Jan. 25, 1966 KATSUMI TAKEDA ET AL 3,231,747

PHOTOELECTRIC SELF-CORRECTING TIMING DEVICE FOR TURNING ON AND OFF ELECTRIC DEVICES

Filed Feb. 14, 1962

2 Sheets-Sheet 1

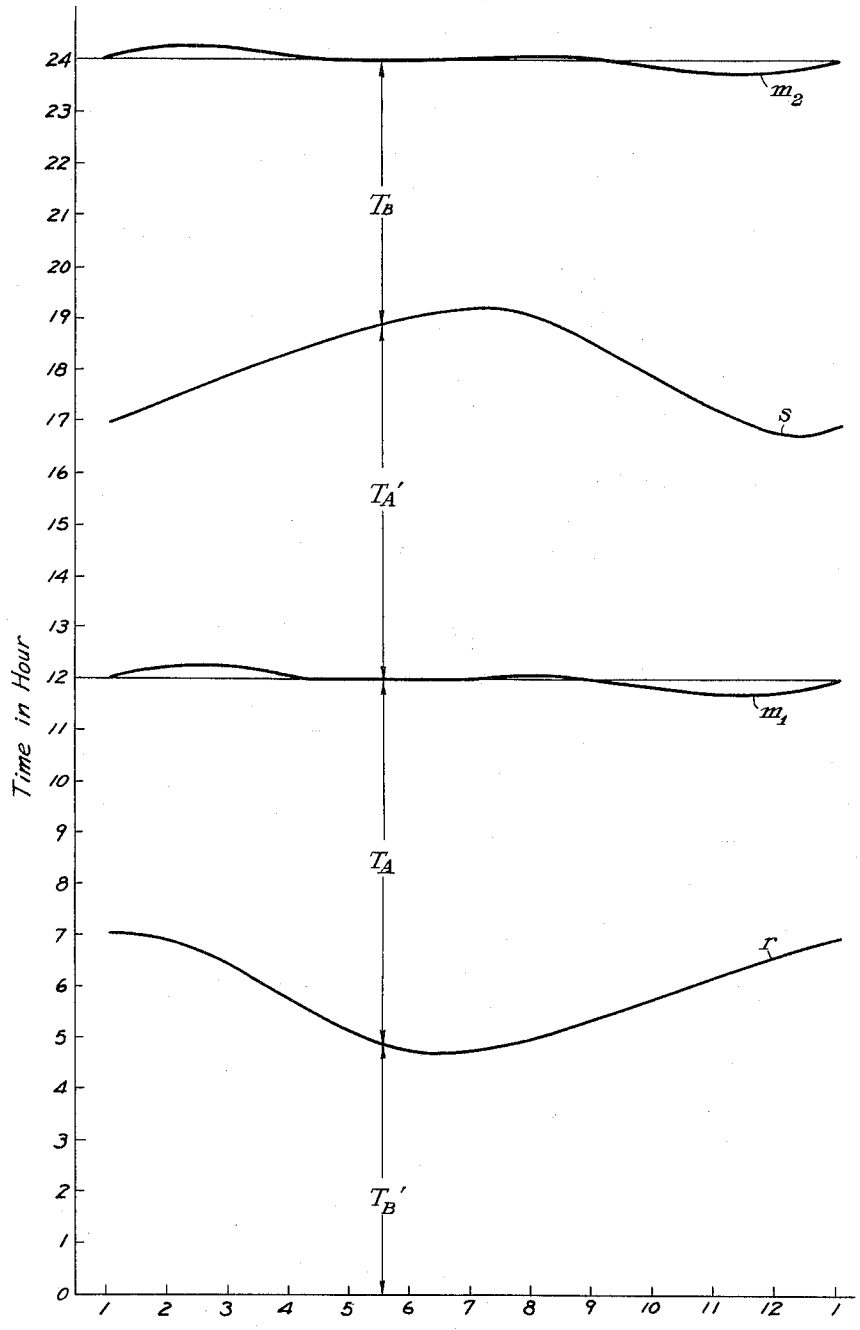
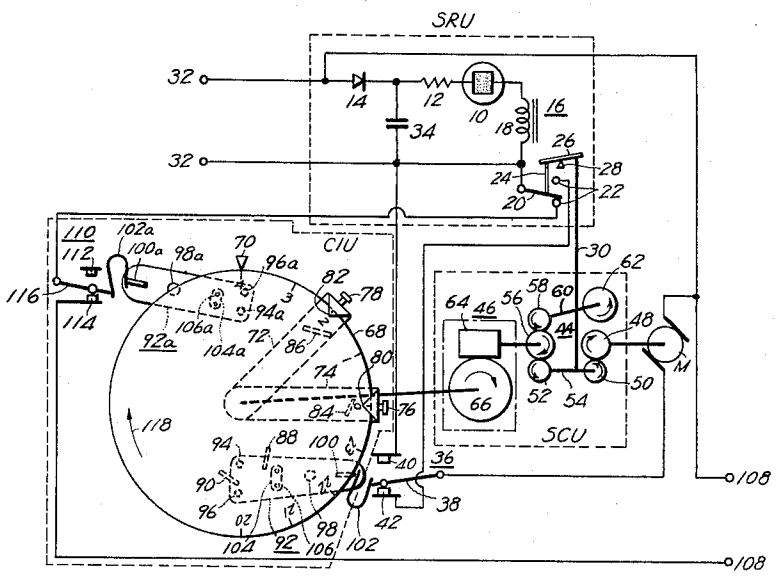


