Dec. 27, 1938. C. G. SUITS 2,141,942

PHOTOELECTRIC RELAY

Filed Nov. 20, 1935

Fig. 1.

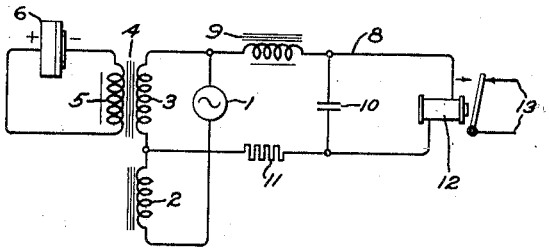


Fig. 2.

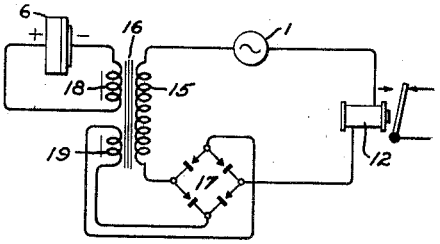
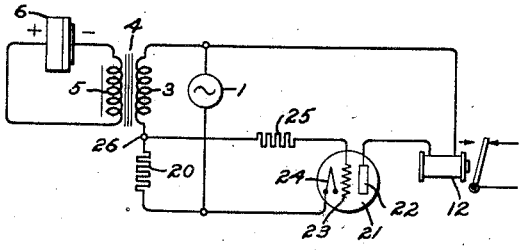


Fig. 3.



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UNITED STATES PATENT OFFICE

2,141,942

PHOTOELECTRIC RELAY

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2 Claims. (Cl. 250—41.5)

My invention relates to photoelectric relays and particularly to such relays in which the photoelectric devices employed are characterized by high current and low impedance. Where the relay employs the usual vacuum tube or gaseous vapor discharge amplifying means difficulty has been experienced in the past in matching such an output circuit with the low impedance photoelectric device.

One object of my invention therefore is to provide an improved photoelectric relay employing a low impedance photoelectric device whereby this difficulty is overcome. Another object is to provide an improved relay of this character which is simple in construction, reliable in operation and inexpensive to manufacture. In accordance with my invention I connect the low impedance photoelectric device employed therein with the high impedance output circuit of the relay by means of a saturable core reactor having a saturating winding which is energized by said photoelectric device and whose impedance is matched with that of said device.

My invention will be better understood from the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

Referring to the drawing, Figs. 1, 2 and 3 are circuit diagrams illustrating some of the various forms which my invention may take.

In Fig. 1 source 1 of alternating current supply such for example as a 110 volt, 60 cycle house lighting circuit, is connected in series with the linear reactor 2 and the main winding 3 of the saturable core reactor 4. The latter reactor is provided with the saturating winding 5 and in circuit with this winding to be controlled thereby is the low impedance photoelectric device 6. Since this device has a low impedance the winding 5 also has a low impedance and is matched therewith. Device 6 is represented as a photoelectric cell which being a voltage generator does not require a separate source of voltage in circuit therewith and which is characterized by low impedance and high current. For convenience in the description to follow and in the claims I shall employ the term photoelectric cell to this device, it being understood that this term is intended to cover any photoelectric device which is voltage generating when exposed to light, although it may produce only a few millivolts, and is characterized by low impedance and high current.

Connected to be energized by the voltage across the winding 3 is the non-linear resonant circuit 8 which is represented as comprising the self-saturating reactor 9, the capacitor 10 and the resistor 11 connected in series. The constants of this circuit are such that when the light falling upon the cell 6 is below a predetermined amount so that the reactor 4 is not saturated and the impedance of its winding 3 accordingly is high the circuit 8 is resonant. However, when the light reaching the cell 6 increases to a higher predetermined value the core of reactor 4 becomes saturated and the resulting decrease in the impedance offered by the winding 3 is such that circuit 8 becomes non-resonant. Various means may be employed for giving an indication or signal responsive to a condition of resonance or non-resonance of the circuit 8. The means for which I have illustrated for giving such a signal is the relay 12 whose winding connects across the capacitor 10 whereby when the circuit 8 is resonant the voltage across the capacitor 10 will cause the energization of the relay, thereby opening the circuit 13 controlled thereby. Conversely circuit 13 will again be closed when circuit 8 becomes non-resonant due to an increase in light affecting the cell 6.

If desired, the non-linear resonant circuit 8 may be connected across the reactor 2 instead of as shown in Fig. 1, in which case the reverse operation will be obtained; that is, the circuit 8 will become non-resonant with a decrease in the light affecting the cell 6 and become resonant with an increase in the light.

In the modified form shown in Fig. 2 the source 1, the winding 15 of the saturable core reactor 16, the full wave rectifier 17 and a winding of relay 12 are connected in a series circuit. The reactor 16 in this case is provided with two separate saturating windings 18 and 19. The winding 18 like the winding 5 of Fig. 1 has a low impedance to match the low impedance of the cell 6. The winding 19 is connected to be supplied by the full wave rectifier 17, the direction of the winding being such that when the core of reactor 16 begins to become saturated by the winding 18, the current in winding 19 increases the degree of saturation. The impedance of winding 19 matches the internal impedance of the rectifier. In this form of my invention as long as the light affecting the cell 6 is below a predetermined amount, reactor 16 is non-saturated and current flowing in the relay circuit is insufficient to operate the relay. When, however, the light reaching the cell 6 increases to a higher predetermined value the resulting decrease in the impedance of winding 15 due to a partial saturation of its core by the winding 18

applied to the winding 19 further raises the degree of saturation until the current in the relay circuit increases to such a value that the relay 12 is operated. A feed-back arrangement of the form shown in this figure is disclosed in my Patent No. 1,940,335, December 19, 1933.

In the modified form illustrated by Fig. 3 the source 1 is connected across the resistor 20 in series with the winding 3 of the saturable core reactor 4. This reactor is provided with a saturating winding 5 which is connected to be energized by the cell 6. The reactor and cell arrangement in this figure is similar to that shown and described in connection with Fig. 1. Connected to be supplied also by the source 1 is the winding of relay 12 controlled by the electron discharge device 21 having the anode 22, the control grid 23, and the cathode 24. The control grid 23 connects through the limiting resistor 25 with the point 26 which is intermediate the winding 3 and resistor 20 whereby the voltage drop across the resistor 20 is applied to the grid of device 21. In this form of my invention as long as the light affecting the cell 6 is below a predetermined value and the reactor 4 accordingly is non-saturated, the voltage across the resistor 20 is insufficient to cause the device 21 to pass enough current to operate the relay 12. When, however, the light affecting the cell increases to a higher predetermined amount, the reactor 4 in becoming saturated passes sufficient current through the rectifier device 21 to become conducting to such an extent that the relay 12 is operated.

I have chosen the particular embodiments described above as illustrative of my invention and it will be apparent that various other modifications may be made without departing from the spirit and scope of my invention which modifications I aim to cover by the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In combination, a photoelectric cell of the voltage generating, low impedance and high current type, a source of alternating current supply, a grid controlled electron discharge device energized thereby and means for coupling said cell with said device comprising a saturable core reactor having a main winding connected with the grid circuit of said device and a low impedance saturating winding in circuit with said cell.

2. In combination, a photoelectric cell of the voltage generating, low impedance and high current type, a source of alternating current supply, a grid controlled electron discharge device energized thereby and means for coupling said cell with said device comprising a saturable core reactor having a main winding connected with and having an impedance of the order of that of the grid circuit of said device and a saturating winding connected with and having an impedance of the order of that of said cell.

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