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Ichiyanagi

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[54] **TIMER DEVICE AND A CAMERA USING SAID DEVICE**

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[52] **U.S. Cl.** **318/484,** 320/1

[51] **Int. Cl.** **H02p 5/16**

[58] **Field of Search** 318/484; 320/1

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Primary Examiner—B. Dobeck

Attorney, Agent, or Firm—McGlew and Tuttle

[57] **ABSTRACT**

A timer device is arranged for electrical connection to equipment to be controlled, such as a movie camera, including a source of potential, such as a battery in operative association with driving means such as an electric motor. The timing device includes a time constant circuit of the RC type in which the capacitor is charged solely from the battery or the like in the equipment. The equipment is of the type having a pair of remote control terminals controlling a supply circuit connecting the battery and the motor. The timer device has a pair of timer terminals arranged for connection to the remote control terminals, and a switching means, such as a transistor, is connected across the timer terminals so that, when the transistor is conductive, the supply circuit connecting the motor to the battery is closed. When a switch is operated, the capacitor means of the time constant circuit is charged, and the capacitor means discharges through the resistor means of the time constant circuit to apply a control current to the base of the transistor during the time required to discharge the capacitor means.

8 Claims, 9 Drawing Figures

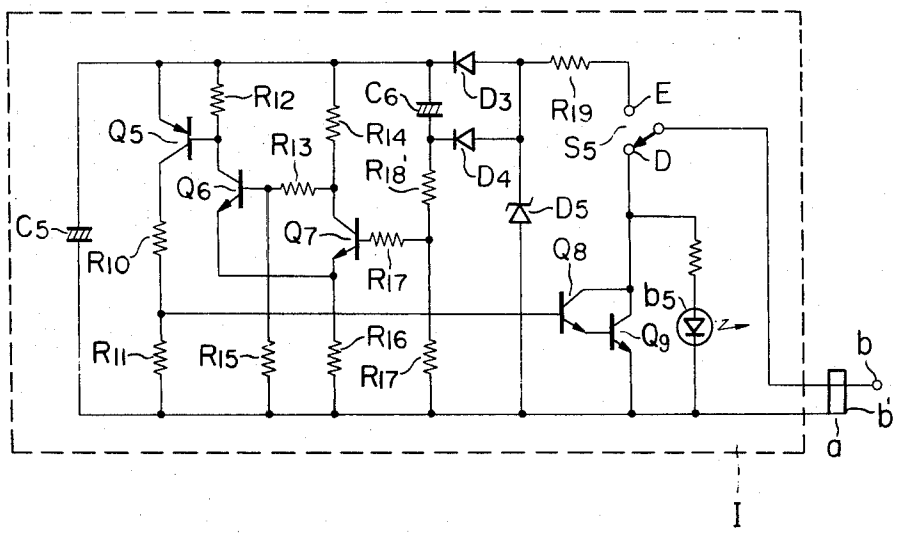


FIG. 1

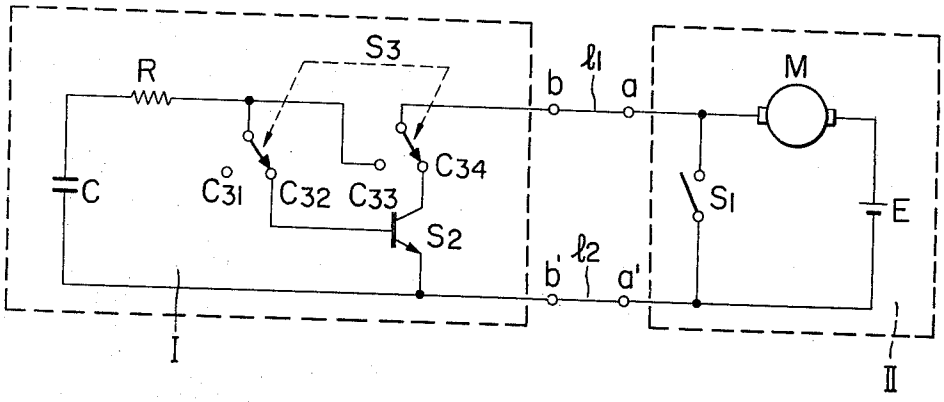


FIG. 2

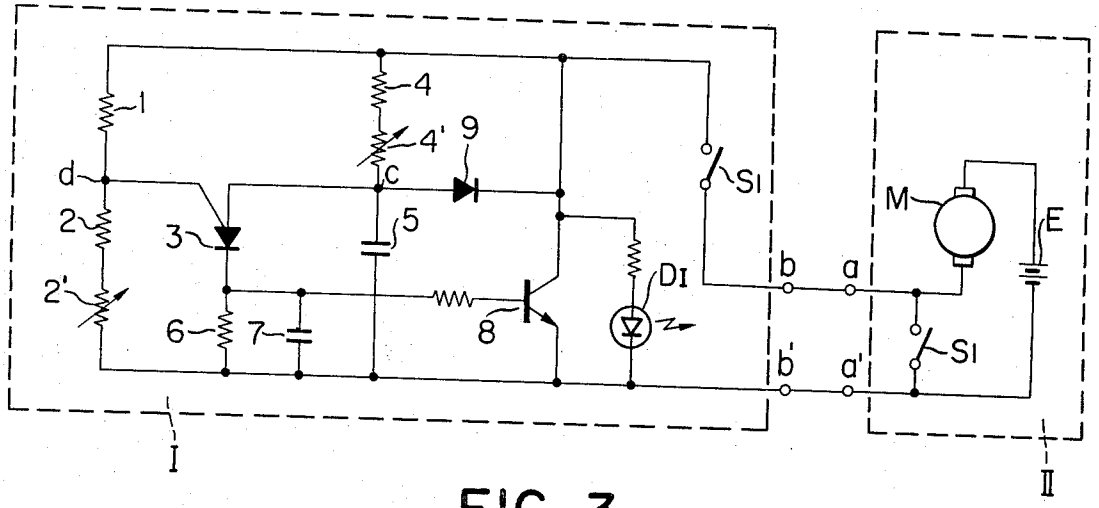


FIG. 3

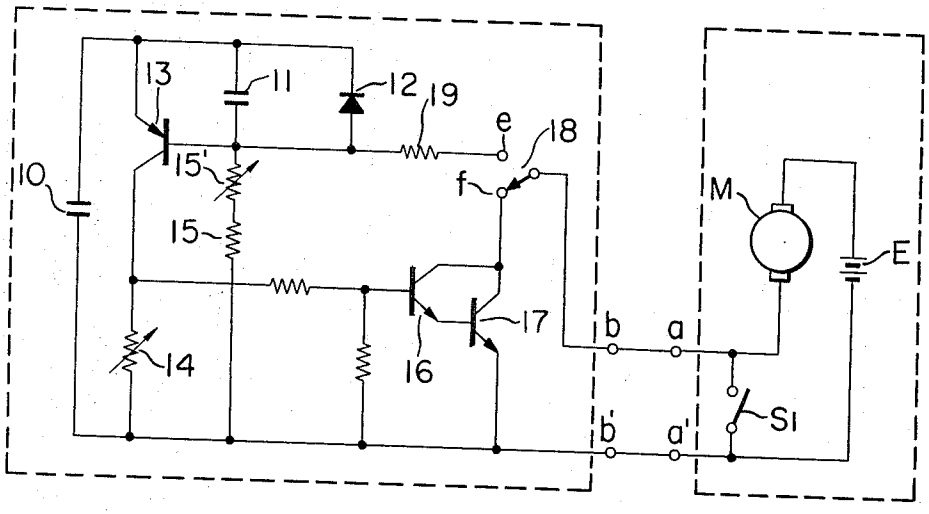


FIG. 4

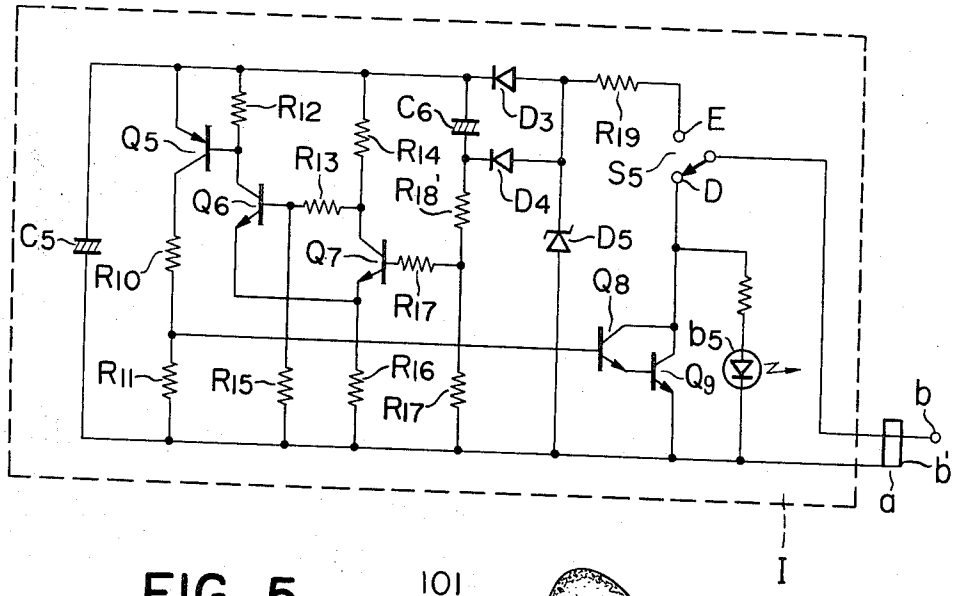
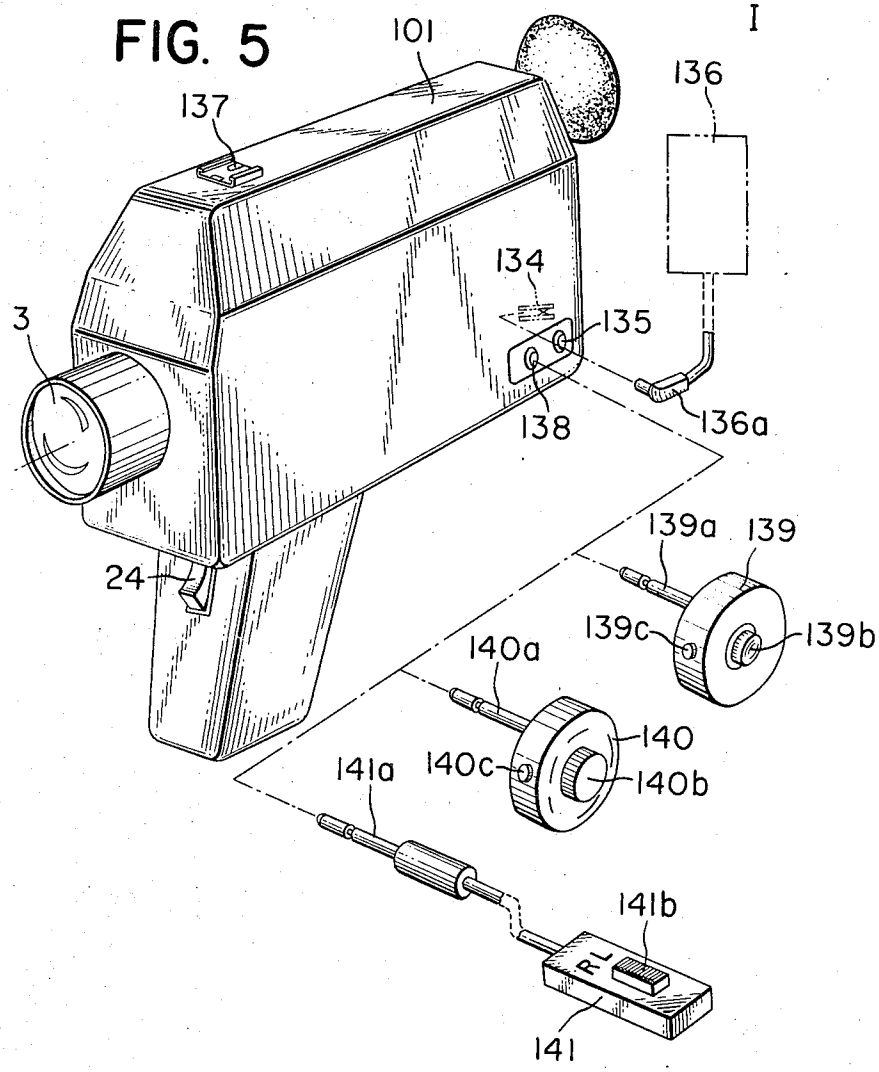