Fig. 1

Jan. 25, 1966 KATSUMI TAKEDA ET AL 3,231,747
PHOTOELECTRIC SELF-CORRECTING TIMING DEVICE FOR TURNING ON AND OFF ELECTRIC DEVICES
Filed Feb. 14, 1962 2 Sheets-Sheet 2

Fig. 2



United States Patent Office 3,231,747 Patented Jan. 25, 1966

3,231,747

PHOTOELECTRIC SELF-CORRECTING TIMING DEVICE FOR TURNING ON AND OFF ELECTRIC DEVICES

Katsumi Takeda and Akiteru Kaminoto, both of Fukuyama, Prefecture of Hiroshima, Japan, assignors to Mitsubishi Denki Kabushiki Kaisha, Tokyo, Japan, a corporation of Japan

Filed Feb. 14, 1962, Ser. No. 173,186
Claims priority, application Japan, Feb. 25, 1961, 36/6,577
2 Claims. (Cl. 250—215)

This invention relates to a system for automatically turning on and off devices, such as electric lamps, at predetermined times.

Heretofore, it has been a practice to turn off electric lamps such as neon tube lamps and advertisement lamps in daytime, and to turn on the same at the sunset, then to turn them off again in the dead of the night during which time nearly all persons are not at work, and to light them again before dawn and to turn them off again at sunrise. Thus the lamps can be reasonably turned on and off without any waste of electric power. To this end, there has been previously used the type of timekeeper device driven by a synchronous motor or by spring means and including contacts adapted to be opened and closed at predetermined times. The use of such timekeeper devices has a disadvantage in that the times of sunrise and sunset continuously vary throughout a year, and therefore the times at which the electric lamps are to be turned off and on, respectively must be adjusted in accordance with such variations of both the sunrise and the sunset. Moreover these devices have the drawback that the times indicated by the devices become very incorrect due to the effect of daily errors added to one another during long service. Further, in the type of timekeeper devices driven by spring means the latter must be wound up from time to time during service whereas the type of timekeeper device using a synchronous motor may provide an erroneous indication of the hour due to any stoppage of electric supply to the motor which might occur during service.

An object of the invention is to provide an improved system for automatically turning on and off devices such as electric lamps wherein the aforesaid disadvantages are eliminated.

