

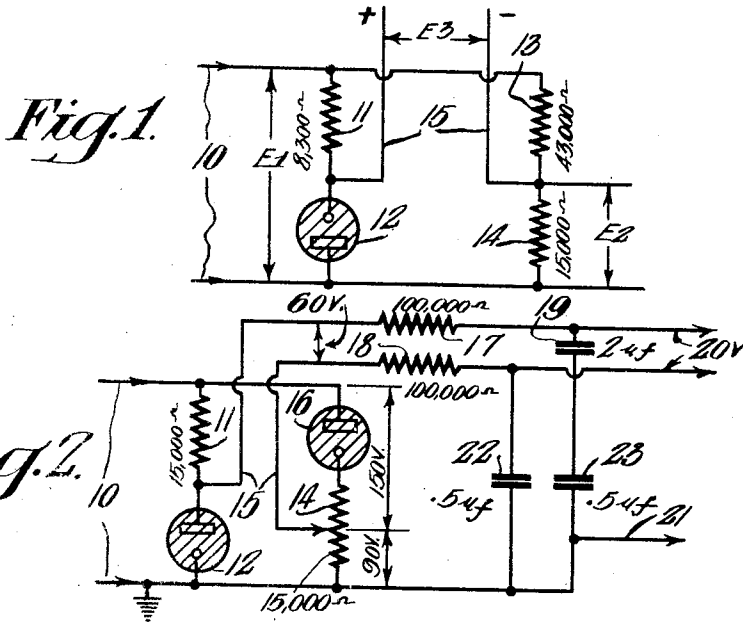
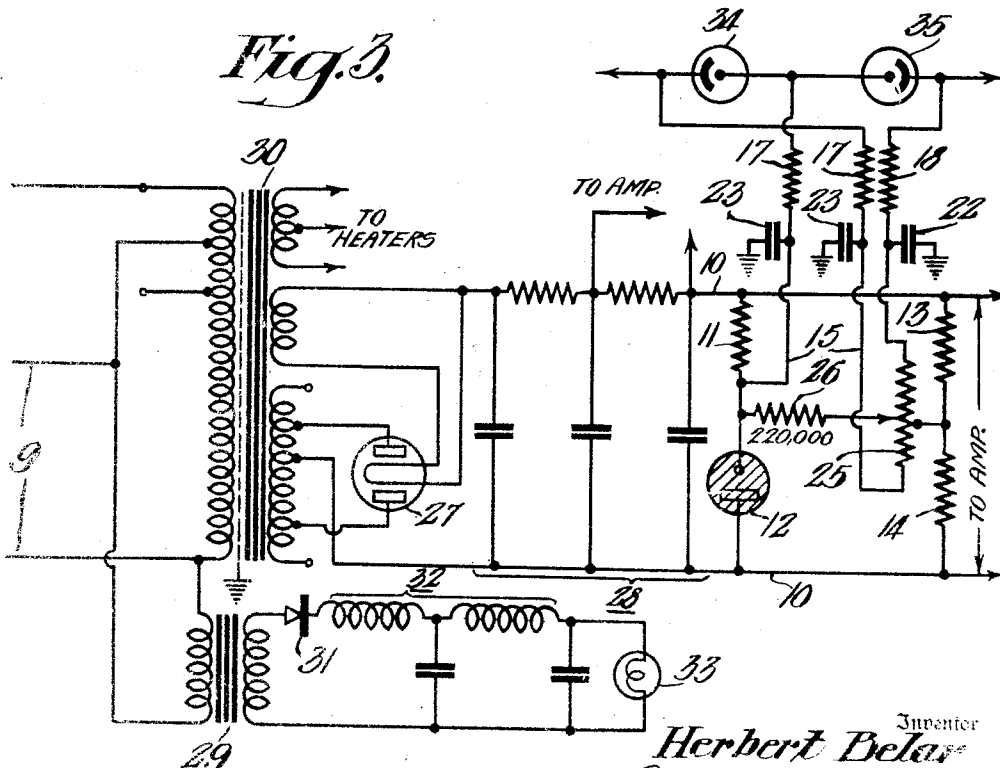
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PHOTOCELL CIRCUIT

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PHOTOCELL CIRCUIT

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This invention relates to an improved circuit for photocells and particularly to a circuit which will compensate for fluctuations in line voltage affecting both the photocell and the exciter lamp therefor. The invention is particularly useful in sound picture equipment or in similar places where it is necessary to maintain a uniform change in photocell output for a given amount of obstruction of the light beam independent of variations in the supply voltage. In a photocell and exciter lamp circuit as ordinarily constructed a change in line voltage causes a corresponding change in photocell sensitivity and at the same time causes a change in the same direction in exciter lamp brightness which varies as the square of the voltage change. These two effects are cumulative and affect the output of the apparatus correspondingly.

