

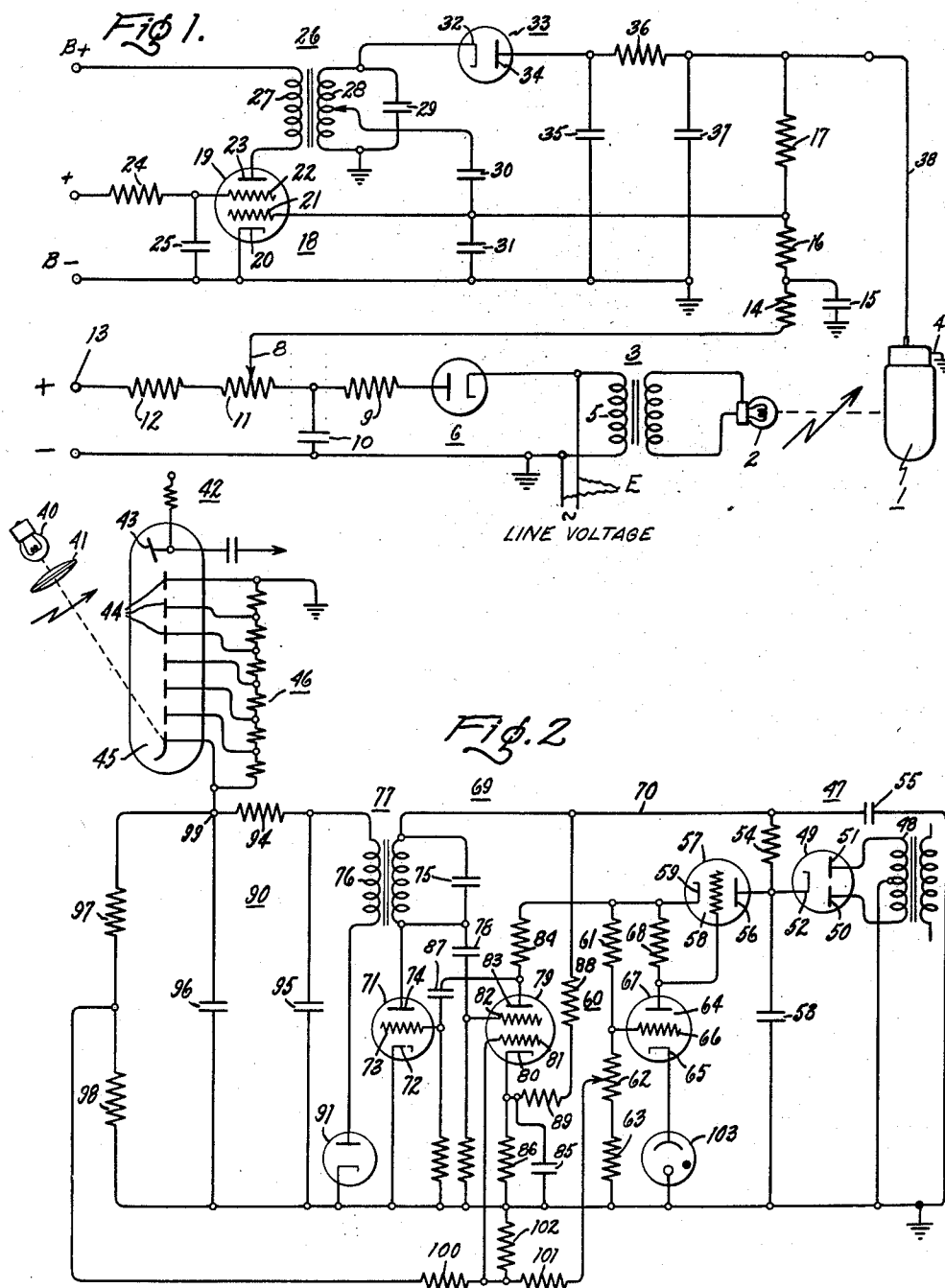
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COMPENSATED LIGHT METER POWER SUPPLY

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COMPENSATED LIGHT METER POWER SUPPLY

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This invention relates to an apparatus for controlling the voltage supply for a photoelectric device. More specifically, this invention relates to a system for varying the voltage supply for a photoelectric device to compensate for variations in the operating voltage supplied to the light source.