Another object of the invention is to provide an improved system for automatically turning on and off utilization devices such as electric lamps substantially at sunrise, sunset and other predetermined times with high reliability and without the necessity of adjusting the times in accordance with the sunrise and the sunset.

Still another object of the invention is to provide an improved system of the type above described and capable of turning on and off electric lamps at times substantially predetermined even after long service.

With the objects in view, the invention resides in a system for automatically turning on and off a controlled circuit at predetermined times comprising photoconductive means responsive to both the sunrise and the sunset, driving rotary means controlled by the photoconductive means, hour dial means driven by the driving rotary means to indicate any time between a pair of predetermined times, rotational movement of said hour dial means effecting opening and closing of the controlled circuit at sunrise and sunset respectively, and a plurality of hour setting members adjustably secured to said hour dial means at positions corresponding to said predetermined times. The setting members are arranged to control the controlled circuit at the predetermined times.

In a preferred embodiment of the invention a system

for automatically turning on and off a device at sunrise, sunset and predetermined times comprises driving rotary means having a predetermined fixed speed of rotation, means responsive to both sunrise and sunset including means for starting operation of the driving means at sunrise and for effecting opening and closing of an energization circuit for the device at sunrise and sunset respectively. The system comprises speed changing means and controlling and hour indicating means including a graduated member driven by the driving means through said speed changing means. The speed changing means is controlled by the sunrise-and-sunset responsive means to change the angular speed of the graduated member of the controlling and hour indicating means from a predetermined magnitude during a time interval between sunrise and sunset to twice the angular speed during a time interval between sunset and the succeeding sunrise. In the system a plurality of hour setting members are adjustably secured to the graduated member of the controlling and hour indicating means in positions corresponding to said predetermined times on the same. First control means are provided controlled by the controlling and hour indicating means to hold the driving means in operation for a period of time for which the driving means are to be operated and to stop operation of the driving means upon the completion of one revolution of the graduated member before the succeeding sunrise. A second control means is provided controlled by said plurality of hour setting members at predetermined times respectively to effect turning on and off the device.

It may be desirable to control a device at a plurality of predetermined times excluding both the sunrise and the sunset. In this case, an energization circuit for the device may be preferably modified such that it will be turned on and off by the second control means alone at a plurality of predetermined times.

The invention will become more readily apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a typical graph illustrating the sunrise and sunset plotted against the calendar month; and

FIG. 2 is a diagram of a system constructed in accordance with the teaching of the invention for automatically turning on and off electric lamps.

The invention is based upon the discovery that, with reference to any calendar day; the time interval between the sunrise and 1200 hours is approximately equal to the time interval between 1200 hours and sunset while the time interval between sunset and 0000 hours is approximately equal to the time interval between 0000 hours and the succeeding sunrise.

Referring now to FIG. 1 of the drawings, there is shown a typical graph illustrating the sunrise and sunset measured in Kobe, Japan (which is in latitude 34°41'N and in longitude 135°11'E) and plotted against the calender month. In FIG. 1 a curve r represents the sunrise and a curve s represents the sunset. A curve m_1 indicates the hour midway between the sunrise and the sunset and a curve m indicates the hour midway between sunset and the succeeding sunrise. As shown in FIG. 1, the deviation of the curve m_1 from the horizontal line passing through the ordinate of 1200 hours is in the same direction as and approximately equal to that of the curve m_2 from the horizontal line passing through the ordinate of 2400 hours, such deviations being relatively small in magnitude. Therefore, if it is assumed that, with reference to any calendar day, T_A represents a time interval between the sunrise and 1200 hours, T_A' a time interval between 1200 hours and the sunset, T_B a time interval between the sunset and 0000 hours, and T_B' represents a time interval be-

tween 0000 hours and the succeeding sunrise then it will be seen from FIG. 1 that T_A is approximately equal to T_A' and that T_B is approximately equal to T_B'. Therefore, we have

$$\frac{T_A+T_A'+T_B+T_B'}{2}\simeq\frac{2(T_A+T_B)}{2}=12 \text{ hours} \quad (1)$$

In other words, a half of the sum of the time interval between the sunrise and the sunset and the time interval between the sunset and the succeeding sunrise, at all times, approximately equal to an interval of 12 hours through a year regardless of the sunrise end sunset.