R12
C6
D3
R19
E
Q5
R13
R14
S5
D
R18'
D4
Q6
C5
D5
Q7
R10
Q8
R17
b5
R11
R15
R16
Q9
R17
b
b'
a
I

FIG. 5


101
137
136
134
3
135
138
136a
139a
139
24
139c
139b
140a
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141a
140c
140b
141b
R
L
141

FIG. 6

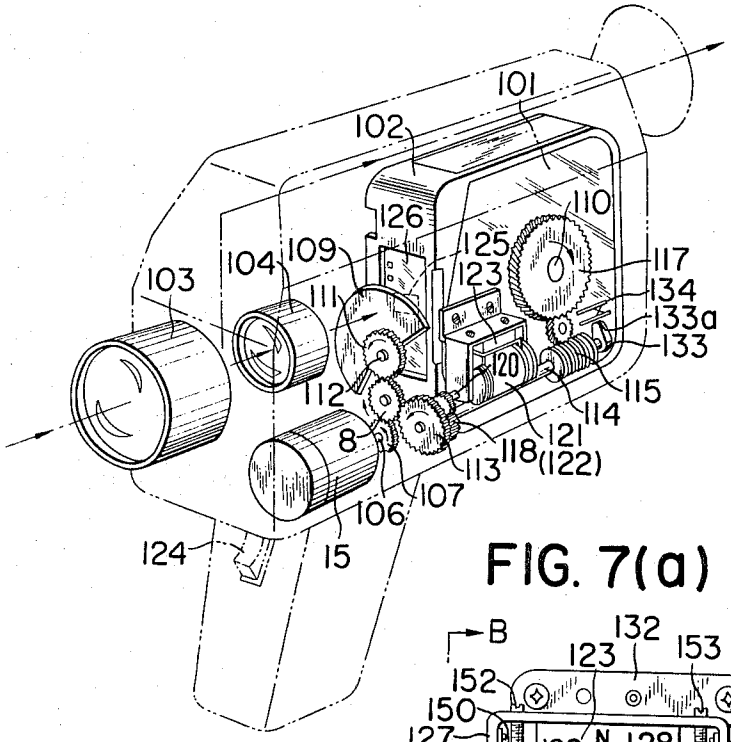


FIG. 7(a)

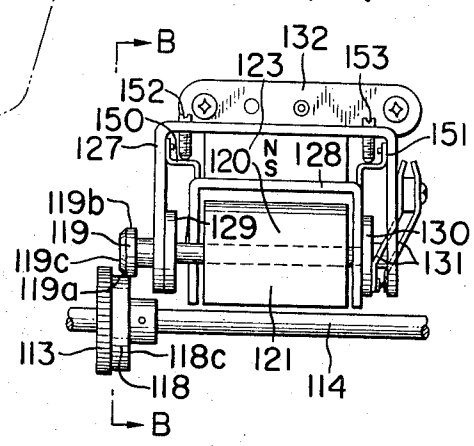


FIG. 7(b)

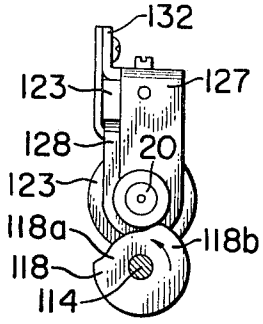
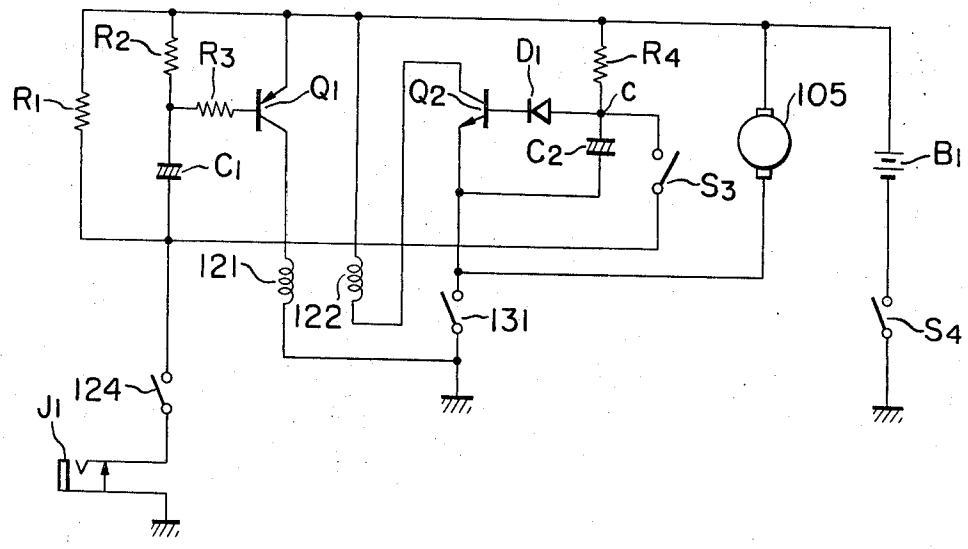


FIG. 8



TIMER DEVICE AND A CAMERA USING SAID DEVICE

FIELD OF THE INVENTION

The present invention relates to a timer device and a photographic camera using said device, and particularly to a timer device which does not contain a power source but effects time limit action electrically.

