

May 15, 1934.

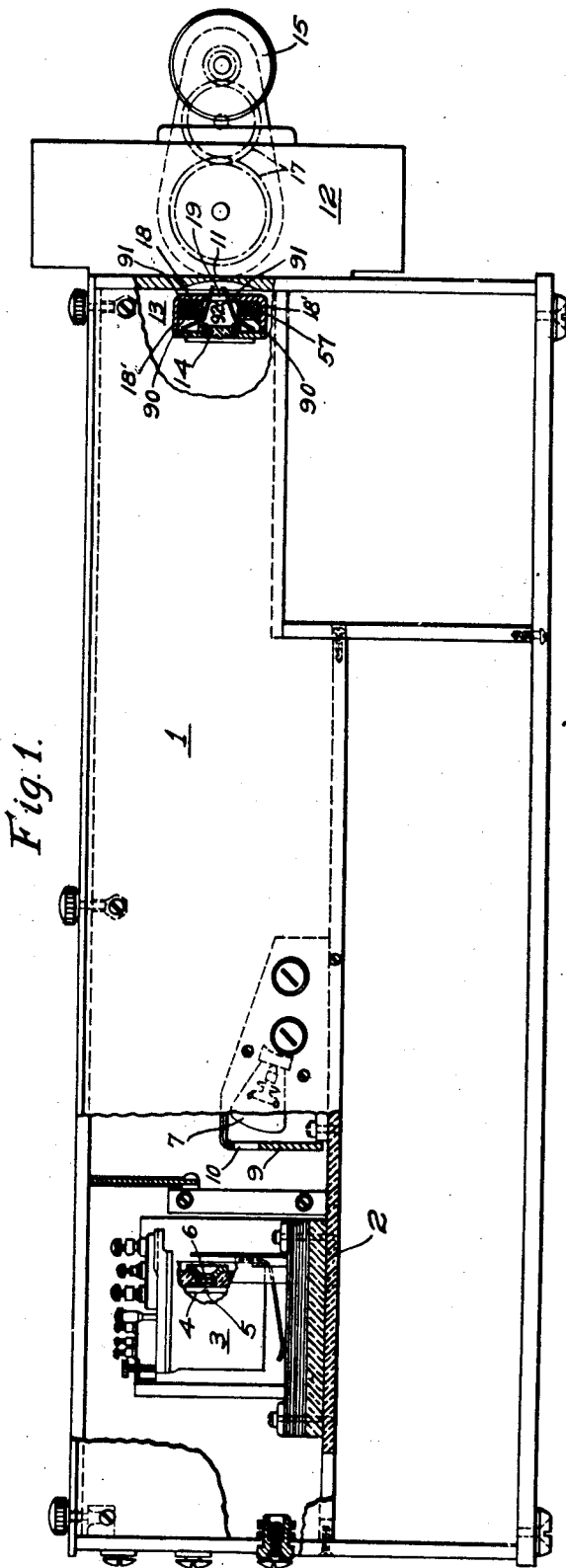
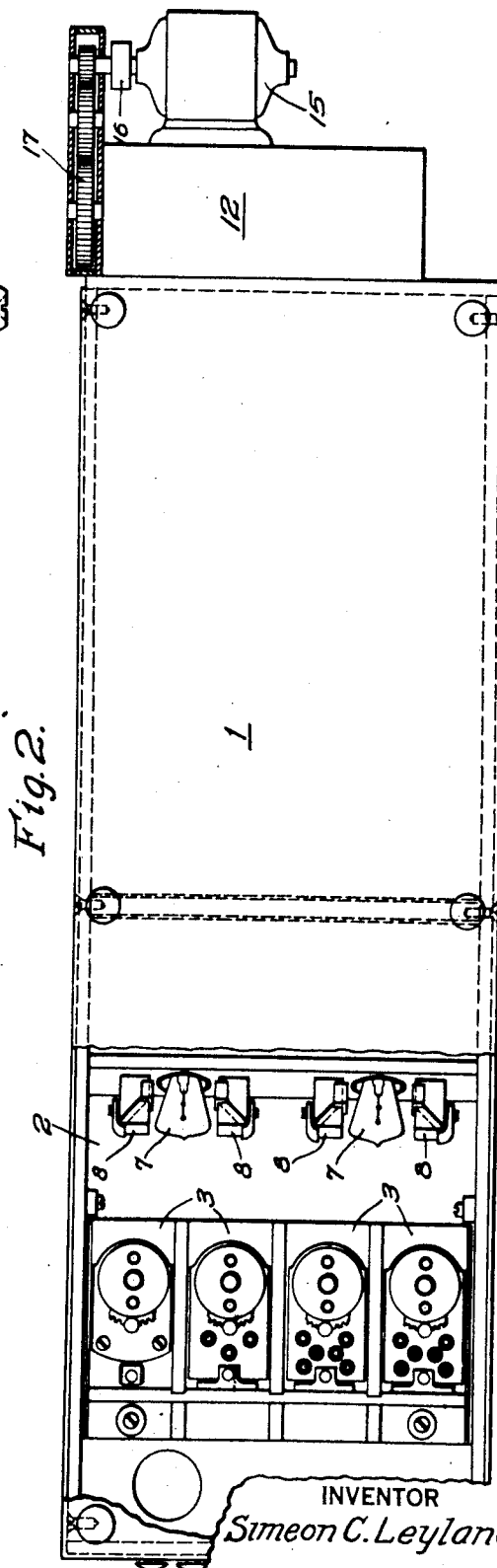
S. C. LEYLAND