The invention will now be described in conjunction with a system for automatically turning on electric lamps such as neon tube lamps or advertisement lamps at sunset, turning them off at 0000 hours, turning them on again at 0200 hours and turning them off again at sunrise. However, the invention is equally applicable for automatically turning on and off electric lamps at times different from the times indicated above.

Referring now to FIG. 2 of the drawings there is diagrammatically illustrated a system for automatically turning on and off a device such as an electric lamp by using a timekeeper device utilizing the discovery previously described.

As shown in FIG. 2, a timekeeper device comprises a sunrise-and-sunset responsive unit generally designated by the reference characters SRU, a drive such as synchronous motor M, a speed changing unit generally designated by the reference characters SCU and controlled by the sunrise-and-sunset responsive unit SRU, and a controlling and hour indicating unit CIU driven by the synchronous motor M through the speed changing unit SCU.

The sunrise-and-sunset responsive unit SRU includes a photocell **10** comprising photosensitive cadmium sulfide or the like which has its internal resistance vary when the photocell is exposed to light.

The photocell **10** is connected to a resistor **12** serially connected to a rectifier **14** and is also operatively connected to a control relay **16**. The relay **16** comprises an operating winding **18** serially connected to the photocell **10**, a movable contact member **20** and a pair of stationary contacts **22**. The movable contact member **20** is electrically connected to the operating winding **18** and normally engages one of the stationary contacts **22** or in this case the lower stationary contact as viewed in FIG. 2. The movable contact member **20** is connected to a movable rod **24** which, in turn is connected at one end to a lever **26** made of an electrically insulating material. The lever **26** is supported on a fulcrum **28** and connected at the other end to a connecting rod **30** the use of which will be later described. The arrangement comprising the rectifier **14**, the resistor **12**, the photocell **10** and the operating winding **18** serially connected to each other is adapted to be connected across a source of alternating current represented by a pair of input terminals **32**. In order to smooth the rectifier output from the rectifier **14** a smoothing capacitor **34** is provided on the rectifier. The lower plate of the capacitor **34** is directly connected to the operati ng winding **18** and also to the input terminal **32**.

The synchronous motor M is connected between the upper input terminal **32** as viewed in FIG. 2 and a transfer arm **38** of a holding switch **36**. The switch **36** includes a pair of stationary contacts **40** and **42**. The upper contact **40** is connected to the junction of the capacitor **34** and the operating winding **18** of the control relay **16** while the lower contact **42** is connected to the upper stationary contact **22** of the relay with the transfer arm **38** normally engaging the lower contact **42**.

The speed changing unit SCU comprises a transfer gearing generally designated by the reference numeral **44** and a reduction bearing generally designated by the reference numeral **46**. The transfer gearing **44** includes a first gear **48** rigidly mounted on the shaft of the motor M, a second gear **50** normally meshing with the first gear **48** and a third gear **52** secured on the shaft **54** of the second gear **50**. A third gear **52** is coupled through an intermediate gear **56** to a fourth gear **58** secured on a shaft **60**. The shaft **60** is provided with a fifth gear **62** which is twice as large as the first gear **48** and has twice the number of teeth. As diagrammatically shown in FIG. 2, the shafts **54** and **60** are operatively coupled to the connecting rod **30** in such a manner that the engagement of the movable contact member **20** of the control relay **18** with the lower stationary contact member **22** effects the meshing of the first gear **48** with the second gear **50** and the disengagement of the first gear from the fifth gear **62** whereas the engagement of the movable contact member with the upper stationary contact member effects the meshing of the first gear **48** which the fifth gear **62** and the disengagement of the first gear from the second gear. The speed changing unit is also designed and constructed such that when the first gear **48** meshes with the second gear **50** the intermediate gear **56** is rotated at a speed equal to twice the speed obtained when the first gear meshes with the fifth gear **62**.

