

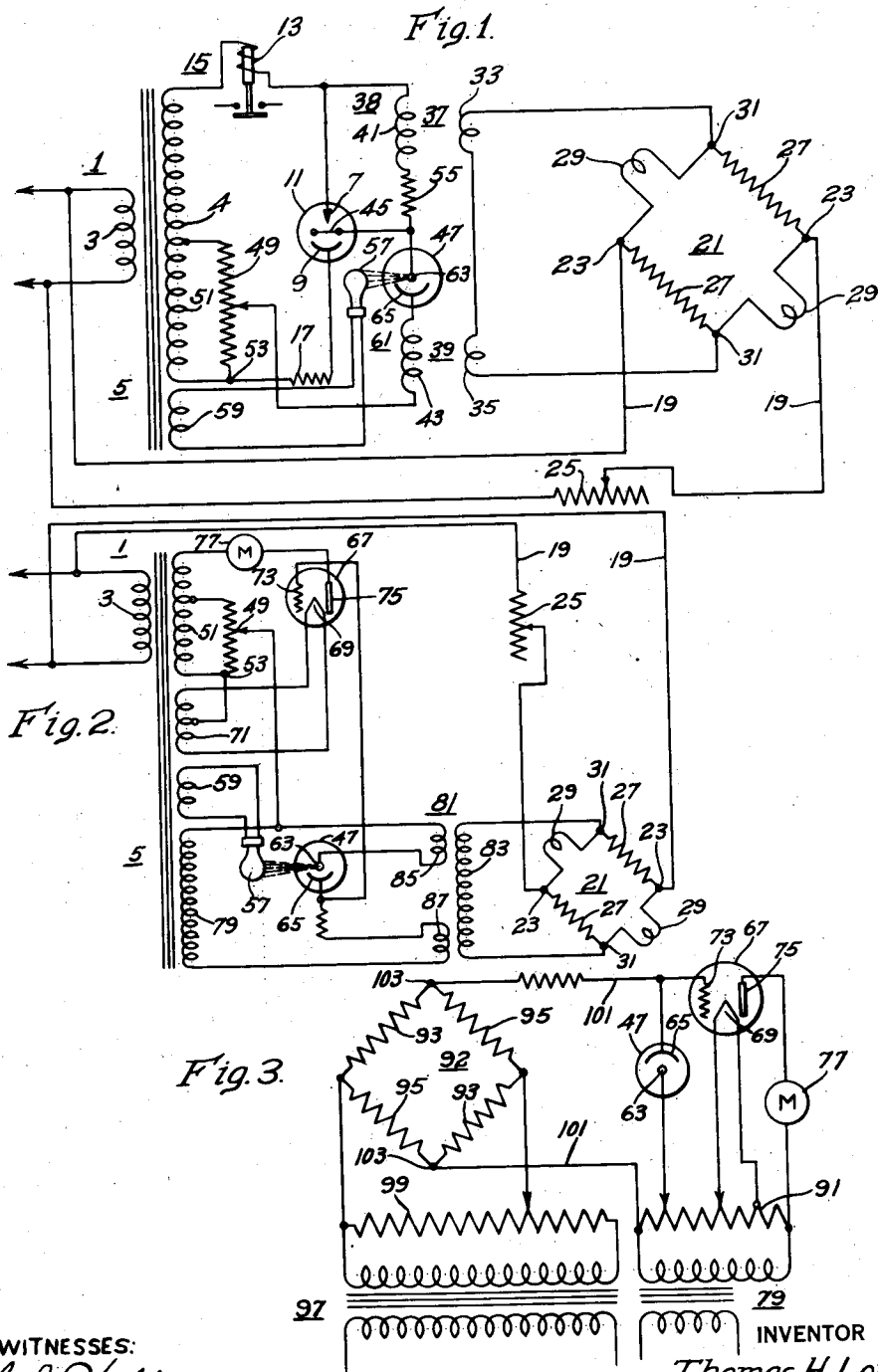
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TRANSLATING APPARATUS

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TRANSLATING APPARATUS

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My invention relates to translating apparatus and has particular relation to apparatus of the type incorporating electric discharge devices.

