

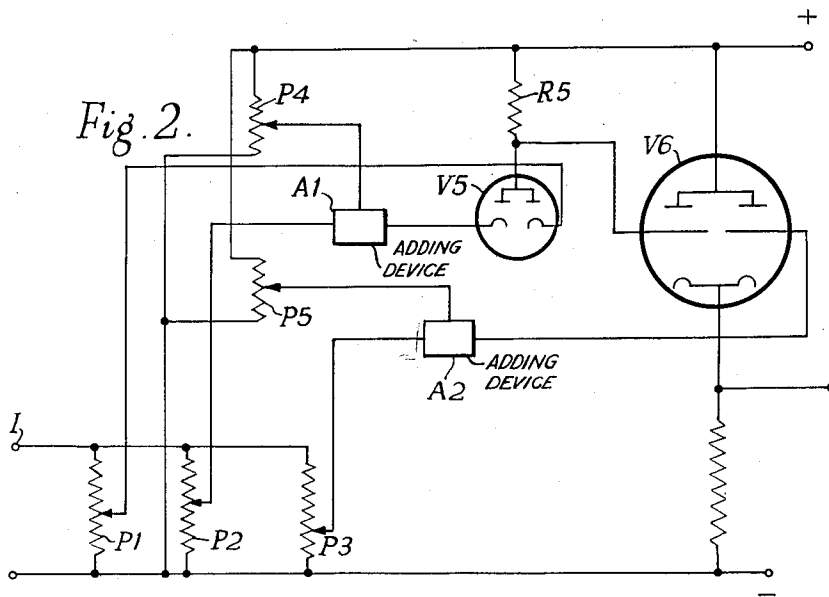
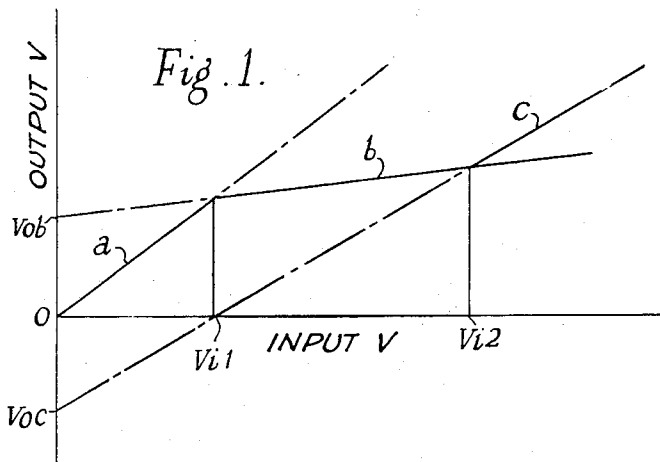
May 7, 1963

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CIRCUIT FOR PRODUCING OUTPUT SIGNAL AS A FUNCTION
OF PLURAL, VARIED-SLOPED INPUTS