Light metering or light transmission testing systems are constantly plagued with inaccuracies brought about by sensitivity fluctuations of the photoelectric device. These sensitivity fluctuations may be caused by conditions inherent in the photoelectric device, or they may be caused by conditions external thereto. The most common of the external conditions are fluctuations in the light source output due to variations in the operating voltage supplied thereto. In the past, attempts to solve this problem have generally been directed toward regulating the voltage supply both for the light source and for the photoelectric device, thus maintaining the output independent of operating voltage fluctuations.

Another approach to this problem is possible which contemplates regulating for a constant output of the photoelectric device rather than trying to hold all of the voltages constant. It is to be understood, of course, that the variable being measured will change the light output received by the photoelectric device; however, it is desired to compensate for the effects of operating voltage variations in the light output received by the photoelectric device. Consequently, the voltage supply to the photoelectric device is varied so that as the light output changes with its operating voltage fluctuations, the sensitivity of the photoelectric device is adjusted to compensate therefor. That is, as the light output goes up due to an applied operating voltage increase, the voltage supply to the phototube will be decreased by a proper amount to decrease the sensitivity. Similarly, if the operating voltage decreases, and the light output decreases, the voltage supply to the photoelectric device is increased to increase its sensitivity. In this fashion, a constant output may be maintained in spite of applied voltage variations. Furthermore, in this approach, only one regulator is needed for the photoelectric device itself, and the power for the light source is taken directly from a power line without regulation. In addition, once compensation is achieved for voltage fluctuations at one value of transmitted light, the compensation is effective at other values of transmitted light.

It is an object of this invention, therefore, to provide a compensated supply circuit which provides a steady output from a photoelectric device in spite of variations in the light source supply voltage.

Another object of this invention is to provide a supply circuit which increases and decreases the sensitivity of a photoelectric device to compensate for variations of light output due to light source supply voltage fluctuations.

Still another object of this invention is to provide a circuit for supplying operating voltage for an illuminated

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photoelectric device, the magnitude of which varies as an inverse function of the illumination source supply voltage fluctuations.

Yet another object of this invention is to provide a supply circuit for a photoelectric device which compensates for variations in the light output and which also regulates the compensated supply voltage.

A further object of this invention is to provide a compensated supply circuit for a photoelectric device in which a variable amplitude oscillator is utilized.

Briefly speaking, this invention contemplates a supply circuit for an illuminated photoelectric device which compensates for any variations in light due to changes in operating voltage for the light source. The rectified output of a variable amplitude oscillator is used to provide operating voltage for the photoelectric device. The amplitude of oscillations is determined in response to a control voltage which varies as a function of the unregulated voltage that supplies the operating voltage for the light source. In this manner, any change in the unregulated voltage produces an accompanying change in the magnitude of the oscillations and thus adjusts the sensitivity of the photoelectric device. In addition, the control voltage representing the fluctuating unregulated voltage is also compared to the rectified oscillator output, and the system is self-regulating as against variations due to changes in the oscillator circuit parameters.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing, in which

Fig. 1 represents one embodiment of my invention; and

Fig. 2 represents another embodiment of the invention.

Referring now to Fig. 1, there is shown a photoelectric device 1 which may be either a phototube or a photomultiplier tube. A lamp 2 or any other source of light is positioned adjacent to the photoelectric device 1 so that its light output illuminates the photoelectric device 1. The lamp is supplied with operating voltage E from a source of unregulated operating voltage designated by the legend Line Voltage through a transformer 3. Of course, the source of operating voltage may comprise a power distribution system or any other convenient source of alternating voltage.

A controllable variable amplitude voltage source is utilized to provide an adjustable operating voltage for the photoelectric device. This source comprises a variable amplitude oscillator 18. This oscillator comprises an electron discharge device 19 having a cathode 20, a control electrode 21, a screen grid 22, and an anode 23. The anode 23 is connected through the primary 27 of a transformer 26 to the positive terminal B+ of a source of unregulated direct current voltage, the negative terminal -B of which may be grounded as indicated. The secondary 28 of the transformer 26 is connected in parallel with a capacitance 29 to provide a tuned resonant circuit which is the frequency determining element of the oscillator 18. A capacitance voltage divider, comprising two series connected capacitances 30 and 31, is connected between an intermediate point on the secondary 28 and ground. The control electrode 21 is connected to the junction of the capacitances to provide a feedback voltage to control electrode 21 between the output and the input of the oscillator which has the necessary 180° phase reversal to sustain oscillations by virtue of transformer 26. A source of positive screen grid voltage is provided through the resistance 24, while

a by-pass capacitor 25 is connected between the screen grid and ground.