1,958,897

AUTOMATIC OSCILLOGRAPH

Filed Jan. 22, 1931

2 Sheets-Sheet 1



INVENTOR
Simeon C. Leyland.

BY
Wesley E. Barr
ATTORNEY

May 15, 1934.

S. C. LEYLAND

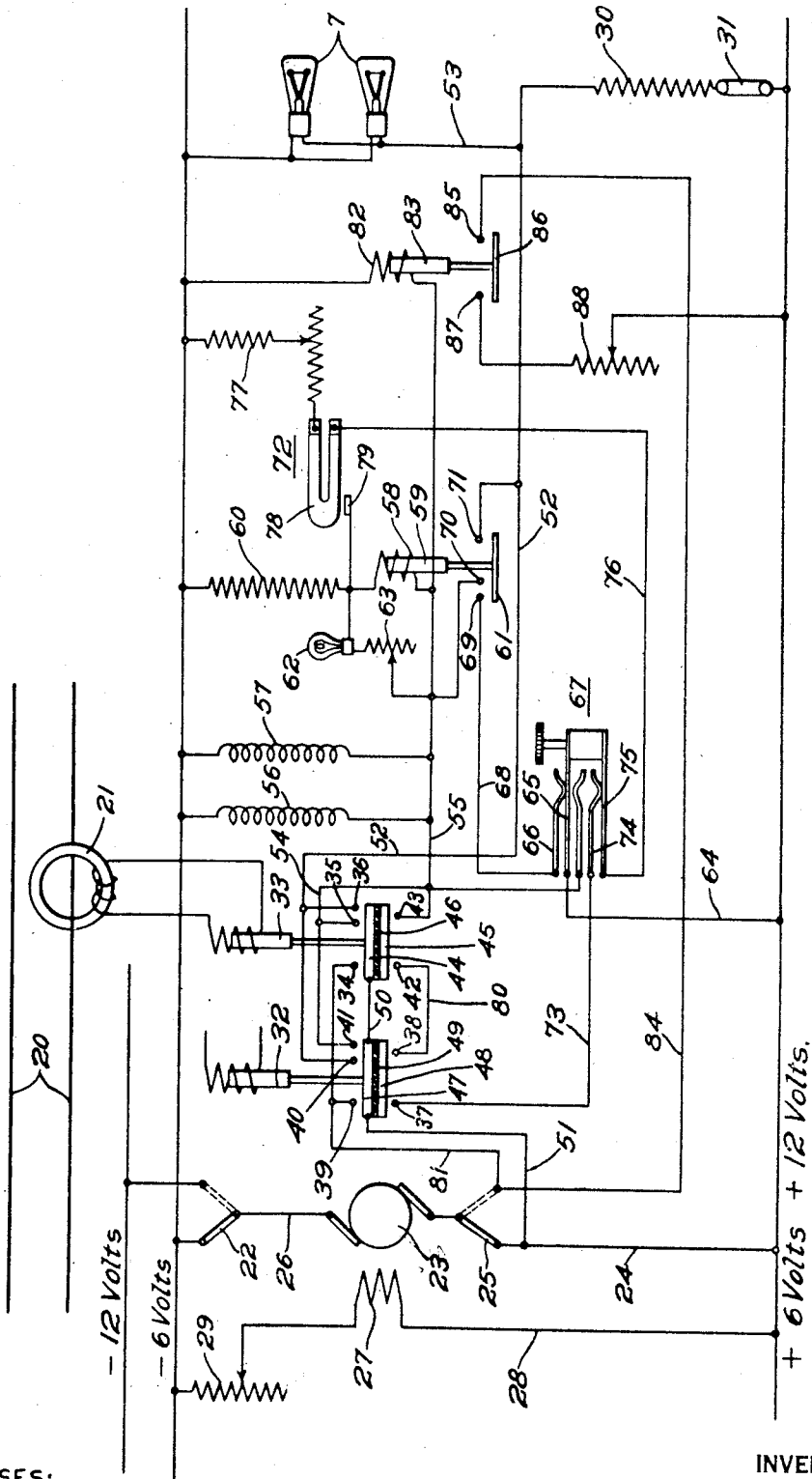
1,958,897

AUTOMATIC OSCILLOGRAPH

Filed Jan. 22, 1931

2 Sheets-Sheet 2

Fig. 3.



WITNESSES:

E. J. Weller
F. M. Harris

INVENTOR

Simeon C. Leyland

BY

Wesley E. Carr
ATTORNEY

UNITED STATES PATENT OFFICE

1,958,897

AUTOMATIC OSCILLOGRAPH

Simeon C. Leyland, Belleville, N. J., assignor to
Westinghouse Electric & Manufacturing Com-
pany, a corporation of Pennsylvania

Application January 22, 1931, Serial No. 510,471

9 Claims. (Cl. 234—1.5)

My invention relates to oscillographs and more particularly to oscillographs designed to automatically record disturbances on electrical transmission lines.

5 An object of my invention is to provide an oscillograph that will attain its operative recording condition, in response to a disturbance on the line with which it is associated, more quickly than other oscillographs of the mechanical type.

10 A further object of my invention is to provide means for rendering the recording apparatus inactive a predetermined time after the transmission-line disturbance ends.

In practicing my invention, I employ a mag-
15 netic shutter so located between the galvanometer and the film that the oscillograph lamps may be lighted without exposing the film. The shutter is specially constructed for fast operation and is so located, with respect to a cylindrical lens,