It is an object of my invention to provide, for a translating system of the type incorporating a plural-electrode electric-discharge device, a contrivance for compensating for the variations introduced in the response of the system by the effects of external physical disturbances.

Another object of my invention is to provide a translating system of the type incorporating electric-discharge devices that shall have a uniform response regardless of the normally vitiating disturbances arising in the region wherein the system is disposed.

Still another object of my invention is to provide an energy translating system of the type incorporating electric-discharge devices that shall respond uniformly regardless of the normally vitiating disturbances arising by reason of variations in the systems with which the apparatus is associated.

A further object of my invention is to provide a photo-sensitive relay of the type incorporating an electroionic or an electronic-amplifying device that shall always have a predetermined response when influenced by radiations of predetermined characteristics regardless of the influence of the physical properties of the environment of the relay.

A still further object of my invention is to provide a relay of the type incorporating a photo-sensitive trigger and an electroionic or an electronic amplifying device for the trigger that shall have a predetermined response for predetermined illumination impinging on the trigger regardless of the variations in the elements associated with the relay and cooperating therewith.

A specific object of my invention is to provide for an energy translating system, a contrivance for compensating for the effects of variations in the power source whereby the energy for the system is supplied.

Another specific object of my invention is to provide for an energy translating system, a contrivance for compensating for the effects of ambient temperature variations on the response of the system.

Still another specific object of my invention is to provide a photo-sensitive relay of the type incorporating an electroionic or an electronic amplifying device that shall yield a uniform response regardless of the variations in the power source supplying the system and regardless of the variations

in the source of illumination whereby the photo-sensitive trigger of the relay is excited.

More concisely stated, it is an object of my invention to provide an energy translating system of a type that shall be particularly applicable in situations where uniform response is required regardless of the characteristics of the apparatus associated with the energy translating system and of the environment of the translating system.

According to my invention, I provide an energy translating system incorporating a balanced network having input and output terminals. The balanced network may be of the Wheatstone bridge type and its arms should be of a character suitable for the purposes for which the network is utilized.

Normally, the input circuit is connected to two conjugate terminals of the network and the output circuit is connected to two other conjugate terminals. The input terminals are connected to a power supply source and when the network is incorporated in the translating system for the purpose of compensating for the effects of variations in the power-supply source, that feeds the system, the input terminals of the network are connected to the power-supply source that feeds the translating system. Moreover, if the network is to provide compensation for variations in the power-supply source, the arms of the network that effect the necessary compensation are of a type responsive to voltage or current variations.

On the other hand, if the network is to compensate for the effects of ambient temperature variations or for the effects of humidity, the input terminals thereof are connected preferably to an independent power-supply source and the arms of the network that effect compensation are of a character responsive to ambient temperature or humidity variations.

The output terminals of the network, whether it is utilized for compensating for voltage variations, temperature, humidity variations or other types of variations are coupled to the energy translating system in such manner as to provide the necessary compensation. It is understood, of course, that the coupling may be a direct connection, an electrostatic connection or an electromagnetic connection depending on the contingency of the situation. In many instances I have found in the practice of my invention that an electromagnetic connection yields rather satisfactory results, since the electric discharge devices that are utilized in the translating systems of the type

in which I am particularly interested respond to voltage variations rather than to current variations and by utilizing the proper transformers, I can attain the necessary voltage without considerable loss of power in the network.

As has been suggested hereinabove, in the preferred practice of my invention, the network is commonly a Wheatstone bridge. When the network is utilized for compensating for variations in the output of the source supplying energy for the operation of the energy translating device, two opposite arms of the bridge are of a type having a substantial voltage coefficient of resistance. The other arms of the bridge are of a type having an inappreciable voltage coefficient of resistance.

It is of course understood that essentially only a difference in the voltage coefficients of resistance of the two sets of opposed arms is necessary. Hence one set may have a positive voltage coefficient of resistance and the other set a negative voltage coefficient of resistance, or one coefficient may be high while the other is low.

The output of the bridge is inductively coupled to one or more of the input circuits of the electric discharge devices incorporated in the energy translating system.

