously noted, the present invention includes a reset means **62** such that the timer will automatically reset the starting point of its programming sequence once the programmed sequence of the timer is carried out. Reset means **62** includes an energy storage means **64**, indicator means **66** which locates the starting point of the programmed cycle and stop means **68** which limits the rotational displacement of shaft means **18** when the cam-programming means **44** is being reset to its starting position. Energy storage means **64** includes a coil spring **65** substantially surrounding cam **52** of cam-programming means **44** and having one end **65'** fixedly coupled to the wall of housing **12**. As will be hereinafter described, energy storage means **64** will rotationally return the cam-programming means **44** back to its original starting point once its cycle has been completed. Indicator means **66** includes a pair of cooperating axially displaceable rotatable dial means **70** and **72** carried by shaft means **18**. Dial means **72** is rotatable about bushing **22**. It is also spring biased through coil spring **74**. Dial means **72** further includes ratchet teeth **76** adapted to engage corresponding ratchet teeth **78** carried by ring member **80** which is ridigly attached to wall **13** of housing **12**. Dial means **70** serves as a rotating knob and includes a pointer **82** which can be aligned with pointer **84** of dial means **72**. Pointers **82** and **84**, when aligned, will indicate a particular program setting shown by the indicia indicated on plate **86**, the indicia being more particularly shown in FIG. **4**. Dial means **70** is rigidly held to shaft means **18** through setscrew **88**. Stop means **68** includes cooperating tabs **90** and **92** (FIG. **3**) extending from dial means **70** and **72** respectively.

Timer **10** is energized or started through an electromechanical means **94**, the electromechanical means being energized in response to the axial displacement of shaft means **18** through actuator blade **96**. Electromechanical means **94** includes a solenoid **98**, the solenoid including a solenoid plunger **100**. As shown, plunger **100** is connected to actuator blade **96** through pin **102**. Actuator blade **96** is fixedly held to housing **12** at end **96'** with the central portion of the blade being coupled to the shaft means **18** by virtue of aperture **104** interfitting with recess **106**. Actuator blade **96** extends through aperture **95** of sidewall **16**.

Having described the essential features of the timer, its operation can now be described. Referring to FIGS. **1** and **3**, ratchet teeth **76** of dial means **72** is first disengaged from the ratchet teeth of ring member **80** and then the dial means is rotated until pointer **84** is in line with the desired starting point of the programmed sequence as indicated on faceplate **86**. This is done manually, and when accomplished, dial means **72** is released such that the ratchet teeth are again engaged. Dial means **70** is then manually rotated until its pointer **82** is in line with pointer **84**. Dial means **70** is then axially depressed so as to axially displace shaft means **18**. As shown in FIG. **2**, such displacement engages clutch means **32**, solenoid plunger **100** with solenoid **98** and at the same time cams **52** and **54** are depressed such that their coded indicia are engaged with switch means **48**. Switch means **48** will be energized, and in addition to carrying out a time delay and/or load-switching function, a holding circuit to solenoid **98** and motor **28** will be completed such that shaft means **18** will be rotationally driven by the motor **28**. As indicated in FIG. **3**, shaft means **18** will be rotationally displaced counterclockwise (arrow **1**) until such time as the programming sequence is completed. This is indicated by the dotted portion of pointer **82**. At this point, the coded indicia of cam **52** will be such that the appropriate electrical switching means will be released thus releasing the holding circuit to the solenoid **98**, thus releasing the solenoid to disengage clutch means **32** such that shaft means **18** will no longer be driven by the motor. During the time that shaft means **18** was being driven by the motor, energy was being stored in energy storage means **64**. Upon disengagement of the clutch means **32**, shaft means **18** becomes free to rotate in the opposite direction thus releasing the stored energy in energy storage means **64** to thus cause shaft means **18** to rotate in the opposite direction (arrow **2**) until stop means **90** and **92** become engaged. As shown in FIG. **3**, this will be at the point where pointers **82** and **84** are aligned. Thus the timer has been automatically reset and is now ready for the next cycle.

Referring to FIG. **5**, another feature of the invention is shown. Such feature is in the arrangement of the terminal boards **15** and the terminals associated therewith with respect to the terminals of the switching means **48**. This structure permits the terminal boards to be readily placed in position with assurance that there will be a quick and positive engagement of the terminals of the terminal boards with the terminals of the electrical switching means **48**. The terminals for the terminal boards includes terminal ring **108** and contact blade **110**. Electrical lead **112** is electrically coupled to contact ring **108** through jack **114** which is connected to contact ring **108** through setscrew **116**. Contact ring **108** forms an interference fit with aperture **118** of terminal board **15** through tabs **108'** which extend into the aperture and which are spring loaded against a wall of the aperture. Contact blade **110** is spring loaded such that when terminal board **15** is placed into position to complete the housing of the timer, the contact blade **110** will engage and bear against terminal **120** of electrical switch means **48**. It is to be understood that a similar arrangement is used to form an electrical contact with terminal **120'**.