20 as to obtain a maximum speed and efficiency. The oscillograph-lamp filaments are kept heated at all times by a flow of current therethrough and are quickly brought to full brilliancy when a disturbance occurs on the line.

25 The film holder is driven through a magnetic clutch, and the magnetic shutter, the clutch and the lamp are energized in response to a transmission-line disturbance.

Other objects, features and advantages of my
30 invention will be apparent from the following description, taken in connection with the accompanying drawings in which:

Figure 1 is a side view, partly in section, of an oscillograph constructed in accordance with my
35 invention,

Fig. 2 is a plan view of the apparatus shown in Fig. 1, and

Fig. 3 is a diagram of the electrical connections employed in my oscillograph.

40 Referring to Figs. 1 and 2, the apparatus comprises a light-proof casing 1 having a supporting shelf 2 therein for a plurality of galvanometers 3. These galvanometers may be constructed as shown in U. S. Patent No. 1,712,570 issued to
45 J. W. Legg May 14, 1929. Each galvanometer 3 comprises a deflecting element 4 upon which is supported a mirror 5. A spherical lens 6 is positioned immediately in front of the mirror 5.

Two straight-line-flament lamps 7 are mount-
50 ed in front of the galvanometers 3, each lamp being so positioned between two prisms 8 that one lamp supplies two beams of light for two galvanometers.

The lamps 7 and prisms 8 are enclosed by a
55 light-proof cover 9 having a slit 10 in the left-

hand side thereof for admitting light to the galvanometers 3.