A rectifying means is provided for the output of the oscillator to produce an adjustable negative unidirectional voltage supply which is utilized to control the photoelectric device. The tuned circuit of the oscillator 18 is connected to the cathode 32 of a rectifier 33 which may be a diode. The anode 34 of the rectifier is connected through a resistance-capacitance filter comprising a resistance 36 and two filter capacitances 35 and 37 and conductor 38 to the photoelectric device 1. The two filter capacitances 35 and 37 are connected between ground and opposite terminals of the resistance 36 respectively to provide filtering and smoothing as well as storing action. An opposite terminal of the photoelectric device is connected to ground as indicated at 4.

In order to adjust the magnitude of the voltage supplied to the photoelectric device to compensate for variations in light output due to unregulated voltage source variations, there is provided a circuit means for producing an oscillator control voltage which causes the oscillation amplitude to vary as an inverse function of the direction of unregulated voltage fluctuation at the primary 5 of transformer 3. To this end, a rectifier 6 is connected across the source of operating voltage E through resistances 9, 11, and 12, and a source of positive constant unidirectional potential which is connected between the terminal 13 and ground. The rectifier 6 and the source of unidirectional potential are so poled that current flows through the resistances 9, 11, and 12 in a direction to produce a voltage drop which is negative with respect to the positive terminal 13 of the source and normally of lesser magnitude.

A capacitance 10 is connected between ground and the junction of resistances 9 and 11 so that the voltage of the frequency of the operating alternating current voltage does not appear on resistances 11 and 12. Resistance 11 is a potentiometer having a variable contact 8 which is connected through resistances 14, 16, and 17 to conductor 38 leading to the photoelectric device. The point between resistances 16 and 17 is connected to the control electrode 21 of the oscillator 19 and, of course, the potential at this point controls the amplitude of the oscillations generated by the oscillator.

In operation, increases in the voltage E tend to increase the current in resistances 9, 11, and 12 and to make the potentiometer 11 more negative with respect to the fixed voltage terminal 13, thereby reducing the potential on the grid 21 of oscillator 18 with respect to the cathode and reducing the intensity of oscillations produced and hence reducing the voltage applied to the photoelectric device. Similarly, decreases of the voltage E tend to increase the amplitude of the oscillations produced and, consequently, the voltage applied to the photoelectric device. The extent of this control of the intensity of oscillations produced may be varied by varying the contact 8 along potentiometer 11. Thus, greater relative compensation for unregulated voltage variation is effected with contact 8 nearer the right end of potentiometer 11 than nearer the left end.

Since the light source 2 is indicated as of the incandescent type, the voltage variations may change more rapidly than changes in the intensity of the light produced by the light source. For this reason, capacitance 15 is connected between ground and the junction of resistors 14 and 16 and operates with resistor 14 as a delay circuit to delay the application of the voltage change to the grid of the oscillator by an amount equal to the delay in the incandescent light source. The amount of the delay may be varied by adjusting the relative values of either resistance 14 or capacitance 15.

In this way, increases in unregulated voltage E tending to produce increases in light reduce the intensity of oscillations produced by the oscillator, and hence the voltage applied to the photoelectric device. Similarly,

a reduction in the unregulated voltage increases the sensitivity of the photoelectric device.

The connection of the control electrode 21 of the oscillator to the junctions between resistors 16 and 17 has a further effect of tending to maintain the voltage supplied to the photoelectric tube constant irrespective of the variations in the oscillator parameters such as in the operating voltage supplied to the oscillator and irrespective of changes within the tube, such as deterioration, and so forth. For example, if the operating voltage supplied to the oscillator reduces, thereby tending to cause the oscillations produced to reduce in intensity, the voltage between control grid 21 and cathode 20 becomes less negative, thereby tending to increase the oscillations produced and to maintain the voltage supplied to the photoelectric tube constant. Similarly, if the intensity of oscillations produced increases with increases in operating voltage applied to the oscillator, the voltage between the control grid and cathode becomes more negative, thereby decreasing the intensity of the oscillations produced.