PRIOR ART

Heretofore, there have been many instances where, in a device which does not contain a timer device, for example, in a photographic camera, it is desirable to provide a timer device to conduct various actions. For example, when an operator actuates a photographing camera at a predetermined time before actual photographing so that the photographing action is effected after a lapse of a predetermined length of time, ordinarily an auxiliary attachment or so-called self-timer is mounted onto a camera and the operator actuates the self-timer and, after a lapse of a predetermined length of time as counted by the self-timer, the photographic camera is operated to take the photograph. The so-called self-timer used here is either a mechanical self-timer having a delay device comprising a mechanical gear group, or an electric self-timer having an electrical delay device, in which an electromagnetic member, which a CR time constant circuit and a switching circuit connected to a power source and to a switching circuit output, is made to engage with a lens operating part of the camera, etc. as usually used. In these conventional types of self-timer, either an electric or mechanical delay device as a time limit mechanism, and a power source or a spring source to actuate the above-mentioned device, are provided, wherein an actuating piece coupled with a camera operating member is electrically or mechanically driven by the output of the delay device so that an operation of a camera is effected. Therefore, it is necessary to incorporate various members mechanically, making the set-up complicated, and at the same time it is necessary to couple the same with the equipment to be controlled, e.g. a camera, with the operating member thereof in the mechanism, so that it is necessary to exercise great care, to insure reliability of action, in installation of the same, etc.

When a control device for a camera, etc. is desired to be activated consecutively at intervals of a predetermined length of time, for example for consecutively photographing the state a flower or vegetable to bloom for a long period of time at intervals of a predetermined length of time, the camera needs to repeat consecutively the actuation and stop. In order to have the control device for a camera, etc. perform such action as mentioned above, the accessory device and its set-up have to be very complicated.

SUMMARY OF THE INVENTION

The object of the present invention is to eliminate the above-mentioned disadvantages of a conventional timer device, and particularly to provide a timer device which is attached electrically to a remote terminal of a control device for a camera, etc., and which has a time constant circuit to effect timer action by a power source at the control device and a switching circuit having its conductance controlled by the time constant

circuit. Particularly it is intended to provide a timer device to a be attached to remote terminal of the control device.

The other objects of the present invention shall become clear from the concrete examples of the present invention which will be now explained in detail.

BRIEF EXPLANATION OF DRAWINGS

FIG. **1** is a principle circuit diagram of the timer device of the present invention.

FIGS. **2, 3** and **4** modified circuit diagrams of the timer device according to the present invention.

FIG. **5** is an exploded perspective view in which a timer device containing the circuits shown in FIG. **1** through FIG. **4** is applied as a timer device for a cine-camera.

FIG. **6** is an interior perspective view of the camera shown in FIG. **5.**

FIG. **7** *a* is a partial side elevation view of the release device shown in FIG. **6.**

FIG. **7** *b* is left end elevation view on the line B—B of FIG. **7** *a.*

FIG. **8** is a schematic wiring diagram of a circuit to activate the release device shown in FIG. **7.**

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** shows an electric circuit diagram to indicate the arrangement and the principle of the timer device according to the present invention, wherein I is a timer circuit in a timer device, and II is a control device to which the timer device is connected, for example a driving circuit for a cine-camera. The output terminals b, b' of the timer circuit I of the timer device are electrically connected to the circuit II at the camera by remote terminals a, a' at the camera and lead wires or sockets, l_1, l_2. C is a capacitor, R is a resistance which constitutes a time constant circuit with the capacitor C, S_3 indicates interlocking duplex switches, S_2 is a switch composed of such switching elements as transistors, etc., S_1 is a release switch closed in association with the release button of a camera, M is a motor to drive a film, a shutter, etc., and E is a power source battery at a camera. The driving circuit at a camera is linked with a shutter release button, and the motor M is driven by closing the switch S_1, to activate the camera so that photographing action is initiated, and the camera continues photographing action as long as the switch S_1 is closed.

Next, for effecting timer action photographing using timer circuit I, first the interlocking switches S_3 are changed from the state shown in FIG. **1** over to the contacts C_{31}, C_{33} instantly. As a result of this action, the capacitor C is charged by closing the circuit, battery E — motor M — l_1 — switch S_3 (C_{33}) — resistance R — capacitor C — l_2 — E. Next, the switch S_3 is changed over and the is returned to C_{32}, C_{34}. As S_3 is returned the transistor S_2 will be conducted through as the charged voltage of the capacitor C_2 is impressed to the base of the same, and the motor M is driven by the circuit E — M — l_1 — S_3 (C_{34}) — S_2 — l_2 — E. The electric charge of the capacitor C is discharged through the base of the transistor S_2 via the resistance R, and the motor M continues driving until the switching transistor S_2 becomes non-conductive after a time constant period which is determined by the product of the resistance R and the capacitor C, and the camera continues

photographing action. As the transistor S_2 becomes non-conductive, the motor M is stopped. As has been explained, the timer circuit in the timer device is activated by the power source E at a camera and after a time counting action for a predetermined length of time, stops the functioning of the driving circuit at a camera. Therefore no power source at all is needed at the timer device itself, and it is not necessary to provide a power source supplying terminal separately. Thus the device can be very easily constructed, and sure action can be expected by only attaching the device to the remote terminals of a camera. Concerning repeated use thereof, it can be used many times by only changing over the switch S_2, so that its handling is very simple.

FIG. 2 is a circuit connection diagram showing an example of the timer device of the present invention, wherein a motor circuit as, for example a driving motor for a cine-camera or a driving motor for an electric wind up camera as in FIG. 1 is shown as an equipment to be controlled. In the drawing, 1 and 2, 2' are bleeder resistances, 3 is a uni-junction transistor (UJT), and 4,4' are resistances equivalent to R in FIG. 1. 5 is a capacitor, 6 is a resistance in a base circuit, 7 is a capacitor, 8 is a switching transistor, and 9 is a diode for preventing reverse current. D_1 is a luminous diode and is lighted when the transistor 8 is not conductive thus indicating the conductive state of the transistor.