In my improved circuit an appropriate network of resistors and one or more voltage regulating tubes is so connected to the photocell circuit that the voltage applied to the photocell varies inversely as the change in line voltage and by a sufficiently greater percentage to effectively compensate for the variations in exciter lamp brightness so that the resulting photocell output is maintained substantially uniform over a considerable range of line voltage variation.

One object of the invention is to provide an improved photocell circuit.

Another object of the invention is to provide a photocell circuit which will compensate for supply line voltages.

Another object of the invention is to provide a circuit for operating a photocell and its exciter lamp from the same supply line which will compensate for variations in exciter lamp brightness.

Another object of the invention is to provide a circuit for operating a photocell and its exciter lamp from the same supply line which will maintain a substantially constant output independent of supply line variations.

Other and incidental objects of the invention will be apparent to those skilled in the art from a reading of the following specification and an inspection of the accompanying drawing, in which:

Figure 1 is a simplified schematic diagram of one form of the invention,

Figure 2 shows a second form of the invention which can exercise a greater degree of control than the form shown in Fig. 1, and

Figure 3 shows a modification of the form of the invention shown in Fig. 1 and the manner

in which it would be applied to a commercial type of photocell supply circuit.

Referring first to Fig. 1, direct current is supplied to the leads 10. This current is preferably supplied at a potential E_1 of approximately 240 volts. A voltage divider is provided consisting of the resistor 11 and the gas tube 12 which is preferably of the type known commercially as the VR150 and which provides a constant voltage drop of 150 volts. This arrangement leaves the balance of the supply voltage across the resistor 11, this voltage at the normal supply voltage of 240 volts being, of course, 90 volts. A second voltage divider is provided consisting of the resistors 13 and 14 which may have the values of 43,000 ohms and 15,000 ohms as indicated. The use of these high values for the resistors is permissible due to the extremely small current drawn by the photocell. It will be apparent that when the supply voltage E_1 is 240 volts the voltage drop across the resistor 13 will be 178 volts and the drop across the resistor 14 will be 62 volts. If the photocell potential is taken off across the leads 15 then the voltage supplied to the photocell will, under these circumstances, be 88 volts. If, now, the supply voltage were to rise, for example, to 250 volts, an increase of approximately four percent, the voltage drop across the resistor 11 would increase by the entire amount of the supply line increase to 100 volts, while the voltage drop across the resistor 13 would increase to 185½ volts. The voltage across the leads 15 therefore drops from 88 volts to 85½ volts or a decrease of over three percent.

In the form of the invention shown in Fig. 2, a second voltage regulator tube 16 is substituted for the resistor 13. In this arrangement any variation in line voltage across the leads 10 appears in its full value across each of the resistors 11 and 14 since the voltage drop across the tubes 12 and 16 remains constant. The resistor 14 in this instance is provided with a movable tap by which the output voltage may be adjusted. The output leads are also provided with a filter arrangement consisting of the resistors 17 and 18 and the two-microfarad condenser 19 in addition to the condensers 22 and 23. In this arrangement, the supply voltage may be assumed to be the same as before, i. e. 240 volts, which will give a drop of 150 volts across each of the tubes 12 and 16 and a drop of 90 volts across each of the resistors 11 and 14. In this case if the supply voltage varies as, for example, by an increase of 10 volts, the voltage drop across the resistors 11

and 14 will increase by the full amount of increase in line voltage, each of these becoming 100 volts, and the voltage across the leads 15 will decrease to the difference between the drop across the tube 16 and that across the resistor 11 (if the contact on the resistor 14 is adjacent the tube 16) and the voltage across the leads 15 will drop from 60 volts to 50 volts, a decrease of over sixteen percent on a line voltage change of about four percent which is sufficient to completely compensate for the variation in brightness of the exciter lamp.

In the form of the invention shown in Fig. 3, a conventional amplifier power supply is indicated, including the full wave rectifier 27 and the filter network 28. The arrangement of the tube 12 and the resistors 11, 13 and 14 is the same as in Fig. 1 while the output leads are provided with the filter resistors 17 and 18 and capacitors 22 and 23 as in Fig. 2. This circuit differs, however, in that the supply voltage is shown as applied to two photocells 34 and 35 which may have their outputs connected in push pull relation. The output of the two photocells is balanced by means of the potentiometer 25 connected to the connection between the resistors 13 and 14 and also connected by the resistor 26 which may have a value of 220,000 ohms to the connection between the regulating tube 12 and the resistor 11. In this arrangement alternating current from the supply line 9 is fed to the rectifier 27 through the transformer 30 and current from the same supply line is fed through the transformer 29 to the exciter lamp 33. The exciter lamp supply current may be rectified by the rectifier 31 and filtered by an appropriate filter network 32. It will be apparent that in this arrangement the effective variation in voltage in the supply line 9 will affect the exciter lamp 33 and the photocells 34-35 simultaneously and oppositely thereby maintaining the sensitivity of the apparatus substantially constant.