The reduction gearing **46** includes a pinion **64** integral with the intermediate gear **56** and a gear **66** meshing with the pinion **64**.

The controlling and hour indicating unit CIU comprises an hour dial **68** rotatable together with a gear **66** of the reduction gearing **46**. The hour dial **68** is preferably made integrally with the gear **66** and has its front face graduated in hours throughout one half of the periphery thereof. In the embodiment illustrated the graduations on the hour dial **68** include lines or indicia designated as **20, 21, 22, 23, 0, 1, 2, 3**, and **4** disposed at equal angular distances corresponding to 22.5 degrees or $\pi/8$ radian. If desired the number of the graduated lines and the angular distance therebetween may be varied.

To indicate the hour an indicating pointer **70** is disposed adjacent to the periphery of the hour dial **68** at such a position that the pointer aligns with one of the outermost graduation lines for the line **4** in this case when the device is not operated.

To set the hours at which the electric lamps are to be fired or put out, a pair of radial straps **72**, and **74** are disposed opposite the rear face of the hour dial **68** at a distance therefrom. Each of the hour setting strips **72** and **74** has one end portion pivotably secured on the xais of the hour dial **68** and the other end portion folded over the front face of the hour dial. The strips **72** and **74** are adjustably secured on these other end portions to the hour dial **68** by set screws **78** and **76** respectively and include formed at these ends pointers **82** and **80** respectively. In the illustrated embodiment the pointers **80** and **82** indicate 0000 hours and 0200 hours respectively. It will be seen that, due to the structure of the hour setting strips they can readily be varied in their positions relative to the graduations on the hour dial **68**. To do so the set screw **76** or **78** in first loosened and the hour setting strip **72** or **74** is moved to any desired position on the graduation for the particular purpose followed by tightening of the loosened set screw. The strips **72** and **74** are further provided with transfer pawls **86** and **84** projecting from the surfaces thereof away from the rear face of the hour dial **68**.

It is to be understood that the number of hour setting strips may be varied in accordance with the number of time settings at which the electric lamps are to be turned on and off.

As shown in dotted lines in FIG. 2, the hour dial **68** includes a pair of transfer pawls **88** and **90** projecting from the rear face thereof.

Opposite the rear face of the hour dial **68** at a small distance therefrom a control plate made of an electrically insulating material generally designated by the reference numeral **92** is disposed including on one end a pair of spaced pins **94** and **96** capable of engaging the transfer

pawls **88** and **90**, respectively, once during one compete revolution of the hour dial **68**. The control plate **92** is pivotably mounted substantially at its center on a stationary pin **98** and includes on the other end portion a supporting element **100** secured to one end of a U-shaped spring **102**. The other end of spring **102** is secured to the movable arm **38** of the switch **36** at its free end. The control plate **92** is further provided with a slot **104** through which a stationary pin **106** extends in order to restrict the pivotal movement of the control plate. In an analogous manner another control plate **92***a* made of an electrically insulating material is disposed substantially symmetrically to control plate **92** with respect to the axis of the hour dial **68** near the pointer **70**. This control plate is identical in structure with the control plate **92** as above described and need not be further described. The former plate is generally designated by the reference numeral **92***a* and the various compnents thereof corresponding to those of the plate **92** are identified by the same reference numerals with the suffix character *a*.