In operating this device, the power source switch S_1 of main body is placed in the off state and the timer device is connected to the remote terminals *a,a'* of the main body. Next, as the starting switch S_1' at the timer device I is placed in the on state, the capacitor 5 is charged by the power source E of the main body through the motor and the resistances 4,4'. If the values of the resistances 4,4' are suitably selected, and the impedance at the terminals *b,b'* of the timer circuit is set at a higher value than the impedance of the motor, the motor will not be activated. As the charging of the capacitor 5 proceeds and the voltage at the point C becomes higher than the voltage at the point d of the bleeder circuit, UJT3 is placed in a conductive state, and there will be a voltage drop across resistance 6. This is impressed on the base of the transistor 8 placing it in the on state. As the transistor 8 is placed in the on state driving curent flows to the motor M from the power source E, activating the same. The electric charge of the capacitor 5 is discharged through the diode 9 and the transistor 8, and the UJT transistor becomes non-conductive. In this state, a portion of the electric charge of the capacitor 5 has been charged at the capacitor 7, and the transistor 8 is in, on state during such time (T_2) as this charge is discharged through the resistance 6, so that the motor continues rotation. That is during such time (T_1) as from the moment the switch S_1' becomes on till the moment the UJT3 becomes on, the motor is stopped, and during such time (T_2) as from the moment the UJT becomes off till the moment the transistor 8 becomes off the motor rotates, thus repeating the above-mentioned action. By varying the variable resistances 2' and 4' the working time can be suitably established.

FIG. 3 is a circuit connection diagram showing another example of the present invention. In the drawing, 10 and 11 are capacitors, 12 is a diode, 13 is a transistor, 14, 15, 15' are resistances, 16, and 17 are switching transistors, 18 is a change over switch, 19 is a series resistance. This device is connected to the circuit II of the equipment to be controlled, such as a camera, etc., at the remote terminals *b,b'* as in the case of FIG. 2.

In operating this device, the power source switch S_1 at the circuit II is placed in the off state and the change over switch 18 is placed on at the "*e*" side, and the capacitors 10, 11 are charged by the power source E through the motor M, the series resistance 19 and the diode 12. As the resistance 19 in this circuit is made to have a sufficiently higher value than the impedance of the motor M, the motor M will not be energized. Next, as the change over switch 18 is placed on at the "*f*" side, the capacitor 11 is charged in the opposite direction by the electric charge of the capacitor 10, and as it becomes higher than the V_{BE} of the transistor 13, the transistor 13 becomes on. By this, the electric charge of the capacitor 10 is discharged through the resistance 14, and the switching transistors 16 and 17 become on by the terminal voltage of the resistance 14. Therefore driving current flows from the power source E through the transistor 17 to the motor M, rotating the same. After a lapse of such time as set by the resistance 14, the discharging of the capacitor 10 is completed, and the transistors 16, 17 become non-conductive and the motor is stopped. The time (T_3) during which the capacitor 11 is reversely charged can be set by varying the resistance 15'. As has been explained above, in this device after a lapse of time (T_3) since the manual change over switch 18 is changed over from "*e*" to "*f*", the motor is energized and is rotated as long as such time (T_4) that the capacitor 10 is discharged. Then the motor is stopped.

FIG. 4 is a circuit diagram for another modified example of the timer device according to the present invention, wherein b,b' are terminals formed in remote jack shape to be connected to the remote terminals of the equipment to be controlled, such as a camera, etc. to which the timer device is to be attached. S_5 is a timer starting switch, and is changed over instantly from the contact D to the contact E at the time the timer circuit I is initiated, and is returned to the contact "D" again. C_5 is a capacitor, Q_5 is a switching transistor with the resistances R_{10}, R_{11} connected to its collector, and the resistance R_{12} to its base. Q_6 is a transistor forming a Schmidt circuit together with the transistor Q_5. R_{13} to R_{18} are resistances. D_5 is a constant voltage or Zener diode, and D_3 D_4 are diodes for preventing reverse current. C_6 is a capacitor for a time constant circuit. Q_8, Q_9 are transistors forming a switching circuit with a Darlington connection, and diode D_5 is a luminous diode. For initiating the equipment to be controlled such as camera by connecting the terminals *b,b'* to the remote terminals *a,a'* of the camera driving circuit II as in FIG. 1 through FIG. 3, first the starting switch S_5 is changed over to "E" side. By this change over the capacitor C_5 is charged by the power source battery at the camera driving circuit through the resistance R_{19} and the diode D_3. At this time the capacitor C_6 is not charged as the current flows through the diodes D_3, D_4. On the other hand, since the driving circuit at a camera is held at lower value than the actuating current value of load by the resistance value of the resistance R_{19}, the the load within the driving circuit, for example, the motor, is not actuated. Since the capacitor C_5 is always charged to a constant electric potential by the Zener diode D_5, it is always charged to a constant potential even if the power source battery voltage at the camera