The right end of the casing 1 has a horizontal slit 11 therein for admitting the reflected light from the galvanometers 3 to the film contained
60 in a film holder 12, which may be of the type shown in U. S. Patent No. 1,563,382, issued to J. W. Legg, December 1, 1925, and assigned to the Westinghouse Electric & Manufacturing
65 Company.

A magnetic shutter 13 is positioned between the galvanometers 3 and the slit 11 adjacent to the slit. A cylindrical lens 14, the focal point of which is near the film surface, is mounted
70 opposite the slit and is supported by means of the shutter structure. The shutter comprises a magnet-coil casing which includes a plate 18 of magnetic material having a long narrow opening 19 punched therein and extending the length
75 of the slit 11. The top and bottom edges of the plate 18 are bent, as indicated at 18', to constitute the top and the bottom of the coil casing.

The coil casing is completed by rectangular magnetic strips 90 and non-magnetic strips 91.

When current is passed through the magnet
80 coil 57, the shutter vanes 92, which are of magnetic material, are actuated to the position shown in the drawings. The magnetic circuit may be traced, through the front face of plate 18, the upper edge 18', the upper strip 90, and the upper
85 vane 92 and back to the front face of plate 18. A shutter of the character disclosed herein is described and claimed in U. S. application, Serial No. 505,059, filed December 27, 1930, in the name of Clare Anderson and assigned to the Westing-
90 house Electric & Manufacturing Company.

The film is moved past the slit 11, at a suitable speed, by means of a motor 15, which is connected to the film holder 12 through a magnetic clutch
95 16 and a train of gears 17.

The electrical connections of the oscillograph are shown in Fig. 3 where the apparatus is shown connected to a transmission line 20, through a current transformer 21, for response to any in-
100 crease in line current above a certain value. When it is desired to have the apparatus respond to a disturbance on the line in the shortest possible time, the apparatus is connected to the switch 22 in the full-line position, as illustrated.
105 When so connected, the film-motor 23 is running continuously, its armature being connected across a six-volt source through conductor 24, switch 25, conductor 26 and switch 22. The motor field winding 27 is also connected across a six-volt
110

source of current through a conductor 28 and a field rheostat 29.

The oscillograph lamps 7 are connected in parallel and are continuously energized by being connected across the six-volt source through a conductor 53, a resistor 30 and the switch 31; the resistor 30 being of such value that the lamps 7 are energized for illumination below their normal brilliancy.

In one oscillograph embodying my invention, the two lamps 7 were four volt, two-ampere tungsten-filament lamps, and the resistor 30 had a value of 0.6 ohms. Connected across a six-volt source, and in series with the resistor 30, each lamp was supplied with a preheating current of 1.875 amperes.

Two quick-acting relays 32 and 33 are provided, one of which will close in response to a smaller current than the other. The winding of the relay 33 is shown connected to the transmission line 20. When a disturbance of predetermined magnitude occurs on the line, the armature of relay 33 will be pulled against the front contacts 34, 35 and 36, while the armature of relay 32 will remain against its back contacts 37 and 38.

If the winding of relay 32 is connected to the transmission line 20, the armature of that relay will be pulled against its front contact points 39, 40 and 41, while the armature of relay 33 will remain against its back contacts 42 and 43. When either quick-acting relay is closed, the effect on the oscillograph control circuit is the same.

The armature of relay 33 comprises a front contact-bridging member 44 and back contact-bridging member 45; these two members being electrically separated by a piece of insulating material 46. The armature of relay 32 likewise comprises a front bridging member 47 of conducting material and a back member 48 of conducting material electrically separated by an insulating member 49. The front members 44 and 47 are electrically connected by a conductor 50.

When either of the quick-acting relays, the relay 33, for example, is actuated by a line disturbance, a circuit is completed from the positive side of the six-volt supply, through the conductor 24, a conductor 51, the front armature member 47 of relay 32, the conductor 50, the front armature member 44 of relay 33, the front contact 36, a conductor 52, a conductor 53 and the lamps 7, to the negative terminal of the six-volt supply. The completion of this connection energizes the lamps 7 to full brilliancy in a much shorter time than would be possible if the lamps were not preheated.