It can be seen that the feedback circuit from the conductor 38 to the control electrode 21 has a tendency to oppose any variations in oscillation intensity caused by changes in unregulated voltage E. However, the relative values of the circuit components are so adjusted that the effect of changes in the voltage E overrides the tendency of the feedback to oppose any changes in intensity of oscillation.

In this way, the single connection from potentiometer 11 through resistances 14, 16, and 17 to conductor 38 and the connection of the control grid 21 to the junctions of the resistances 16 and 17 effects the desired inverse compensation for variations in operating voltage supplied to the light source in addition to controlling for variations due to changes in the oscillator parameters such as the operating voltage supplied to the oscillator. Furthermore, this connection provides control of oscillation intensity in spite of extraneous effects within or upon the tube 19, such as deteriorations, temperature, and so forth.

Another embodiment of the invention is shown in Fig. 2 in which a compensated power supply for a photomultiplier tube is disclosed. Fig. 2 shows a lamp 40 energized from a source of unregulated voltage which for the sake of clarity is not illustrated, the light output of which is focused by means of lens 41 on a photomultiplier tube. The photomultiplier tube 42 comprises an anode member 43 connected to a source of positive voltage through a resistor and a photoelectric cathode 45 upon which the light from the lamp 40 is focused. A number of secondarily emissive electrodes 44 are positioned between the cathode and the anode to provide electron multiplication. A voltage divider 46, one end of which is grounded and the other end of which is connected to a source of negative voltage, provides voltage for the photoelectric cathode 45, as well as the secondarily emissive electrodes 44. The voltage provided by the divider 46 impresses an electric field on the electrodes that tends to accelerate electrons from the cathode 45 to the anode 43 through the electrodes 44. An electron emitted by the action of light on the photoelectric cathode 45 is drawn toward the first of the electrodes 44. The electrode 44 adjacent the cathode 45 emits secondary electrons when struck by the cathode electron. The secondary electrons emitted from the first secondarily emissive electrode 44 strike the next adjacent electrode 44 liberating further secondary electrons. This process continues until a stream of secondary electrons strikes the anode 43 to produce an output signal which is led to an external indicating or control circuit by means of a coupling capacitor. The negative voltage supplied to the lower end of the voltage divider 46 is provided by a compensated power supply system which varies the magnitude of this

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negative voltage with variations of line voltage to compensate for variations of light output of the lamp 40.

The system of Fig. 2 for supplying operating voltage to the photoelectric device is similar to that of Fig. 1 in that it employs an oscillator 69 comprising electron discharge devices 71 and 79 to generate oscillations in a parallel resonant circuit 75, which oscillations are supplied to a rectifier and filter circuit comprising diode 91 and filters 94, 95, 96 to produce a unidirectional voltage for the cathode 45 of the photoelectric device.

The tuned circuit 75 comprises the frequency determining circuit of the oscillator, its lower terminal being connected directly to the anode 74 of electron discharge device 71 and through capacitance 78 to a control grid 82 of the tube 79. The anode of the tube 79 is connected through a coupling capacitor 87 to the control grid 73 of tube 71. Thus, any oscillations generated in the tuned circuit 75 are supplied through tube 79 to the control grid of tube 71 to support oscillations, the tube 79 serving to provide the 180° phase displacement required to support oscillations by tube 71.

The output of the oscillator 69 is coupled to a rectifying and filtering circuit to provide the unidirectional operating voltage for the photoelectric device. The oscillations generated in resonant circuit 75 are coupled by means of transformer 77 to a secondary winding 76, one end of which is connected through rectifier 91 to ground and the other end of which is connected to the photomultiplier 42 by a resistance-capacitance filter 90 and terminal lead 99. The rectifier 91 is so poled that current flows through the filter resistance 94 in a direction to produce a voltage drop at the terminal lead 99 which is negative with respect to ground. Filter capacitances 95 and 96 are connected between opposite terminals of the filter resistance 94 and ground to provide filtering, as well as storing action for the rectified oscillations. Two series connected resistances 97, 98 are connected between terminal lead 99 and ground and mirror the negative unidirectional operating voltage applied to the photomultiplier tube 42 in order to provide a feedback voltage to the oscillator for a purpose to be described in greater detail later.