3,089,093

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

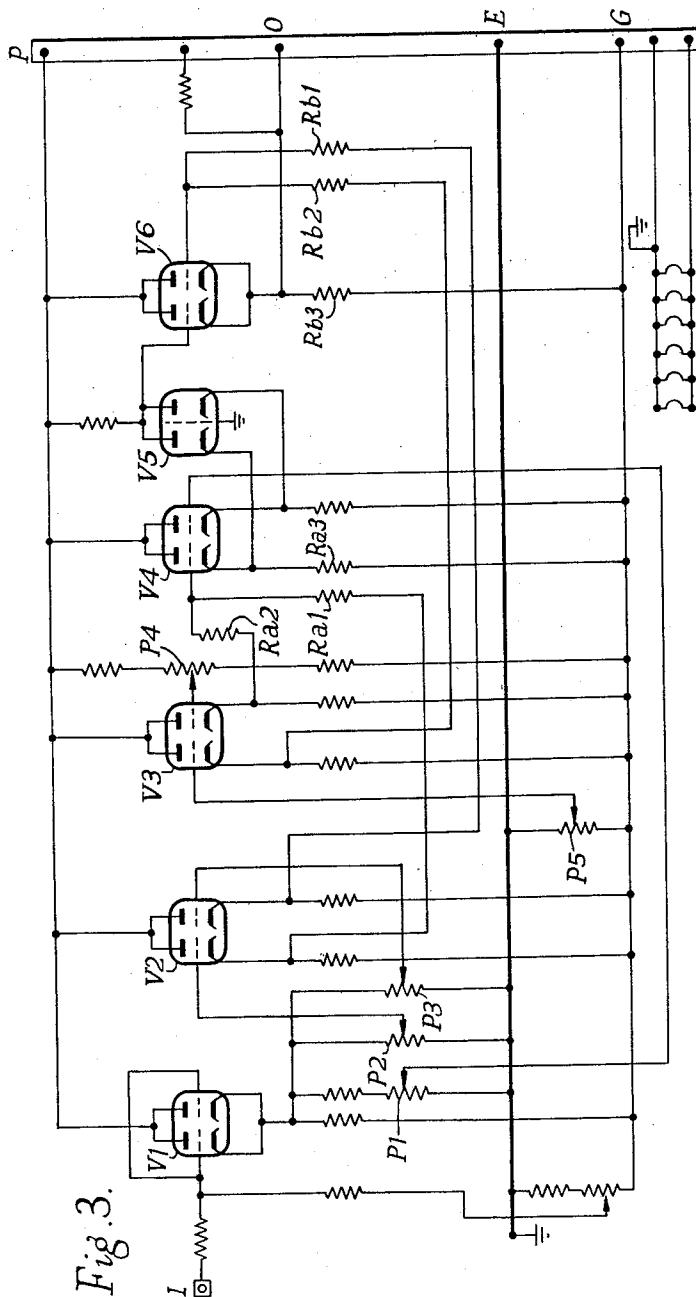


Fig. 3.

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CIRCUIT FOR PRODUCING OUTPUT SIGNAL AS A FUNCTION OF PLURAL, VARIED-SLOPED INPUTS

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This invention relates to electric voltage modifying networks and has for an object to provide an improved voltage modifying network in which the voltage output varies with the voltage input according to a function which up to a predetermined point has a first constant gradient, and from this point has a second constant gradient which is different from the first, means being preferably provided for allowing selective variation of the gradient in each part, and preferably also of the point of transition from one gradient to the other.

Another object is to provide an improved electric voltage modifying network having an input for the application of an input voltage, and output from which an output voltage may be obtained, and means for deriving from the input voltage two primary output voltages which will present functions of the input voltage corresponding respectively to two different gradients, wherein up to a predetermined point of the input voltage the output voltage is determined by the first and is independent of the second of said primary output voltages, while beyond said predetermined point the output of the network is determined by the second and is independent of the first primary output, the two branches of the output characteristic being joined without discontinuity at said predetermined point.

According to the invention from a broad aspect, two voltages are derived from the input voltage which represent functions of the input voltage corresponding respectively to different gradients, a bias voltage of such value is added to one of these voltages as to make the two voltages equal at a desired point of transition from one gradient to the other, and the two voltages are supplied selectively to the output under the control of a discriminating device which, according as the gradient corresponding to higher input voltages is intended to be more positive or less positive than that corresponding to the lower input voltages renders either the higher or the lower voltage effective and the other voltage ineffective for output purposes. If more than two different gradients are required as a function of the input voltage, a correspondingly greater number of outputs corresponding to the required gradients are derived from the input voltage, the requisite bias voltages are superimposed, and a further discriminating device is provided associated with each additional gradient, each further discriminating device being fed with the output of the preceding discriminating device and with a suitably biased primary output.

The apparatus according to the invention may for example be applied to the gamma control of a television-transmitter output. In this connection it is another object of the invention to provide an improved electric voltage modifying network adapted to provide a relatively high gamma for input voltages corresponding to the shadows of the picture to be transmitted, a relatively low gamma for the areas of medium illumination, and again a high gamma for the highlights.

The drawings accompanying the provisional specification illustrate the invention in a form applicable for this purpose.

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FIG. 1 is a diagram showing the required output voltages plotted over the input voltages.

FIG. 2 is a basic circuit diagram for the purpose of explaining the principle of the invention, and

FIG. 3 is a circuit diagram of a practical circuit.

Referring now to the drawings, FIG. 1 illustrates a form of output characteristic that may be desired for the transmission of television images. The output curve comprises three distinct sections *a*, *b*, and *c*, which have different gradients and which join each other at points corresponding to inputs *Vi1* and *Vi2* respectively.

According to the invention three primary outputs, respectively having the gradient of parts *a*, *b*, and *c* are derived from the input, preferably by means permitting the gradient of each part to be adjustably varied, and means are provided and associated with each by which a bias voltage *Vb* is superimposed upon the output having the gradient of part *b*, and a bias voltage *Vc* upon the output having the gradient of part *c*, these bias voltages being adjustable so that the output voltages corresponding to gradients of parts *a* and *b* can be made to coincide for an input *Vi1*, and these corresponding to the gradients of parts *b* and *c* to coincide for an input *Vi2* as indicated on the diagram. In order to obtain the desired plural-gradient output curve, two discriminators are used. The first discriminator is fed at its input side with the primary outputs having the gradients of parts *a* and *b* respectively, the latter being suitably biased, and renders at each input voltage that one of the two primary outputs effective which has the lower voltage and the other output ineffective. The other discriminator is fed with the output of the first discriminator and with the duly biased primary output having the gradient of part *c*, and renders at each input voltage the higher of these two voltages effective and the lower one ineffective.