For a predetermined output of the power supply system the network is so adjusted that it has zero output or possibly a predetermined output. A variation in the output of the power system produces a variation in the input of the network and a consequent variation in the output of the network. The change is impressed suitably on one or most of the control circuits of the electric discharge devices. The effect of the impressed variations on the electric discharge devices is to compensate for the effects of variations in the power supply system on the output of the electric discharge devices.

It will be noted that normally the effect of a variation in the power supply source is to change the potentials impressed between the principal electrodes of the electric discharge device or devices utilized in the system, and the control electrodes, and also, to change the potentials impressed between the principal electrodes. In my improved system these changes are compensated by reason of corresponding changes introduced in the balanced network which are, in turn, fed to the electric discharge devices.

For energy translating apparatus of a type that incorporates a photo-sensitive trigger, the source of illumination whereby the trigger is energized is normally excited from the power source whereby the translating system is energized. Consequently, a variation in the power source not only affects those potentials associated with the electric discharge device and with the photo-sensitive trigger, but also affects the source of illumination. By properly coupling a suitable network provided in accordance with my invention to an energy translating system of this type, not only are the effects of voltage variations on the electric discharge devices compensated but the effects of voltage variations on the output of the source of illumination are also compensated.

It will be apparent from the hereinabove set forth description that a balanced network of the Wheatstone bridge type may also be utilized to compensate for ambient temperature variations. In such a network constructed according to the preferred practice of my invention, two opposite arms are normally composed of a metal having an appreciable temperature coefficient of resistance, while the other arms are constructed of a

metal having substantially a zero temperature coefficient of resistance. Specifically, the former set of arms might be iron, while the latter set of arms might be "Advance". It is to be noted, moreover, that in general, for purposes of temperature compensation, the groups of arms need only be of such character that they are each composed of metals that differ appreciably in the temperature coefficient of resistance of the individual elements; that is to say, the set of arms having the lower temperature coefficient of resistance need not necessarily have a zero temperature coefficient of resistance but may have a negative temperature coefficient of resistance or even a low positive temperature coefficient of resistance.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments when read in connection with the accompanying drawing, in which:

Figure 1 is a diagrammatic view showing an embodiment of my invention, as it is applied to the compensation of variations in the source whereby power is supplied to an energy translating system.

Fig. 2 is a diagrammatic view showing a modification of my invention as it is utilized for the same purposes as the embodiment shown in Fig. 1, and

Fig. 3 is a diagrammatic view showing an embodiment of my invention as it is utilized for the purposes of compensating for such effects as are produced by changes in the ambient temperature or changes in the ambient humidity.

The apparatus shown in Fig. 1 comprises a transformer 1, the primary 2 of which is fed from a suitable source (not shown), and one section 3 of the secondary 5 of which is connected between the principal electrodes 7 and 9 of a cold-cathode electric discharge device 11 of the grid glow type through the exciting coil 13 of a suitable relay 15 and through a suitable current-limiting impedance 17. It is to be noted that while I have shown a grid glow tube 11 utilized in systems of the type illustrated in Fig. 1, other electric discharge devices such as mercury pool devices are equally as well applicable and may be substituted for the grid-glow tube without effecting the essential features of my invention.

The input leads 19 of the balanced network 21, provided for compensation, are connected across the terminals of the power supply primary 2 and feed conjugate terminals 23 of the network through a variable resistance 25 of suitable character. Two opposite arms 27 of the network 21 are resistors of ordinary character, preferably equal in magnitude. These resistors have substantially zero voltage coefficients. The other two opposite arms 29 of the network 21 are resistors having high voltage coefficients of resistance and are preferably tungsten lamp filaments of equal resistance at a given voltage.

Since it is desired that the network 21 shall be balanced under normal conditions, the resistors 27 should be of such character that, when conditions are normal, they have the same resistance as resistors 29. Under such conditions, the resistances of all sides of the network will be identical.

It will be noted that since tungsten and carbon have voltage coefficients of resistance of op-

posite sign that it may be desirable to use a network in which the opposite arms are respectively tungsten and carbon.

The output leads of the network are fed from two conjugate terminals 31 thereof and are connected through the primaries 33 and 35 of a plurality of transformers 37 and 39, the secondaries 41 and 43 of which are in turn connected between the control electrode 45 and the principal electrodes 7 and 9 of the electric discharge device 11.