Referring to FIG. **6**, another embodiment of the invention is shown. In this embodiment, the electromechanical means **94'** is disposed within the housing **12** of the timer and is in axial alignment with shaft means **18**. Electromechanical means **94'** includes solenoid **98'** which includes a solenoid plunger **100'** which is coupled to shaft means **18**. Shaft means **18** is, in this embodiment, axially spring biased through coil spring **43'**. Thus the solenoid plunger **100'** is responsive to the axial displacement of shaft means **18**. Further in this embodiment, the functions of interval load switching and time delay sequencing is combined into a single cam **122** and thus the interval sequencing and the time delay sequencing is not adjustable with respect to one another. The cam **122** is axially aligned on the shaft means **18** through washers **124** and **126**. Unidirectional clutch means **32** is substantially the same as the clutch means shown in FIGS. **1** and **2**. However, faceplate **38** is resiliently biased against gear means **34** by spring means **128**.

The operation of the timer of the embodiment of FIG. **6** is substantially the same as that of FIGS. **1** and **2**. That is, when shaft means **18** is manually axially displaced, cam **122** is biased against electrical switch means **48** through coded indicia **122'** such that the holding circuit is completed to the solenoid **98'**. Unidirectional clutch **32** will remain engaged such that shaft means **18** will be driven by the motor **28**.

Thus there is described a timer having reset means which automatically resets the timer back to its original starting point of its programmed sequence, has an electromechanical starting means in response to its axial displacement of the timer shaft, and has a cam-programming means wherein there is an interval load sequencing function and a time delay function. Additionally, the timer utilizes a terminal board having electrical terminal construction whereby the terminal boards can be easily put into place and the terminals on the terminal boards automatically be engaged with electrical terminals of the electrical switch means.

What is claimed is:

1. In a timer including cam-programming means and electrical switch means responsive to said cam-programming means,

a. timer reset means setting said cam-programming means at a predetermined starting point after completion of a programmed sequence including a coil spring substantially surrounding and coupled to said cam-programming means and having one end coupled to a wall of a housing for said timer, indicator means locating said starting point, and stop means limiting the rotational displacement of said shaft means upon being reset to its starting position, and

b. an electromechanical means energizing said timer in response to displacement of a shaft means carrying said cam-programming means.

2. In a timer according to claim 1 wherein said electromechanical means includes a solenoid.

3. In a timer according to claim 2 wherein said solenoid is coupled to a spring-biased actuator means connected to said shaft means.

4. In a timer according to claim 3 wherein said actuator means includes an actuator blade responsive to the displacement of said shaft means one end of which is coupled to said solenoid.

5. In a timer according to claim 1 wherein said indicator means includes a pair of cooperating axially displaceable rotatable dial means coupled to said shaft means, one of said dial means being spring biased and including ratchet teeth adapted to engage rigid ratchet teeth means.

6. In a timer according to claim 1 wherein said indicator means includes a pair of cooperating axially displaceable dial means coupled to said shaft means, one of said dial means including ratchet teeth adapted to engage rigid ratchet means, and said stop means includes cooperating tabs extending from said cooperating dial means.

7. In a timer according to claim 1 wherein said cam-programming means includes timer sequencing delay means, and timer interval load sequencing means.

8. In a timer according to claim 7 further including means adjusting the duration of sequencing of said cam-programming means.

9. In a timer according to claim 8 wherein said adjusting means includes spring-biased holding means extending through and carried by a wall of a housing for said timer, said spring-biased holding means adapted to selectively engage gear teeth disposed on said cam-programming means.

10. A timer comprising:

a. a housing,



b. a rotating cam shaft means extending through and carried by said housing,

c. motor drive means including clutch means coupling said shaft means to said drive means,

d. cam-programming means carried by said shaft means and electrical switch means responsive to said cam-programming means,

e. spring-biased blade actuator means fixedly coupled to said shaft means, said blade actuator means coupled to solenoid means, said motor drive means responsive to said solenoid means, displacement of said shaft means actuating said blade actuator means, and

f. reset means adapted to set said cam-programming means to its sequence starting point after completion of its programmed sequence, said reset means including a coil spring coupled to said cam-programming means, and an indicator means locating said starting point and stop means limiting the rotational displacement of said shaft means upon being reset to said starting point.

11. A timer according to claim 10 wherein said indicator means comprises a pair of rotatable axially aligned, cooperating but independently axially displaceable dial means, one of said dial means fixedly coupled to said shaft means, the other carried by said shaft means, said dial means carried by said shaft means including ratchet teeth adapted to selectively engage ratchet means fixedly coupled to a wall of said housing.

12. A timer according to claim 11 wherein said stop means includes cooperating tabs extending from said dial means.

13. A timer according to claim 10 wherein said cam-programming means includes timer-sequencing delay means and timer interval load sequencing means.

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