The basic features of one form of network suitable for obtaining this result are shown in FIG. 2. The input *I* is applied to three potentiometers *P1*, *P2*, *P3*, which are respectively set to produce the three outputs having the gradients required for parts *a*, *b*, and *c*. The primary output obtained at potentiometer *P2* is fed through an adding device *A1* serving to superimpose a variable bias voltage obtained from a potentiometer *P4*, and the output of this adding device *A1* is fed to one input terminal, and the output of the potentiometer device *P1* is fed to the other input terminal, of a first discriminator device in the form of a double diode *V5*, of which the anodes are interconnected to form the common output of the first discriminator. A series resistance *R5* included in the anode voltage supply of the diode *V5* ensures that electron current through the anodes will only flow from that cathode which has the lower potential, since due to the electron current flow from that cathode the anode potential will fall substantially to the potential of the said cathode and will thus be negative in relation to the other cathode. The third primary output obtained from potentiometer *P3* and having the gradient *c* has superimposed upon it, in a second adding device *A2*, a bias voltage obtained from a further potentiometer *P5*. The output of this adding device *A2* forms one, and the output from the first discriminator *V5* forms the other input of a second discriminator *V6*, represented as a double triode in which the two grids form the two input electrodes, which the two cathodes and the two anodes are respectively interconnected to permit the final output to be derived from the cathodes with low effective output impedance in a cathode-follower circuit. It will be appreciated that this discriminator will respond only to the more positive one of the two inputs supplied to it, since when grid current flows the two interconnected cathodes will assume a potential substantially equal to that

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of the grid having the higher potential and thus will be positive relative to the other grid. While the adding devices A1 and A2 may be of a variety of well-known construction, one suitable form is represented in FIGURE 3 by resistors RA1 and RA2 in the lead to one of the grids of valve V4 in conjunction with cathode resistor RA3 (adding device A1) and by resistors RB1 and RB2 in the lead to one of the grids of valve V6 in conjunction with the cathode resistor RB3 of the said valve (adding device A2).

In practice electrical isolation is desirable at various points of the circuit, and means for reducing certain disturbing influences are preferably incorporated. One form of a practical circuit is illustrated in FIG. 3. In this circuit the input I is first fed to a cathode-follower stage V1, the output of which feeds the three potentiometers P1, P2 and P3. The output of potentiometer P2 is again fed to a cathode-follower stage utilising the left-hand half of a double-triode valve V2, and the output of this stage is fed to the left-hand grid of a valve V4, which forms part of a further cathode-follower stage, through a resistance network which, in addition to the cathode resistor Ra3 of this stage, includes a first resistor Ra1 in series with this output and a second resistor Ra2 in series with the output of another cathode follower stage, utilising the right-hand half of valve V3, to the grid of which a bias voltage is applied with the help of a potentiometer P4. The output of potentiometer P1 is applied to the right-hand grid of valve V4 to produce a cathode-follower output which constitutes one input, and the cathode-follower output produced with the help of the left-hand system of valve V4 constitutes the second input of a first discriminator device V5. The third primary output produced in potentiometer P3 is likewise fed to a cathode-follower stage utilising the right hand system of valve V2, the output of which is fed to one of the grid inputs of the second discriminator device V6, through an addition network comprising a resistor Rb1 in series with this output of valve V2 and a second resistor Rb2 in series with the output of a cathode-follower system utilising the left-hand system of the valve V3, and the cathode resistor RB3 of device V6. To the grid of this last-mentioned system a biasing potential is applied obtained from a potentiometer P5. The final output, obtained from the cathode resistor of valve V6, is led to a terminal O, while P is the positive terminal of the anode voltage source effective between this terminal P and earth terminal E, and a negative H.T. voltage is applied to terminal G. It will be obvious to those skilled in the art that the specific devices incorporated in the apparatus described with reference to FIG. 3 can in many cases be replaced by other devices equivalent in operation.

What we claim is:

1. An electric voltage-modifying network having an input for the application of an input voltage, an output

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from which an output voltage may be obtained, means for deriving from the input voltage two primary output voltages which represent functions of the input voltage corresponding respectively to two different gradients, means for adding to one of these primary output voltages a bias voltage for making the two voltages equal at a predetermined value of the input voltage, and a potential-difference sensitive discriminating gate having two input terminals and an output terminal and operative to connect the output terminal to one or the other input terminal according to the sign of the difference between the potentials at the two input terminals, and connecting means applying the two primary output voltages respectively to the said input terminals.

2. A device as claimed in claim 1 for producing an output voltage curve having more than two consecutive sections of different gradients, the device including means for deriving for each additional section from the input voltage an additional primary output voltage corresponding to the required gradient, means for superimposing on each such additional primary output voltage the requisite bias voltage, and, for each additional section, a further discriminating device having two input terminals respectively connected to the output of the preceding discriminating device and to the output of the associated means for superimposing the corresponding primary output voltage with its associated bias voltage.

3. A device as claimed in claim 1, including a discriminator device constituted by a pair of diodes having interconnected anodes constituting the output terminal and separate cathodes constituting the two input terminals, and an anode resistance, so that the output voltage obtainable at the interconnected anodes corresponds to the less positive one of the two input voltages.

4. A device as claimed in claim 1, including a discriminating device constituted by a pair of triodes having interconnected cathodes jointly in series with a cathode resistor, separate grids respectively constituting the two input terminals, and interconnected anodes, the arrangement being such as to cause the flow of grid current, and the output terminal being constituted by the interconnected cathodes, so as to produce an output voltage corresponding to the more positive one of the two input voltages.

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