In the system of the type shown in Fig. 1, the triggering device 47 is of the photo-sensitive type and comprises an ordinary photo cell connected between the control electrode 45 of the tube 11 and the secondary 43 of the compensating transformer 39. Potential is applied to the cell 47 from a potentiometer 49 that is, in turn, energized from a suitable section of windings 51 of the secondary 5 of the power supply transformer 1. The lower tap 53 of the potentiometer 49 is connected to the cathode 9 of the electric discharge device 11 through the impedance 17.

An impedance 55 of proper magnitude is also connected between the control electrode 45 and one terminal of the secondary 41 of the compensating transformer 37 that is disposed in the control circuit 38 associated with the anode 7 of the electric discharge device 11.

The photo-sensitive device 47 is energized from a suitable source of illumination 57 that is supplied with power from a section 59 of the secondary 5 of the power supply transformer 1.

The network 21 is so adjusted that for a predetermined output of the power source 3, the resistances 29 are equal in magnitude to the resistances 27. The output of the network is then zero and the electric discharge device 11 is not effected thereby. When the output of the power source changes, the resistances of the lamp filament arms 29 are changed and the balance of the bridge 21 is disturbed. In such a case a current having a polarity and a magnitude determined by the polarity and magnitude of the change in the power supply transformer 1, flows through the primaries 33 and 35 of the compensating transformers 37 and 39, respectively, and corresponding potentials are impressed on the control circuits 38 and 41 of the electric discharge device 11.

The character of the compensating voltage which need be supplied by the balanced network 21 is dependent on the character of the photo-sensitive device 47 and of the electric-discharge device 11 utilized in the system. If the electric-discharge device is of the grid-glow type, as is shown in Fig. 1, the variation in the output of the primary 3, since it effects a variation between the control electrode 45 and the principal electrodes 7 and 9 of the electric-discharge device 11, has the effect of changing the breakdown characteristic of the system. The electromotive force impressed between the cathode 9 and the anode 7 of the electric-discharge device of the grid-glow type is normally given such a factor of safety that it is not affected.

For example, if the output of the power source should be decreased, the potential between the cathode 9 and the anode 7 of the electric-discharge device 11 would be decreased with substantially no effect. If at the same time a photo-sensitive device 47 of the high vacuum type is utilized in the system, the current through the photosensitive device remains constant in spite of the decrease of electromotive force impressed thereon and consequently the drop of potential between the anode 7 and the control electrode 45

remains constant. As a result of this situation, the potential drop between the cathode 9 and the control electrode 45 is decreased and less negative charge is required to be supplied by the cell 47 to the control electrode 45 of the electric-discharge device 11 to prevent the device from becoming energized than was required before the variation in the power output of the primary 3 took place. That is to say, the electric-discharge device now becomes energized for a lower flux of illumination impinging on the photo-sensitive trigger 47 than it did before the change took place.

In such a system the properties of the elements of the balanced network 21 are such that the electromotive force induced between the control electrode 45 and the anode 7 of the electric-discharge device 11 has the effect of raising the voltage of the control electrode 45 relative to the cathode 9 and of thus reverting the system to its original condition.

In the system of the type incorporating the high vacuum photo-sensitive cell, it will be noted that compensation of the system for the effects of the decrease of the illumination impinging on the photo-sensitive cell is not possible by the utilization of the lower compensating transformer 39. This transformer would have only the effect of raising the electromotive force impressed on the cell 47, and, since the cell is of the high vacuum type and is normally operated in its saturation region, the increase in the electromotive force applied to the cell would have no notable results. However, it is possible by properly designing the upper compensating transformer 37, for example, or by utilizing two compensating transformers to affect the circuit 38 associated with the control electrode 45 and the anode 7 to compensate for the variations in the source 57 that provides the illumination for exciting the photo-sensitive cell 47.