One characteristic of this circuit which must be corrected for is that, when the power in the main power supply is turned off, there is not an immediate cessation of the current supplied to the leads 10. The voltage and current supplied to these leads drops off gradually due to the immediately preceding filter. As a consequence of this, the voltage across the regulating tubes 12 and 16 falls to the point where these tubes extinguish and cease passing current, and the entire potential across the leads 10 is then applied across the leads 15, as the value of the resistors is negligible compared to the photocell resistance. If the voltage produced across the leads 15 when the tubes 12 or 16 extinguish is higher than that which can be safely applied to the photocell, it is necessary to either provide a switch in the leads 10 immediately preceding the voltage regulator, this switch being actuated simultaneously with the switch in the main power line, or to provide a filter in the leads 15. The filter in the leads 15 is preferable for a number of reasons, one of them being that any accidental surges in the power line will not be impressed on the photocell, and another being the difficulty in securing exact synchronization between two independent switching contacts. The filter circuit shown in Figures 2 and 3, and consisting of the resistors 17 and 18 and the capacitors 19, 22 and 23, prevents any tendency for this sudden surge of voltage to reach the photocell with sufficient intensity to do any damage. The timing of this filter circuit is dependent on the timing of the

main filter circuit 28 (Figure 3) and it should be sufficiently slow to take care of any voltage surge from the filter circuit 28 in the manner described above.

It will be noted that the characteristic feature of this voltage regulator is that the voltage drop across the gas tube is greater than the voltage drop in the resistor which constitutes what might be considered the adjacent arm of a bridge circuit.

I claim as my invention:

1. Photoelectric apparatus including an electrical power supply, an exciter lamp and a photocell both fed from said power supply, and a voltage regulating circuit connected between said power supply and said photocell and varying the voltage applied to said photocell inversely as and in greater ratio than any variations in voltage of said power supply for compensating for variations in the brightness of the exciter lamp, said voltage regulating circuit being a bridge circuit having adjacent arms consisting of a resistor and a constant voltage device, the voltage drop across said resistor being less than that across said device.

2. Photoelectric apparatus including an electrical power supply, an exciter lamp and a photocell both fed from said power supply, and a voltage regulating circuit connected between said power supply and said photocell and varying the voltage applied to said photocell inversely as and in greater ratio than any variations in voltage of said power supply for compensating for variations in the brightness of the exciter lamp, said voltage regulating circuit being a bridge circuit having adjacent arms consisting of a resistor and a voltage regulator tube, the voltage drop across said resistor being less than that across said tube.

3. Photoelectric apparatus including an electrical power supply, an exciter lamp and a photocell both fed from said power supply, a voltage regulating circuit connected between said power supply and said photocell and varying the voltage applied to said photocell inversely as and in greater ratio than any variations in voltage of said power supply for compensating for variations in the brightness of the exciter lamp, said voltage regulating circuit being a bridge circuit having adjacent arms consisting of a resistor and a voltage regulator tube, the voltage drop across said resistor being less than that across said tube, and a filter circuit between said voltage regulating circuit and said photocell for preventing voltage surges in excess of the safe operating voltage of the photocell from reaching said photocell.

4. Photoelectric apparatus including an electrical power supply, an exciter lamp and a photocell both fed from said power supply, a voltage regulating circuit connected between said power supply and said photocell and varying the voltage applied to said photocell inversely as and in greater ratio than any variations in voltage of said power supply for compensating for variations in the brightness of the exciter lamp, said voltage regulating circuit being a bridge circuit having adjacent arms consisting of a resistor and a voltage regulator tube, the voltage drop across said resistor being less than that across said tube, and a filter circuit between said voltage regulating circuit and said photocell for preventing voltage surges from said regulating circuit from reaching said photocell.

5. Photoelectric apparatus including an electrical power supply, an exciter lamp and a photo-

cell both fed from said power supply, a voltage regulating circuit connected between said power supply and said photocell and varying the voltage applied to said photocell inversely as and in greater ratio than any variations in voltage of said power supply for compensating for variations in the brightness of the exciter lamp, said voltage regulating circuit being a bridge circuit having adjacent arms consisting of a resistor and a voltage regulator tube, the voltage drop across said resistor being less than that across said tube, and a filter circuit between said voltage regulating circuit and said photocell for preventing voltage surges originating in said regulating circuit from reaching said photocell.

6. Photoelectric apparatus including an electrical power supply, an exciter lamp and a photo-

cell both fed from said power supply, a voltage regulating circuit connected between said power supply and said photocell and varying the voltage applied to said photocell inversely as and in greater ratio than any variations in voltage of said power supply for compensating for variations in the brightness of the exciter lamp, said voltage regulating circuit being a bridge circuit having adjacent arms consisting of a resistor and a voltage regulator tube, the voltage drop across said resistor being less than that across said tube, and a filter circuit between said voltage regulating circuit and said photocell for preventing voltage surges originating in the regulating circuit in excess of the safe operating voltage of the photocell from reaching the photocell.

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