In order to control an electric lamp or lamps, such as a neon tube lamp or lamps, represented by a pair of load terminals **108** a control switch **110** is provided which includes a pair of stationary contacts **112** and **114** and a transfer arm **116** adapted to electrically engage either of the contacts. The lower contact **114** is connected to one of the load terminals **108**, for example, the lower terminal in FIG. 2 and the upper load terminal **108** is connected to the upper input terminal **32** and the synchronous motor M. The transfer arm **116** of the control switch **110** is connected at its free end to a U-shaped spring **102***a* associated with the control plate **92***a* and at the other end to the lower control **22** of the control relay **16**.

The device thus far described is operated as follows:

It is now assumed that before sunrise the various components of the device are in the positions illustrated in FIG. 2. If the sky becomes light at sunrise the internal resistance of photocell **10** decreases permitting a current to flow from the source of alternating current **32** through the operating winding **18** of the control relay **16**. Therefore, the operating winding **18** is energized with a rectified current from the rectifier **14** which is fed by a source of alternating current **32**. The energization of the winding **18** effects pulling up of the movable contact member **20** to engage the same with the upper contact **22** (see FIG. 2). This completes a circuit from the upper terminal **32** through the synchronous motor M, the transfer arm **38** of the holding switch **36**, the stationary contact **42** thereof, the upper contact **22** of the control relay **16** and the movable contact member **20** to the lower terminal **32** to thereby start the operation of the motor.

On the other hand, the separation of the movable contact member **20** from the lower contact **22** prevents the energization of the electric lamp.

At the same time the pulling up of the movable contact member **20** effects disengagement of the first gear **48** from the second gear **50** and the engagement of the first gear **48** with the fifth gear **62** through the movable rod **24**, the lever **26** and connecting rod **30** (see FIG. 2).

When the motor M is operated the hour dial **68** will be rotated in the direction of the arrow **118** in FIG. 2 through the speed changing unit SCU. It is to be noted that the hour dial is designed to be rotated at an angular velocity of $22.5°/2$ or $\pi/16$ per hour by properly selecting the speed of the motor M and the gear ratios of the speed changing unit SCU. Soon after the rotation of motor M and hence the hour dial **68** has been initiated, the transfer pawl **88** on the hour dial forces the pin **94** on the control plate **92** to move the control plate from its position illustrated in FIG. 2 in the clockwise direction as viewed in the same figure. Thereby the transfer arm **38** of the holding switch **36** is rapidly separated from the lower contact **42** and brought into and held in contact with the upper contact **40** by the action of the U-shaped spring **102**. Thus a holding circuit for the motor M is completed. Under these circumstances, therefore, the motor continues to be operated regardless of the deenergization of the control relay **16**.

As previously described, a half of the sum of the time interval between sunrise and sunset and the time interval between the sunset and the succeeding sunrise is, at all times, approximately equal to an interval of 12 hours throughout a year regardless of sunrise and sunset. It will be apparent that the hour dial **68** is rotated through an angle of $22.5°/2\times 2T_A$ during the period from the sunrise to sunset or the period $T_A+T_A'\simeq 2T_A$. That angle is equal to the angle through which the hour dial is rotated at twice the angular velocity as previously determined for T_A hours.

At the sunset the internal resistance of the photocell **10** is increased and deenergizes the control relay **16**. The deenergization of the control relay effects separation of the movable contact member **20** from the upper contact **22** and the engagement of the contact **20** with the lower contact **22** as well as disengagement of the first gear **48** from the fifth gear **62** and the engagement of the first gear with the second gear **50**. Because of the presence of the holding circuit the motor M continues to be operated and the hour dial **68** is rotated at twice the angular velocity or at an angular velocity of

$$\frac{22.5°}{2}\times 2 \text{ (or equal to } 22.5^0)$$

per hour until the hour signal is rotated through

$$\frac{22.5°}{2}\times 2\times T_B$$

for a period of from the sunset to 0000 hours. Therefore, for a period from sunrise through the sunset to 0000 hours the hour dial will be rotated through an angle represented by the expression

$$\frac{22.5°}{2}\times 2T_A+\frac{22.5°}{2}\times 2\times T_B=\frac{22.5°}{2}\times 2(T_A+T_B)$$

For the Expression 1 it will be seen that the above-mentioned angle is equal to

$$\frac{22.5°}{2}\times 2\times 12=270°$$

This means that approximately 0000 hours is indicated when the hour dial which was initiated to be rotated at sunrise has been rotated through an angle of 270° or $3\pi/12$ radian. In other words, the device indicates 0000 at the instant the hour dial **68** has been rotated through three right angles.