The intensity of the oscillations produced are dependent upon the transconductance of the tube 79 which is controlled as a function of variations in operating voltages applied to the light source. The compensation means presently to be described operates to maintain the voltage of the cathode of the photoelectric device at a correct value irrespective of variations in light output.

Operating voltage for the anode of discharge device 71 is supplied directly from a power rectifier 49 through a filter resistance 54, a lead 70, and the tuned circuit 75. The resistance 54 has its opposite terminals connected to ground through filter capacitances 53 and 55 which cooperate therewith to smooth out the voltage supplied to the anode of tube 71.

Operating voltage for the anode of discharge device 79 is supplied thereto through a plate resistance 84 and the cathode-anode space of voltage regulator tube 57 which is connected between the anode of tube 79 and the cathode of rectifier 49. The rectifier 49 is of the full wave type having its two anodes 50 and 51 connected to opposite terminals of a secondary winding of power supply transformer 48, the mid-terminal of which is connected to ground and to the cathode 72 of the tube 71. The primary winding of power transformer 48 is connected to the same source of unregulated alternating voltage which energizes the light source 40.

The discharge device 57 operates as an ordinary series-connected voltage regulator tube to control the voltage both across an output voltage divider 60 comprising the resistances 61, 62, and 63 and on the anode 83 of the discharge device 79. The cathode of the tube 57 is connected to ground through resistances 61, 62, and 63 of the output voltage divider 60. The junction between re-

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sistances 61 and 62 is connected to a grid 66 of the amplifier tube 67. The cathode 65 of this latter tube is connected through a voltage regulator tube 103 to ground and its anode 64 is connected through a resistance 68 to cathode 59 of the voltage regulator tube and directly to the grid 58 of the voltage regulator tube. So connected, this circuit operates in the usual way to maintain constant the voltage on the anode of tube 79 and across the output divider 60. That is, should this voltage increase, the voltage between the grid and cathode of tube 67 increases, thereby increasing current through resistance 68 tending to make the control grid 58 of tube 57 more negative with respect to the cathode 59 and thereby reducing anode current flowing through this tube and hence the voltage across 61, 62, and 63.

As has been pointed out previously, the intensity of oscillations produced by the oscillator 69 may be controlled by varying the amount of feedback between the anode and the control grid of tube 71 through control of the transconductance of tube 79. The control of tube 79 is effected in response to variations both of the unregulated voltage and the unidirectional voltage supplied to the photoelectric device. Control in response to line voltage variations is effected by a resistance 86 connected between cathode 80 of the tube 79 and ground and two series resistances 88 and 89 connected between the cathode of tube 79 and the output of the rectifier. Since the rectifier 49, as has been pointed out previously, is connected to the power transformer 48 which is supplied from the same source of unregulated voltage that energizes the light source, the output of the rectifier will reflect any variations in the unregulated voltage. In this manner, as the unregulated voltage varies, the voltage of the cathode of tube 79 mirrors these variations and controls the tube transconductance. Thus, as the unregulated voltage becomes more positive tending to make the control grid more negative relative to the cathode, the transconductance of this tube is reduced, hence reducing the intensity of the oscillations produced. Similarly, as the unregulated voltage decreases, the transconductance of the tube is increased and the intensity of oscillations is increased.

The light source 40 being of the incandescent type, variations of the unregulated voltage will not cause instantaneous changes of light output. As a result, it is necessary to delay the control of the transconductance of tube 79, and the attendant change in intensity of oscillations for a period of time equal to the delay in the light source. For this purpose, capacitance 85 is connected between ground and the junction of resistance 89 and the cathode of tube 79 and operates in conjunction with resistance 89 as a delay circuit to delay application of the voltage change at the rectifier output.