The application of my invention to a system incorporating a high vacuum photo-sensitive cell in which it is necessary to compensate for variations in the illumination produced by variations in the power source should be apparent to one skilled in the art and need hardly be described herein. It need only be noted that if a decrease in the illumination takes place, for example, by reason of a decrease in the output of the power source, fewer negative charges are supplied to the electric-discharge device 11 than were supplied before the change took place and the potential of the control electrode 45 relative to the cathode 9 need, therefore, be decreased to compensate for the change. A corresponding situation arises when the power output of the power supply source is increased.

When the photo-sensitive device 47 utilized in the system is of the gas filled type, since the effect of the variations in the output of the power supply system is to change the electromotive force impressed across the photo-sensitive device, a consequent change in the current output of the photo-sensitive device takes place and the potential of the anode 7 relative to the control electrode 45 of the electric discharge device 11 is changed, as well as the potential of the cathode 9 relative to the control electrode. In such a case, it will be noted, that while the effects introduced by the compensating transformers must be of the same polarity as for the system incorporating the vacuum cell, the magnitude of the changes are somewhat different and as a result the compensating system must be designed

to suit the particular translating system with which it is to be utilized.

It is to be remembered also that while the potential of the control electrode 45 of the electric-discharge device 11 relative to the cathode 9, is changed by the compensating effect, the potential of the anode 63, of the photo-sensitive device 47, is also changed relative to the cathode 65. The character of the compensating network 21 and of the transformers 37 and 39 associated therewith should preferably be of a type such that the anode 63 is raised to the same potential relative to the cathode 65 that it had before the change in the output in the power supply system took place. I may further say that in the system incorporating the gas filled photo-sensitive device, the compensation for variations in the source 57 of illumination may take place through the compensating transformer 39 associated with the circuit 61 of the energy translating network in which the photo-sensitive device 47 is connected. This situation arises by reason of the fact that the output current of a gas filled photo-sensitive device may be controlled by controlling the electromotive force impressed between its terminals.

It will be noted that while I have shown my invention as applied to a particular circuit, it is equally as well applicable to circuits of other types. The circuit of the type shown in Figure 1, is commonly known as an inverse circuit; that is to say, it is a circuit in which the effect produced on the electric-discharge device is in inverse relation to the state of excitation of the photo-sensitive device. If the photo-sensitive device 47 is highly excited, the electric-discharge device 11 is deenergized, while, if the photo-sensitive device is in a state of low enough excitation, the electric-discharge device is energized.

The apparatus of the type shown in Fig. 2 incorporates a hot cathode electric-discharge device 67 in place of the cold cathode electric-discharge device 11 utilized in apparatus of the type shown in Fig. 1. The electric-discharge device 67, shown in this view, may be of the gas filled or high vacuum type and comprises a cathode 69 heated from a suitable section 71 of the secondary 5 of the power supply transformer 1, a control electrode 73 and an anode 75.

The output of the electric-discharge device 67 feeds through a meter 77 or a load of suitable character depending on the use to which the system is put. The photo-sensitive trigger 47 of the system is connected to an independent section of windings 79 of the secondary 5 of the power supply transformer 1 and the electromotive force impressed thereon is dependent only on the condition of the primary 3 of the transformer. The compensating system is of the same character as that shown in Fig. 1 with the exception that the compensating transformer 81 in the present instance has a single primary 83 and a plurality of secondaries 85 and 87. It is to be noted, however, that the windings of the secondaries 85 and 87 should be of such character as to provide the proper electromotive force for compensating purposes, and, by reason of the fact that the electromotive force impressed in the output of the compensating network is ordinarily rather small and the electromotive force required for compensation is ordinarily considerable, I have found that the number of turns of the secondaries 85 and 87 (and particularly of the secondary 85 whereby compensation for varying the

sensitivity of the cell 47 is provided) should be greater in number of turns than of the primary 83.

The response of the system of the type described in Fig. 2 is the same as the response of the system of the type described in Fig. 1. In analogy with the hereinabove set forth explanation, the two compensating secondaries 85 and 87 incorporated in the system may be utilized, respectively, for compensating for the effects of variations in the illumination impinging on the photo-sensitive device introduced by reason of variations in the output of the power supply system and for the effects of the variations on the electric discharge devices 67 and 47.