At 0000 hours the pointer **70** will align with the graduated line 0 in the hour dial **68**.

As previously described, the control relay is deenergized at sunset to engage the movable contact member **20** with the lower contact **22** resulting in the completion of a circuit extending from the upper input terminal **32** through the electric lamp **108—108**, the stationary contact **114** and transfer arm **116** of the control switch **110**, and the lower contact **22** and the movable contact member **20** of the control relay **16** to the lower input terminal **32**. This causes the electric lamp to be lighted. Thereafter, the hour dial **68** continues to be rotated at the angular velocity of 22.5 degrees per hour as previously described and cooperates with the pointer **70** to indicate nearly correctly the hour at any moment for example after 2000 hours.

At 0000 hours the pointer **70** aligns with the graduated

line 0 on the hour dial 68. As the hour setting strip **72** is set to 0000 hours the same also aligns with the pointer **70**. At that time the transfer pawl **84** forces the pin **96***a* on the control plate **92***a* to move the control plate **92***a* from its position illustrated in FIG. 2 in a counterclockwise direction whereby the transfer arm **116** of the control switch **110** is separated from the lower contact **114** and brought into and held in engagement with the upper contact **112** by the action of the U-shaped spring **102***a*. This interrupts the energization circuit for the electric lamp and turns it off.

Then the hour dial **68** continues to be rotated and cooperates with the pointer **70** to indicate nearly correctly the hour at any moment until the graduation line 4 reaches the pointer **70**.

However, since the hour setting strip **82** is disposed on the graduation line 2 of the hour dial **68**, the transfer pawl **86** on that strip forces the pin **94***a* on the control plate **92***a* to move the plate back in a clockwise direction to its initial position illustrated in FIG. 2. This permits the transfer arm **116** of the control switch **110** to be separated from the upper contact **112** and to be brought into and held in engagement with the lower contact **114** to energize the electric lamp.

At the instant the hour dial has been rotated through one complete revolution to return it back to its starting position at the instant the pointer **70** is again aligned with the graduation line 4, the transfer pawl **90** on the hour dial will force the pin **96** to return the control plate **92** in counterclockwise direction to its initial position illustrated in FIG. 2 through the action of the U-shaped spring **102**. This permits the transfer arm **38** of the holding switch **36** to be separated from the upper contact **40** and to contact the lower contact **42**. At that time the control relay **16** has already been deenergized to separate the movable contact member **20** from the upper contact **22** so that the motor M is stopped. In other words, the hour dial **68** the operation of which was initiated at the sunrise is stopped at 0400 hours. However, engagement of the transfer arm **116** with the lower contact **114** of the control switch maintains the electric lamp in an energized condition until the sun rises.

At the sunrise the internal resistance of the photocell **10** is decreased and the process thus far described will be repeated.

According to the invention any stoppage of supply of electric current to the motor which is in operation can be compensated for by utilizing the period from 0400 hours to sunrise for which the hour dial is stationary. For example, if it is assumed that the supply of electric power to the motor has been interrupted for an interval of three hours beginning at 2200 hours then the pointer will align with the graduation line 1 on the hour dial when the actual hour is 0400 hours. Accordingly the motor is operated until the sun rises, for example, at 0.500 hours. After the sunrise the motor continues to be operated in the manner previously described. Therefore, a time lag on the indication of the pointer due to the stoppage of electric power can be compensated for partially, namely by an interval of one hour beginning at 0400 hours and terminating at 0500 hours. Thus it will be appreciated that the time lag referred to can be fully compensated in three days.