At the same time, a connection is completed from the positive terminal of the six-volt supply, through the conductors 24 and 51, the front armature members 47 and 44, the front contact 35, the conductors 54 and 55, the magnetic-clutch winding 56 and the magnetic shutter winding 57, to the negative terminal of the six-volt supply. Thus, it will be seen that the apparatus immediately begins recording a line disturbance, since the oscillograph deflecting elements are permanently connected to the transmission line 20.

The instant that the quick-acting relay 33 closes, a circuit is also completed from the positive terminal of the six-volt supply, through the conductors 24 and 51 and the front armature members 47 and 44, the front contact 35, the conductors 54 and 55, the winding 58 of a slow-acting hold-in relay 59, and a resistor 60, to the negative terminal of the six-volt supply. The armature 61 of relay 59 does not pull up immediately, since

the relay winding 58 is shunted by a tungsten lamp 62 having a resistor 63 in series therewith. The time-delay of the relay 59 is controlled by adjusting the resistor 63.

As soon as the armature 61 is pulled up, a holding circuit is completed from the positive six-volt supply, through the conductor 64, the elements 65 and 66 of the push button switch 67, the conductor 68, the contact point 69, the armature 61, the contact point 70, the winding 58 and the resistor 60, to the negative side of the six-volt supply.

The closing of the holding relay 59 also connects the magnetic clutch winding 56 and the magnetic shutter winding 57 to the six-volt supply through conductors 64 and 68, the contact points 69 and 70 and the armature 61. The lamps 7 are likewise connected to the six-volt supply, the circuit being completed through the conductors 64 and 68, the contact points 69 and 71 and the armature 61. Therefore, so long as the holding relay 59 remains closed, the oscillograph will operate to record the line disturbance.

The circuit is so designed that the oscillograph will operate for a predetermined time after the termination of a line disturbance. It will be understood, from the foregoing description, that the hold-in relay 59 remains closed after the quick-acting relay 33 has opened. As soon as the relay 33 opens, a circuit is completed through a thermal relay 72, which may be traced from the positive side of the six-volt supply, through the conductor 64, the elements 65 and 66 of the push-button switch 67, the contact points 69 and 70 and armature 61, the conductor 55, the back contact points 42 and 43 and armature member 45, conductor 80, the back contacts 37 and 38 and armature member 48, conductor 73, the elements 74 and 75 of the push-button switch 67, a conductor 76, the thermal-relay 72 and resistor 77, to the negative side of the six-volt supply.

Therefore, as soon as the quick-acting relay 33 opens, the thermal-relay 72 begins to heat and after a predetermined time, the element 78 deflects to make contact with the contact point 79. The relay winding 58 is thereby short-circuited by a circuit which may be traced from the lower terminal of the winding 58, through the conductor 55, the back contact 43, the armature 45, the back contact 42, a conductor 80, the back contact 38, the armature 48, the back contact 37, the conductor 73, the elements 74 and 75 of the push-button switch 67, the conductor 76, the thermal-relay element 78 and the contact point 79, to the upper terminal of the winding 58. As soon as the winding 58 is short-circuited in this manner, the armature 61 drops and the apparatus stops recording.

If a slow response to the line disturbance is permissible, the switch 25 may be thrown to its dotted-line position so that the film-motor 23 will be connected to the current supply when a disturbance occurs. The switch 22 may be thrown to the dotted-line position to connect the motor 23 to the 12-volt supply for driving the film at a higher speed. The preheating switch 31 may be opened or not, as desired.

When the apparatus is set in this position, it responds to a line disturbance in the manner described above except that, when the relay 33 closes, a circuit is completed through the motor armature which may be traced from the positive side of the six-volt supply, through the conductors 24 and 51, the armature member 47, the conductor 50, the armature member 44, the front

80

85

90

95

100

105

110

115

120

125

130

135

140

145

150

contact point 34, a conductor 81, the switch 25, the armature of motor 23, a conductor 26 and switch 22, to the negative side of the supply. At the same time, a circuit is completed through the winding 82 of an auxiliary holding relay 83 which is provided solely for controlling the motor 23 when it is started in response to a line disturbance. It will be noted that the winding 82 is in parallel with winding 58 and resistor 60.