In the apparatus of the type shown in Fig. 3 a system provided for the purpose of compensating for ambient temperature variations is shown. The system comprises an electric-discharge device 67 incorporating a hot cathode 69, an anode 75 and a control electrode 73 similar to the device shown in Fig. 2. As in apparatus of the type shown in Fig. 2, the output current of the electric discharge device 67 feeds through a meter 77 or a load of suitable character and is controlled by the response of a photo-sensitive device 47 to one or more sources of illumination (not shown). The power necessary for the operation of the system is provided by a suitable transformer 79 through a potentiometer 91 of proper character.

The compensating network 92 comprising a Wheatstone bridge, the pairs 93 and 95 of opposite arms of which are composed of metals between which there is a substantial difference in temperature coefficient of resistance, is fed from an independent power supply transformer 97 through a potentiometer 99 of proper character. As has been explained hereinabove, two arms 93 of the bridge may be of "advance", which has substantially zero temperature coefficient of resistance, while the other two arms 95 of the bridge may be composed of iron which has a substantial temperature coefficient of resistance.

The output of the network 92 is fed into the input circuit of the electric-discharge device 67, one output lead 101 being connected to the control electrode 73 of the electric discharge device 67 and the other output lead 101 being connected to the potentiometer 91 whereby power is supplied to the electric-discharge device. The balanced network 92 may be so adjusted that normally a predetermined biasing electromotive force is applied to the control electrode 73 of the electric-discharge device 67 through the output leads 101 of the network. A change in the ambient temperature produces a change in the resistance in the arms 95 of the bridge and a consequent shift in the potential of the output terminals 103 of the network 92. The shift in the potential is so impressed between the control electrode 73 and the cathode 69 of the electric-discharge device 67 that the necessary compensation for ambient temperature variations takes place.

It should be kept in mind that the effects of ambient temperature variations on the electric-discharge device and on the photo-sensitive device utilized in translating systems have been rather aggravating in the past. The output of the electric-discharge device is apparently rather sensitive to temperature variations and the developments which gave rise to the present invention were carried out in connection with experiments which I made to determine the proper

method of taking care of the vitiating influences on the output of the electric-discharge device of the ambient temperature variations. By utilizing the balanced network as described hereinabove, I have found that the deleterious effects of temperature variations are substantially eliminated and that the system has uniform response regardless of temperature variations in its neighborhood.

While I have found that for the practical purposes to which I have applied translating apparatus incorporating electric discharge devices, the effects introduced by variations of other types than temperature variations and voltage variations are substantially negligible, it is highly conceivable that in certain types of apparatus the effects of these variations might become of some importance. It will be observed that my invention is applicable to compensation of ambient humidity variations and changes of other types produced in the environment of the translating apparatus. Systems in which other variations in the environment of the translating apparatus than temperature variations or variations in the power supplied for energizing the translating system are compensated, are therefore, equivalents which lie within the scope of my invention.

Although I have shown and described certain specific embodiments of my invention, I am fully aware that many modifications thereof are possible. My invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. In a translating system of the type including an electric discharge device having input and output terminals, power supply means connected to said output terminals, and means responsive to ambient temperature variations coupled to said input terminals of said electric discharge device to compensate for the effects of ambient temperature variations thereon.

2. In a translating system of the type including an electric discharge device incorporating a control electrode and a plurality of principal electrodes, a network, including a plurality of symmetrically related arms having a substantial temperature coefficient of resistance and a plurality of symmetrically related arms having a small temperature coefficient of resistance, said network having input and output terminals, power supply means connected to said input terminals, and means for coupling said output terminals between the control electrode and a principal electrode of said electric discharge device to compensate for the effects of ambient temperature variations thereon.

3. In a translating system of the type including an electric discharge device, a network, including a plurality of symmetrically disposed arms of advance alloy and a plurality of symmetrically disposed arms of iron and having input and output terminals, power supply means connected to said input terminals, and means for coupling said output terminals to said electric discharge device to compensate for the effects of ambient temperature variations thereon.

4. The combination with an electric discharge device of a network having input and output terminals, power supply means coupled to said input terminals, means to respond to ambient temperature variations to vary the voltage impressed across said output terminals and means for coupling said electric discharge device to said output

terminals to compensate for the effect of ambient temperature variations thereon.