driving circuit varies, for instance by becoming exhausted causing voltage droppage. When pressing of the starting switch S_5 is released and the switch S_5 is returned to contact "D", charging current flows through the resistances R_{18}, R_{18}' to the capacitor C_6 to start the charging, which will be completed after a lapse of time constant period of time which is determined by the product of the capacity of the capacitor C_6 and the resistances R_{18}, R_{18}'. The transistor Q_7 is made conductive by the start voltage of the resistance R_{18} generated by the charging current of the capacitor until the charging of the capacitor is completed, and as a result the electric potential of the base of transistor Q_6 drops, so that the transistor Q_6 becomes non-conductive, and as no base current flows to the transistor Q_5, transistor Q_5 becomes non-conductive, and the charged electric charge of the capacitor C_5 is not discharged. On the other hand, when the charging of the capacitor C_6 is completed and the transistor Q_7 becomes non-conductive, the transistor Q_6 becomes conductive and the base current of the transistor Q_5 flows so that the transistor Q_5 becomes conductive and the electric charge of the capacitor C_5 is discharged. As a result the base current of the transistor Q_8 flows and the transistor Q_9 becomes conductive, so that the luminous diode, which has been on, will be put out. As the transistor Q_9 becomes conductive, the driving current flows within the camera driving circuit (the circuit II of FIG. 1 to FIG. 3), and the motor M within the driving circuit is driven thus conducting the prescribed driving of the shutter, film, etc. As the conductive state of the transistor Q_9 is retained during such time constant period of time as will be determined by the charged electric charge of the capacitor C_5 flowing through the resistances R_{10}, R_{11}, the driving of the motor is continued. As the electric charge of the capacitor C_5 is discharged, the transistors Q_8, Q_9 become non-conductive, and the motor M is stopped.

As has been explained above, after the starting switch S_5 is released, after a lapse of such time constant period of time T_1 as determined by the capacitor C_6 and the resistances R_{18}, R_{18}', the driving circuit at a camera is started and its operating state is retained for such time constant period of time T_2 as determined by the capacitor C_5 and the resistances R_{10}, R_{11}, when the driving circuit is stopped.

FIG. **6** shows a camera set-up when the timer device, having the circuit shown in FIG. **2** through FIG. **4** incorporated therein, is used as a control device for a cine-camera. FIG. **6** shows the arrangement when the timer device of the present invention is connected to the camera shown in FIG. **5.** In FIG. **6, 101** is a camera main body having its external outline shown by a chain line, and **102** is a film magazine as loaded into a camera main body. **103** is a zoom lens body, and **104** is a relay lens body, wherein the optical systems are of a publicly known type. **105** is a driving motor connected to a power source, not shown in the drawing. It is so constructed that the driving power of the motor **105** is transmitted through a gear **107** provided on driving axle **106** of the motor, and an intermediate gear **108** engaging with gear **107**, so that the shutter **109** and the film take up axle **110** are driven. The gear **108** is supported rotatably on the main body of a camera, and the driving power of the motor **105** is transmitted through its engagement with the shutter axle gear **111**, and the shutter **109** is rotated with the shutter axle **112** used as a rotation axis. **113** is a driving gear which engages with intermediate gear **108** and is rotated in a pair with the shutter axle, thereby rotating the driving axle **114.** At the other end of the driving axle **114** a worm gear **115** is attached, and this worm gear transmits the rotation of the axle **114** to the film wind up gear **117** through the worm wheel **116,** and gear **117** drives the film take up axle **110.** The arrow mark in the drawing shows rotation direction of each transmitting member when the motor **105** is rotated to the direction of arrow. At the end of driving axle **114** having the gear **113** attached thereto, a cam **118** of such shape as will be explained later is provided. **119** is a stopper installed on a sliding bar **120** in such manner as to be engaged with and disengaged from cam **118. 121** is an electro-magnet coil retained at the sliding bar **120. 122** is a coil wound with counter polarity against that of the coil **121** at the same place as the coil **121. 123** is a permanent magnet. **124** is a shutter release button, and by pressing the same the camera starts to function and the shutter **109** rotates performing one frame photographing or continuous photographing, details of which will be explained later.

The incident path of light beam is shown by an alternating long and short dash line. The beam after penetrating through the zoom lens is divided into two by a beam splitter not shown in the drawing, and one of the split beams proceeds without changing its direction and passes through the relay lens **104,** giving an exposure to the film **126** through an aperture part **125** shown by broken lines. The other beam proceeds through the upper part of the camera main body to a finder part.

Next, explanations shall be made on the arrangement of one example of the above-mentioned electromagnetic release device, referring to FIGS. *7a*, and *b*.

In FIG. *7a* and FIG. *7b*, **123** is a permanent magnet installed in a first yoke **127. 121** is an electromagnetic coil installed in a second yoke **128.** Permanent magnet **123** and the second yoke **128** are combined in close contact with each other so as to compose a magnetic circuit. **120** is a sliding bar which is slidably supported by the first and the second yokes **127, 128** and also serves as a core for the electro-magnetic coil **121.** Ferromagnetic pieces **129, 130** are fixed on bar **120** so that they are positioned between the two yokes **127, 128,** and stopper **119** is installed at the left end of said sliding bar **120.** This stopper **119** has a beveled part **119***a*, a cylindrical part **119***b*, and an end plane **119***c*. **131** is a switch for a driving motor circuit for a shutter rotating axle which is to be described later in connection with an electric circuit diagram. **114** is a driving axle which rotates at a 1 : 1 ratio with the shutter axle **112** shown in FIG. **6. 118** is a cam installed on axle **114.** Cam **118** has, as shown in FIG. *7b*, a concave part **118***a* cut away, an arc vertex part **118***b* projecting out of the cut away part, and an end plane **118***c* having the profile as shown in FIGS. *7a* and *b*. **132** is a plate for mounting the electromagnetic release device on the camera main body.

FIG. *7a* and FIG. *7b* show a state wherein the stopper **119** engages with the cam **118** and the switch **131** is opened, and no current is flowing through the electromagnetic coil **121,** with a fixed state of the axle **114** in which the ferromagnetic pieces **129, 130** are attracted to the first yoke **127** and the second yoke **128,** respec-

tively, that is the position of the shutter being stopped. In this state, when electric current flows to the electromagnetic coil **121** in such direction that the ferromagnetic piece **129** becomes an N-pole and the ferromagnetic piece **130** becomes an S-pole, the ferromagnetic piece **129** and the first yoke **127** repulse each other while the ferro-magnetic piece **130** and the second yoke also repulse each other, and the sliding bar **120** is shifted in a direction to close the switch **131,** making the stepped part **119***b* of the stopper **119** come off the end plane **118***c* of the cam **118,** but while the oblique plane part **119***a* of the stopper **119** has not come off the end plane **118***c*, the and switch **131** is closed, thereby driving the motor **105** shown in FIG. **2** so that axle **114** starts rotation.