10 The closing of the relay 83 connects the armature of motor 23 to the positive side of the six-volt supply, through the switch 25, a conductor 84, contact point 85, armature 86, contact point 87 and the resistor 88, to the positive side of the supply. Because of this connection, as soon as the disturbance ends, and the quick-acting relay 33 opens, the armature of motor 23 is connected to the twelve-volt supply (which is employed for quick starting and a higher film speed) through the resistor 88 so that the motor 23 is slowed-down to conserve the supply of film.

When the thermal-relay 72 closes to open the main hold-in relay 59, the auxiliary hold-in relay 83 is also opened, since the two relays are connected to the positive side of the voltage supply through the same circuit.

I claim as my invention:

1. Oscillograph apparatus for recording a disturbance in an electrical system, said apparatus comprising a deflecting element having a mirror thereon, a photographic surface, means including an incandescent lamp for projecting a beam of light to said mirror and thence to said surface, a shutter positioned in the path of said beam of light, means for passing sufficient current through the filament of said lamp to keep it heated to a state below normal incandescence before the disturbance occurs, and means for opening said shutter and increasing the flow of current through said filament in response to the occurrence of the disturbance.

2. Electrical apparatus for recording a disturbance occurring in an electrical system, said apparatus comprising an incandescent lamp, a recording surface, means for deflecting a beam of light from said lamp against said surface in accordance with the characteristics of said disturbance, said lamp being connected to a source of current through a resistor, a shutter for preventing said beam of light from reaching said recording surface before the occurrence of said disturbance, and means for opening said shutter and short-circuiting said resistor in response to the occurrence of said disturbance.

3. Electrical apparatus for recording a disturbance occurring in an electrical system, said apparatus comprising a quick-acting relay connected to said system and adjusted to close in response to said disturbance, a source of light, a recording surface, means for deflecting a beam of light from said source against said surface in accordance with the characteristics of said disturbance, means for continuously supplying current to said source of light before the occurrence of said disturbance, a magnetic shutter for preventing light from said source from striking said recording surface before the occurrence of said disturbance, and means for increasing the supply of current to said source of light and for opening said magnetic shutter in response to the closing of said quick-acting relay.

4. Electrical apparatus for recording a disturbance

occurring in an electrical system, said apparatus comprising a quick-acting relay connected to said system and adjusted to close in response to said disturbance, a source of light, a recording surface, means for deflecting a beam of light from said source against said surface in accordance with the characteristics of said disturbance, means for continuously supplying current to said source of light through an impedance before the occurrence of said disturbance, a magnetic shutter for preventing light from said source from striking said recording surface before the occurrence of said disturbance, and means for connecting said shutter to a source of current through the contacts of said relay and for shunting said impedance through the contacts of said relay in response to the closing thereof.

5. Electrical apparatus comprising means for recording a disturbance occurring in an electrical system, means including a quick-acting relay for putting said recording means into active condition in response to said disturbance, means including a hold-in relay which closes in response to the closing of said quick-acting relay for holding said apparatus in active condition, a time-delay device for opening said hold-in relay, and means for connecting said device to a source of current in response to the opening of said quick-acting relay.

6. Electrical apparatus comprising means for recording a disturbance occurring in an electrical system, a quick-acting relay having front and back contacts, means for putting said recording means into active condition in response to the closing of said front contacts, means including a hold-in relay which closes in response to the closing of said front contacts for holding said apparatus in operative condition, and a time-delay device for opening said hold-in relay, said device being made active in response to the closing of said back contacts.

7. Electrical apparatus comprising means for recording a disturbance occurring in an electrical system, a quick-acting relay having front and back contacts, means for putting said recording means into active condition in response to the closing of said front contacts, means including a hold-in relay which closes in response to the closing of said front contacts for holding said apparatus in operative condition, and means including a thermal relay for opening said hold-in relay, said relay being connected to a source of current in response to the closing of said back contacts.

8. The combination with an oscillograph having a preheated lamp, of a deflecting system having a mirror thereon, a photographic surface, a shutter, and means for opening said shutter and increasing the brilliancy of said lamp in response to a disturbance.

9. An oscillographic recorder comprising a lamp, means for preheating said lamp, a motor, means for continuously energizing said motor, a photographic recording surface driven by said motor, a clutch between said motor and said recording surface, a shutter, and means responsive to a disturbance for energizing the lamp to full brilliancy and simultaneously actuating the clutch and the shutter.

SIMEON C. LEYLAND.