From the foregoing it will be appreciated that the objects of the invention have been acomplished by the provision of a system for automatically turning on and off a device comprising sunrise-and-sunset responsive means, and hour dial means controlled by the responsive means, to have its angular velocity in the nighttime equal to twice the angular velocity in the daytime and including adjustably secured thereto a plurality of hour setting members for controlling a device at predetermined times.

The present system has several advantages. For example, settings at which the device is to be turned on and off can be varied in a simple and easy manner. The number of time settings can be changed at will. Also any stoppage of the supply of electric current is automatically compensated for. Further, the system according to the invention is not only of relatively simple structure but also is not much larger than and is substantially equal in weight as compared with any time switch of the prior art type comprising an electric motor as a drive.

While the invention has been described in conjunction with the preferred embodiments thereof it is to be understood that various changes in detail of the construction and the combination and arrangement of the components may be resorted to without departing from the spirit and scope of the invention. For example, the transfer arm **116** may be connected to the lower input terminal **32** rather than to the lower contact **22** of the control relay **16**. In this case, the turning on and off of an electric lamp or the controlling of a utilization device can be effected at predetermined time settings excluding both sunrise and sunset.

What we claim is:

1. A system for automatically turning on and off a device at sunrise, sunset and predetermined times comprising, driving rotary means having a predetermined fixed speed of rotation, means responsive to both sunrise and sunset including means for starting operation of said driving means at sunrise and for effecting opening and closing of an energization circuit for the device at sunrise and sunset respectively, speed changing means, controlling and hour indicating means including a graduated member driven by said driving means through said speed changing means, means for controlling said speed changing means by said sunrise and sunset responsive means to change the angular speed of said graduated member from a predetermined magnitude of angular speed of operation during the time interval between sunrise and sunset to twice said predetermined magnitude of angular speed for operation during the time interval between sunset and the next succeeding sunrise, a plurality of hour setting members adjustably secured to said graduated member of said controlling and hour indicating means in positions corresponding to said predetermined times, first control means controlled by said controlling and hour indicating means to hold said driving means in operation for a period of time for which said driving means is to be operated and to stop operation of said driving means upon completion of one revolution of said graduated member before the succeeding sunrise, and second control means controlled by said plurality of hour setting members at said predetermined times respectively to effect the turning on and off of said device.

2. A system for automatically turning on and off a device at predetermined times comprising, driving rotary means having a predetermined fixed speed of rotation, means responsive to both sunrise and sunset including means for starting operation of said driving means at sunrise, speed changing means, controlling and hour indicating means including a graduated member driven by said driving means through said speed changing means, means for controlling said speed changing means by said sunrise and sunset responsive means to change the angular speed of said graduated member from a predetermined magnitude of angular speed of operation during the time interval between sunrise and sunset to twice said predetermined magnitude of angular speed for operation during the time interval between sunset and the next succeeding sunrise, a plurality of hour setting members adjustably secured to said graduated member of said controlling and hour indicating means in positions corresponding to said predetermined times, first control means controlled by said controlling and hour indicating means to maintain said driving means in operation for a period of time for which said driving means is to be operated and to stop operation of said driving means upon the completion of one revolution of said graduated member before the succeeding sunrise, and second control means controlled by said plurality of hour setting means at said preter-

mined times respectively to effect the turning on and off of the energization of said device.

References Cited by the Examiner

UNITED STATES PATENTS

2,446,450	8/1948	Ziegler	250—215 X
2,531,138	11/1950	Lehde.	
2,644,047	6/1953	Leonard	200—38
2,855,476	10/1958	Garrard	200—38
3,033,969	5/1962	Benway et al.	

RALPH G. NILSON, *Primary Examiner.*

WALTER STOLWEIN, *Examiner.*

MICHAEL A. LEAVITT, *Assistant Examiner.*