On the other hand, the sliding bar **120** further slides until the ferromagnetic pieces **129, 130** are attracted by the yokes **128, 127** thus proceeding to the right hand direction in FIG. **3.** Even if the current for the electromagnetic coil **121** is cut off the sliding piece **120** retains its position by the attractive force of the ferromagnetic pieces **129, 130** and of the yokes **128, 127.**

Next, when current is supplied to the electromagnetic coil **121** in a direction reverse to the above, the polarity of the ferro-magnetic pieces **129, 130** will be reversed to that, in the case of FIG. **3,** therefore the ferromagnetic pieces **129, 130** and yokes **128, 127** repulse each other, respectively, and the sliding piece **120** moves in a direction to open the switch **131.** However, ordinarily the arc part **118***b* of the cam **118** is at an engaging position with the stopper **119** in many cases. Thus even when the stopper **119** returns in the left hand direction in the drawing, first the left end plane **119***c* of the stopper **119** comes in contact with the right end plane **118***c* of the cam **118.** In this position the switch **131** has not been open-circuited yet, and the cam **118** rotates as shown by an arrow mark in FIG. **7***b*, and when its concave part **118***a* comes to an engaging position with the stopper **119,** the stopper **119** further returns to left hand direction as the plane restricting the end plane **119***c* is cut away. Then the switch **131** is open-circuited at such position that the beveled surface **119***a* engages with the concave part **118***a*, open-circuiting the motor circuit at the same time, so that the driving force of motor becomes zero but it further continues rotation by inertia, and the axle **114** stops rotation at such position that the stepped part **119***b* of the stopper **119** engages with the concave part **118***a* of the cam **118,** thus returning to the state shown in FIG.**6***a*, FIG. **6***b*.

When the above steps are made to function as one continuous cycle, one frame photographing is possible, and when electric current is kept blowing to the motor circuit while the engagement between the stopper **119** and the cam **118** is released, continuous photographing can be made, wherein the photographing can be finished by flow of electricity of reverse polarity to the first one to the electro-magnetic coil **121** to stop the shutter axle at a normal stopping position, as in one frame photographing.

During such operation there are such occasions that the ferromagnetic pieces **129, 130** and the yokes **127, 128** very firmly adhere to the permanent magnet **123** by attractive force and it becomes difficult to remove them only by the electro-magnetic force of the electromagnet. Therefore, it is desirous to install springs **150, 151,** as shown in the drawing, to which springiness is given to such direction as to offset the attractive force which attracts the ferromagnetic pieces **129, 130** and the yokes **127, 128. 152** and **153** show adjusting screws to adjust the springiness of the springs **150, 151. 133** is a cam member provided at an extended part of the axle **114'** having a concave part **133a** so made as to close the switch **134.** As the shaft **114** rotates in a ratio of 1 : 1 with the shutter axle **112,** it is so arranged that the convex part **133***a* of the cam closes the switch **134** when the shutter blades **109** cover the photographing opening **125,** and this switch is connected to a connecting jack **135** shown in FIG. **5.** A coupling connector **136***a* can be connected to this jack **135** in such manner that a well-known flashing means **136** can be attached to an attaching shoe **137** of a camera.

The outline of a camera having the above-mentioned set-up is shown as FIG. **5.** A jack **138** is provided as a coupling means for an outside trigger means to actuate the above-mentioned electromagnetic release means at this camera. To this jack, for example, plugs **139***a*, **140***a* or **141***a* for a self timer device **139,** a short period timer device **140** or a remote control device **141,** respectively can be selectively connected as an outside trigger means, as will be explained later. The self timer device **139** is to effect shutter release with a predetermined length of time by incorporating therein the timer circuit shown in FIG. **4,** and the short period timer device **140** has the timer circuit shown in FIG. **2** incorporated therein and is to repeatedly effect the shutter release with a predetermined length of time which is adjustable with a predetermined cycle, and the remote control device is to effect the running lock, etc. of the ON, OFF state or ON state of the release switch. **139***b* is a button linked with the above-mentioned switch S_5 shown in FIG. **4, 139***c* is an indication window for the luminous diode D_5, and **140***c* shows an indication window for the luminous diode D_1 shown in FIG. **2.**

FIG. **8** is a part of an electric circuit connection diagram for a main body **101** of a cine-camera. In the drawing, **124** is a release switch, **131** is an electromagnetic release switch, S_3 is a change-over switch for continuous photographing and one frame photographing, S_4 is a main switch, **105** is a motor, B_1 is a battery, **121, 122** are electromagnetic coils, Q_1, Q_2 are transistors, D_1 is a diode, C_1, C_2 are capacitors, R_1, R_2, R_3, R_4 are resistors, and J_1 is a jack, corresponding to the **138** in FIG. **1.** When the main switch S_4 and the switch S_3 are closed, continuous action is obtained. Now when the release switch **124** is closed, the base current of the transistor Q_1 flows through C_1 R_3, placing the transistor Q_1 in ON state, with electric current flowing through the coil **21,** and the switch **31** is closed as mentioned before. As a result electric current flows to the motor **105** and the motor **105** rotates. Since the current flowing through the resistance R_4 goes through the switches S_3, **124** and jack J_1, the base current of the transistor Q_2 will not flow and the transistor is placed in OFF state.

As the release switch **124** is opened, capacitor C_2 is charged through resistance R_4, and the base current of the transistor Q_2 flows and the current flows through the coil **22,** and the switch **131** for the electro-magnetic release is opened so that the motor **105** stops. When the release switch **124** is closed in a state that the main switch S_4 is closed and the change over switch S_3 is opened, the base current of the transistor Q_1 flows through the C_1, R_3, and the transistor Q_1 becomes ON

state then current flows through the electro-magnetic coil **121**, and as a result the switch **131** is closed. Thereby current flows through the motor **105** and the motor will rotate. The capacitor C_2 is charged through the resistance R_4, the base current of the transistor Q_2 flows, and current flows through the coil **122.** Then the switch **131** is opened and the motor **105** stops after one frame is photographed.