Additionally, the transconductance of tube 79 is further controlled in order to maintain the unidirectional voltage for the photoelectric device independent of changes in tube parameters such as operating voltages as well as changes within the tube itself, such as deterioration, and so forth. This is achieved by feeding back a portion of the unidirectional output voltage, comparing it to a constant positive reference voltage, and applying the resultant to the control electrode 81 of the tube 79. To this end, a resistance 100 is connected between the output resistances 97 and 98 and the control grid 81, while the junction of a pair of resistances 101 and 102 connected between a movable tap on potentiometer 62 and ground is similarly connected to the control grid. Thus, the control electrode has applied thereto a voltage which is proportional to the difference of the relative magnitudes of the positive reference voltage and the negative output voltage. By virtue of this circuit connection, the output voltage is kept constant in the absence of any unregulated voltage source variations. That is, should the intensity of oscillations and, in turn, the output voltage, change due to any change in tube parameters rather than the unregulated voltage, the voltage on the control electrode 81 relative to the cathode changes in

order to return the output voltage to its previous value. It is clear, of course, that the magnitude of the positive reference voltage may be changed by varying the position of the movable tap on the potentiometer 62, thus providing a steady state of adjustment.

It is also clear that the feedback circuit from the output to the control electrode of tube 79 will have a tendency to oppose any variations of oscillation intensity caused by changes in the unregulated voltage. However, the relative values of the circuit components are so adjusted that the effect of the varying unregulated voltage overrides the tendency of the feedback to oppose changes in intensity of oscillation.

In the embodiment of Fig. 2, the control voltage whose magnitude varies with the unregulated voltage source fluctuations is shown as a positive voltage and is, consequently, applied to the cathode of the tube 79 to control its transconductance. It is obvious, of course, that this control could be a negative voltage and, consequently, applied to a control electrode of tube 79 rather than the cathode.

While I have shown particular embodiments of my invention, it will, of course, be understood that I am not limited thereto since many modifications, both in the circuit arrangement and in the instrumentalities employed, may be made. I contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

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

1. In a power supply for a photoelectric device illuminated by a light source energized from a source of unregulated voltage, the combination comprising a variable amplitude oscillator having a regenerative feedback circuit for sustaining oscillations, electron discharge means in said feedback circuit for controlling the amount of feedback, first rectifying means coupled to said oscillator to rectify the oscillations produced thereby to provide a unidirectional operating voltage for said photoelectric device, a second rectifying means coupled to said source of unregulated voltage to provide a unidirectional control voltage which varies with any variations of the unregulated voltage, regulating means coupled to said second rectifying means to provide a constant reference voltage, means coupling said control voltage to said electron discharge means to control the amount of feedback and vary the amplitude of oscillators as an inverse function of any variations of the unregulated voltage, means connected to said regulating means and said rectifying means for comparing said unidirectional operating voltage and said constant reference voltage to provide a regulating voltage for said electron discharge device to maintain the operating voltage constant in the absence of any control voltage variations irrespective of changes in the oscillator parameters.

2. A compensated voltage supply for a photoelectric device which is illuminated by a light source energized by a source of unregulated voltage, comprising a photoelectric device, a variable amplitude oscillator having a regenerative feedback circuit for sustaining oscillations, electron discharge means connected in said feedback circuit for controlling the amount of feedback, means to provide a control voltage in response to fluctuations of the unregulated light source supply voltage, which control voltage varies in magnitude and polarity as a function of variations in the unregulated light source supply voltage, means coupling said control voltage means to said electron discharge means to control the amount of feedback and vary the amplitude of oscillations inversely with any variations of the unregulated voltage to compensate for any light source intensity variations.

3. In a power supply for a photoelectric device illuminated by a light source energized from an unregulated voltage supply, the combination comprising a photoelectric device, a variable amplitude voltage source providing

energization for said photoelectric device, means to produce a control voltage in response to and as a function of variation in the unregulated light source voltage supply, means coupling said control voltage source to said variable amplitude voltage means to control the energization of said photoelectric device and vary the sensitivity thereof.

4. In a power supply for a photoelectric device illuminated by a light source energized from an unregulated voltage supply, the combination comprising a photoelectric device, a voltage source having an output terminal which supplies operating voltage for said photoelectric device, including means to vary the amplitude of the voltage source output, means to produce a control voltage in response to and varying as a function of any variations in the unregulated light source supply voltage, means coupling said control voltage means and said amplitude varying means to vary the operating voltage for said photoelectric device in opposition to any variations of the unregulated voltage, and feedback means connected between said output terminal and said voltage source to compensate for changes in the photoelectric voltage source parameters to maintain the operating voltage constant in the absence of variations of said control voltage.