5. The combination with a network of the type having input and output terminals including a plurality of groups of symmetrically related arms, the temperature coefficients of resistance of the elements of one group being substantially different from those of elements of another group, and means for impressing an electromotive force across said input terminals, of an electric discharge device and means for coupling said output terminals to said electric discharge device to compensate for the effect of ambient temperature variations thereon.

6. A translating system comprising an electric discharge device having a control electrode and a plurality of principal electrodes, circuits associated with said principal electrodes and with said control electrode, power supply means for energizing said electric discharge device coupled to the circuits associated with the electrodes of said device, a circuit having input and output terminals and incorporating a plurality of symmetrically related conductive arms, certain of said arms having an inappreciable voltage coefficient of resistance and certain others of said arms having an appreciable voltage coefficient of resistance, means for coupling said input terminals to said power-supply means and means for so coupling said output terminals to at least one of the circuits associated with said control electrode and said principal electrodes of said electric discharge device as to compensate for the effects of variations in the voltage of said power supply means on the response of said electric discharge device.

7. A translating system comprising an electric discharge device having a control electrode and a plurality of principal electrodes, a circuit associated with said principal electrodes, a plurality of circuits associated with said control electrode and said principal electrodes, photosensitive means, of the type having a saturation characteristic coupled to one of the circuits associated with said control electrode and one of said principal electrodes, power supply means coupled to the circuit associated with said principal electrodes, the electromotive force supplied to the circuit coupled to said photosensitive means being of such magnitude that said photosensitive means is normally operated in its saturation region, a circuit having output terminals and having input terminals coupled to said power supply means, said circuit incorporating means responsive to the electromotive force impressed thereon and means for coupling the output terminals of said balanced circuit to the circuit coupled to said photosensitive device to vary the electromotive force impressed on said last-named circuit and thus to compensate for the effects, on the condition of said circuit associated with the principal electrodes of said electric discharge device, of variations in said power supply voltage.

8. A translating system comprising an electric discharge device having an output circuit and a plurality of input circuits, power supply means coupled to said output circuit to apply an electromotive force to said output circuit and said input circuits, photosensitive means connected in one of said input circuits, said photosensitive means being of a type having a response that is a function of the electromotive force impressed thereon, and means coupled to another of said input circuits and to said power supply means

for compensating for the effects on said output circuit of variations in said power supply voltage.

9. A translating system comprising an electric discharge device having a control electrode and a plurality of principal electrodes, means for impressing potentials between said control electrode and said principal electrodes and between said principal electrodes, a network including a plurality of arms having substantially different coefficients of resistance, said network having input and output terminals embracing different arms thereof, power-supply means connected to said input terminals and means for so coupling said output terminals between the control electrode and the principal electrodes of said electric discharge device that variations in the operating characteristics of said electric discharge device that are produced by conditions tending to produce a change in the resistances of certain of said arms are neutralized by the additional potentials impressed between said control electrodes and said principal electrodes from said network.

10. A translating system comprising an electric discharge device having a control electrode and a plurality of principal electrodes, means for impressing potentials between said control electrode and said principal electrodes and between said principal electrodes, a network including a plurality of arms having substantially different voltage coefficients of resistance, said network having input and output terminals embracing different arms thereof, power-supply means connected to said output terminals and means for so coupling said output terminals between the control electrode and the principal electrodes of said electric discharge device that variations in the operating characteristics of said electric discharge device that are introduced by variations in the potential supplied by said means for impressing potentials between the electrodes of said electric discharge device are neutralized by the additional potentials impressed between said control electrodes and said principal electrodes from said network.

11. A translating system comprising an electric discharge device having a cathode, an anode and a control electrode, a voltage source connected to cause current flow between said anode and cathode, a network comprising a bridge circuit, the opposite sides of said bridge being resistances of similar temperature coefficients but the temperature coefficients of adjacent sides of said bridge being dissimilar to each other, connections from a pair of diagonally opposite junctions of said bridge circuit to said voltage source and connections from the other pair of diagonally opposite corners of said bridge to impress a voltage tending to make said control electrode less positive relative to said cathode whenever said voltage source makes said anode more positive relative to said cathode.