When the plug **140**a of the timer device **140** is connected to the jack J_1 shown in FIG. **8** and the release switch **124** is closed, C_4 is charged through the R_1, R_7, VR_2. As the current flowing through R_1 is small, the voltages at both its ends are of low potential. Thus the base current of the transistor Q_1 will not flow through C_1, R_3. When the capacitor C_4 is sufficiently charged and the electric potential at the point A shown in FIG. **5** becomes higher than that at the point B the electric charge of the C_4 flows through the transistor Q_4 and is charged at the C_3, and at the same time the base current of the transistor Q_3 flows through the R_9, placing the Q_3 in ON state, discharging the electric charge of the C_4 through the diode D_2, then the base current of the transistor Q_1 flows through the C_1, R_3, placing the Q_1 in ON state, flowing current through the coil **121,** closing the switch **131** and the motor **105** is rotated.

As the switch S_3 is opened, when the C_2 is sufficiently charged through the R_4, the base current of the transistor Q_2 flows, placing the Q_2 in ON state, flowing current through the coil **122,** opening the switch **131.** Since the electric charge charged at the capacitor C_3 is discharged through the R_8, the transistor Q_3 is placed again in OFF state. The C_4 is charged again through R_1, R_7, VR_2, then with an interval of every T_1 hour, one frame photographing is repeated.

In FIG. **8,** the switches **24,** S_3, S_4 are closed and the timer device **139** is connected instead of the timer device **140** by inserting jack plug **139***a* in the J_1. In FIG. **4** when the switch S_5 is changed over from D to E by pressing the button **139***b*, C_5 is charged through R_1, R_{14}, D_3. As the current flowing through R_1 is small, the base current of transistor Q_1 will not flow through the C_1, R_3. When S_5 is changed over to D, the electric charge of C_5 is charged at the C_6 through R_{18}. When C_6 is sufficiently charged, the Schmidt circuit composed of Q_6, Q_7, R_{12}, R_{13}, R_{14}, R_{15}, R_{16} is reversed, and Q_7 is changed from ON state to OFF state. Q_6 is changed from OFF state to ON state and the transistors Q_5, Q_8, Q_9 also are changed from OFF state to ON state. The base current of Q_1 flows through C_1, R_3 placing Q_1 in ON state, flowing current through the coil **121** and closing the switch **131,** and the motor **105** is rotated. When the discharging of the electric charge of C_5 is finished, Q_8, Q_9 are placed in OFF state, and the current of R_4 will not flow through **124,** S_3, S_5, Q_9. Thus C_2 is sufficiently charged through R_4, and the base current of Q_2 thereafter flows, placing Q_2 in ON state, flowing current through the coil **122** and opening the switch **131,** and the motor **105** is stopped. That is, the cine-camera will not work for the period of T_1 time during which C_6 is charged through R_{18}, and the cine-camera works for the period of T_2 time during which C_5 is discharged through R_{10}, and the camera stops thereafter. Therefore by making C_6, R_{18} variable, T_1 can be made variable, and by making the C_5, R_{10} variable T_2 can be made variable. **139** *b* is an adjustment knob therefor.

As has been explained above the timer device of the present invention does not need any power source within itself. Further a terminal for a supplying power source does not have to be provided, so that, the device can be made up simply and the timer action can be so made that either one of a repeated action or one action and stop may be selected. Thus the present invention provides a timer device convenient for attaching to various types of electrical appliances.

What is claimed is:

1. A timer device, for electrical connection to equipment to be controlled and which equipment includes a source of potential, a driving means connected to the source, a controlled mechanism coupled to the driving means and actuated thereby and a pair of remote control terminals included in a supply circuit connecting the driving means to the source, for remotely controlled energization of the driving means, said timer device comprising, in combination, a time constant circuit including resistor means connected to a first capacitor; a pair of timer terminals for connection to respective remote control terminals; switching means having a control element connected to said time constant circuit, said switching means being connected across the timer's terminals for completion of said supply circuit when said control element is energized by discharge of said first capacitor; and means operable to connect said time constant circuit across said timer terminals for charging of said first capacitor solely by said source of potential in said equipment; said first capacitor discharging through said resistance means to supply a control current to said control element, so that said timer device controls connection of said driving means to said source.

2. A timer device, as claimed in claim **1,** including a second capacitor connected to said first capacitor and charged by said first capacitor; a second resitance means forming a second time constant circuit with said second capacitor; a second switching means connected in the discharge circuit of said second capacitor and triggered conductive when the charged voltage of said capacitor attains a predetermined value; and means including said second switching means impressing the charge of said second capacitor on said first capacitor.

3. A timer device, as claimed in claim **1,** including a second capacitor connected to said first capacitor and charged thereby; second switching means connected in the discharge circuit of said second capacitor; and means connecting said first capacitor to the control element of said second switching means.

4. A timer device, as claimed in claim **1,** including constant voltage means connected to said first capacitor and maintaining the voltage applied thereto from said source of potential in the equipment at a constant value; said switching means comprising a Schmidt trigger circuit.

5. A timer device, as claimed in claim **1,** including blocking diodes connected to both terminals of said first capacitor and preventing reverse current flow.

6. A timer device, as claimed in claim **1,** including a luminous diode connected in parallel with said switching means and constituting an indicator.

7. A timer device, as claimed in claim **2,** in which said second resistance means includes a variable resistor operable to adjust the conductance time of said second switching means whereby triggering conductive of said first-mentioned switching means is cyclically repeated at timed intervals controlled by said second switching means.

8. A timer device, as claimed in claim **3,** in which said first-mentioned switching means comprises transistors connected to form a Darlington switching circuit.

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