5. In a power supply for a photoelectric device illuminated by a light source energized from an unregulated voltage supply, the combination comprising a photoelectric device, a source of alternating voltage including means to vary the amplitude of said voltage, rectifying means coupled to said alternating voltage source to provide a variable unidirectional operating voltage for said photoelectric device, means to produce a control voltage in response to and varying as a function of any variation of the unregulated light source supply voltage, means coupling said control voltage to said amplitude varying means to control the amplitude of said alternating voltage as an inverse function of the variations of the unregulated supply to compensate for light source intensity variations.

6. In a compensated power supply for a photoelectric device illuminated by a light source energized from an unregulated voltage supply, the combination comprising a photoelectric device, a source of variable amplitude alternating voltage, rectifying means coupled to said alternating voltage source to provide a variable unidirectional operating voltage for said photoelectric device, means to produce a control voltage in response to and varying as a function of variations of the unregulated light source voltage supply, means coupling said control voltage to said source of alternating voltage to control the amplitude thereof as an inverse function of any variations of the unregulated supply, and amplitude control means to compensate for changes in the photoelectric voltage source parameters coupled between the output of said rectifying means and said alternating voltage source to maintain the operating voltage constant in the absence of control voltage variations.

7. In a power supply for a photoelectric device illuminated by a light source energized from an unregulated voltage supply, the combination comprising a photoelectric device, a variable amplitude oscillator, rectifying means coupled to said oscillator to provide a variable unidirectional voltage for said photoelectric device, means to produce a control voltage in response to and varying as a function of any variations of the unregulated light source voltage supply, and means coupling said control voltage to said oscillator to vary the amplitude of the oscillation as an inverse function of variations in the unregulated supply.

8. In a power supply for a photoelectric device illuminated by a light source energized from an unregulated voltage supply, the combination comprising a photoelectric device, a variable amplitude oscillator, rectifying means coupled to said oscillator to provide a variable unidirectional operating voltage for said photoelectric

device, means to produce a control voltage in response to and varying as a function of variations of the unregulated light source voltage supply, means coupling said control voltage producing means and said oscillator to vary the amplitude of the oscillation as an inverse function of any variations of the unregulated light source voltage supply, and amplitude control means to compensate for changes in oscillator parameters coupled between the output of the rectifying means and the oscillator to maintain the operating voltage constant in the absence of control voltage variations.

9. In a power supply for a photoelectric device illuminated by a light source energized from an unregulated voltage supply, the combination comprising a variable amplitude oscillator, rectifying means coupled to said oscillator to provide a variable unidirectional operating voltage for the photoelectric device, means for producing a control voltage in response to and varying as an inverse function of any variations in the unregulated light source voltage supply including rectifying means for producing a first voltage of one sign varying with the unregulated light source voltage supply, a constant reference voltage of opposite sign, and means connected to said rectifying means and said reference voltage source for algebraically adding the first and reference voltages to produce said control voltage, and means coupling said control voltage to said oscillator to vary the amplitude of oscillations inversely with any variations of the unregulated supply.

10. In a power supply for a photoelectric device illuminated by a light source energized from an unregulated voltage supply, the combination comprising a variable amplitude oscillator, first rectifying means coupled to said oscillator to provide a unidirectional operating voltage for a photoelectric device, means for producing a control voltage which varies as an inverse function of variations in the unregulated supply including second rectifying means for producing a first voltage of one sign varying with the unregulated supply, a constant reference voltage of opposite sign, means connected to said rectifying means and said reference voltage means for algebraically adding

said first voltage and said constant reference voltage to produce said control voltage, means including delay means coupling said control voltage means to said oscillator to vary the amplitude of said oscillations as an inverse function of variations in the unregulated supply, and amplitude control means to compensate for changes in oscillator parameters coupled between the output of said rectifying means and said oscillator to maintain the operating voltage constant in the absence of control voltage variations.

11. In a power supply for a photoelectric device illuminated by a light source energized from an unregulated voltage supply, the combination comprising a photoelectric device, a variable amplitude voltage source coupled to said photoelectric device to provide energizing voltage therefor, means responsive to fluctuations in said unregulated light source voltage supply to vary the amplitude of the output voltage from said voltage source inversely with fluctuations in said unregulated supply whereby the sensitivity of said photoelectric device is so varied that the output from said photoelectric device is constant irrespective of light source intensity fluctuations.

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