12. A translating system comprising an electric discharge device having a control electrode and a plurality of principal electrodes, a circuit associated with said principal electrodes, a plurality of circuits associated with said control electrode and said principal electrodes, photosensitive means, of the type having a saturation characteristic coupled to one of the circuits associated with said control electrode and one of said principal electrodes, power supply means coupled to the circuit associated with said electric discharge device, the resultant electromotive force supplied to the circuit coupled to said photosensitive means being of such magnitude that said photosensi-

tive means is normally operated in its saturation region, means to be energized from said power supply means for energizing said photosensitive device, a network having output terminals and input terminals coupled to said power supply means, said network incorporating means responsive to variation in the electromotive force impressed thereon, and means for coupling the output terminals of said network to the circuit coupled to said photosensitive device to vary the electromotive force impressed on said last-named circuit in such a sense as to compensate for the effects, on the condition of said circuit associated with the principal electrodes of said electric discharge device and on said energizing means for said photosensitive device, of variations in said power supply voltage.

13. A translating system comprising an electric discharge device having a control electrode and a plurality of principal electrodes, circuits associated with said principal electrodes and with said control electrode and said principal electrodes, photosensitive means, of the type having a saturation characteristic, coupled to a circuit associated with said control electrode and one of said principal electrodes, power supply means coupled to a circuit associated with said principal electrodes, the electromotive force supplied to the circuit coupled to said photosensitive means being of such magnitude that said photosensitive means is normally operated in its saturation region, a circuit having output terminals and having input terminals coupled to said power supply means, said circuit incorporating means responsive to the electromotive force impressed thereon and means for coupling the output terminals of said circuit to the circuit coupled to said photosensitive device to vary the electromotive force impressed on said last-named circuit in such a sense as to neutralize the effects, on the condition of said circuit associated with the principal electrodes of said electric discharge device, of variations in said power supply voltage.

14. A translating system comprising an electric discharge device having a control electrode and a plurality of principal electrodes, circuits associated with said principal electrodes and with said control electrode and said principal electrodes, photosensitive means coupled to a circuit associated with said control electrode and one of said principal electrodes, power supply means coupled to a circuit associated with said principal electrodes a circuit having output terminals and having input terminals coupled to said power supply means, said circuit incorporating means responsive to the electromotive force impressed thereon and means for coupling the output terminals of said circuit to the circuit coupled to said photosensitive device to vary the electromotive force impressed on said last-named circuit in such a sense as to neutralize the effects, on the condition of said circuit associated with the principal electrodes of said electric discharge device, of variations in said power supply voltage.

15. The combination with an electric discharge device of a network having input and output terminals, power supply means coupled to said input terminals, means, forming a part of said network, to respond to ambient temperature variations to vary the voltage impressed across said output terminals and means for coupling said electric discharge device to said output terminals to compensate for the effect of ambient temperature variations thereon.

16. The combination with an electric discharge

device and a photosensitive device for controlling said electric discharge device of a network having input and output terminals, power supply means coupled to said input terminals, means to
5 respond to ambient temperature variations to vary the voltage impressed across said output terminals and means for coupling said electric discharge device to said output terminals to compensate for the effect of ambient temperature variations thereon.

10 17. Apparatus according to claim 9 characterized by that the electric discharge device is controlled by a photosensitive device coupled between its control electrode and one of its principal
15 electrodes.

18. A translating system comprising an electric discharge device having a control electrode and a plurality of principal electrodes, circuits associated with said principal electrodes and with
20 said control electrode and said principal elec-

trodes, photosensitive means coupled to a circuit associated with said control electrode and one of said principal electrodes, power supply means coupled to a circuit associated with said principal electrodes, a source of radiant energy for exciting
5 said photo-sensitive device, said source being energized from said power supply means, a circuit having output terminals and having input terminals coupled to said power supply means, said circuit incorporating means responsive to
10 the electromotive force impressed thereon and means for coupling the output terminals of said circuit to the circuit coupled to said photosensitive device to vary the electromotive force im-
15 pressed on said last-named circuit in such a sense as to neutralize the effects, on the condition of said circuit associated with the principal electrodes of said electric discharge device, of variations in said power supply voltage.

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