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H. E. KALLMANN

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ELECTRON DISCHARGE DEVICE

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Fig. 1

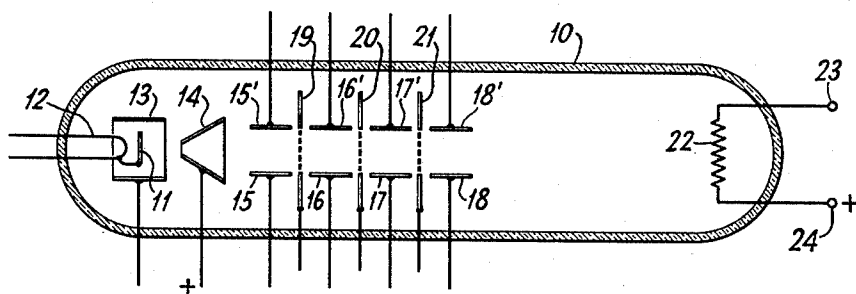
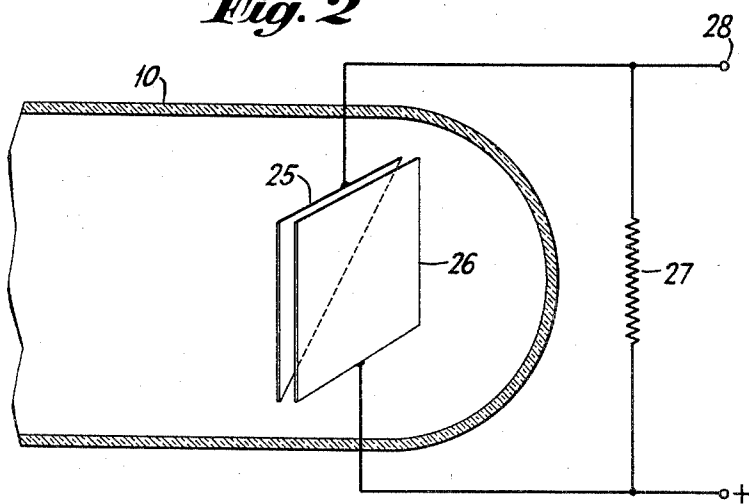


Fig. 2



BY

INVENTOR.
HEINZ ERWIN KALLMANN

H. E. Kallmann
ATTORNEY.

UNITED STATES PATENT OFFICE

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ELECTRON DISCHARGE DEVICE

Heinz Erwin Kallmann, Ealing, London, England,
 assignor to Electric & Musical Industries Limited,
 Hayes, England, a company of Great Britain

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9 Claims. (250—158)

This invention relates to electron discharge devices, and is more particularly, but not exclusively concerned with electrical methods and means for summing a series of magnitudes.

Various ways are possible in which such summation may be effected, but unless special precautions are taken it is often difficult to avoid unduly loading or coupling the sources of electromotive force corresponding to the various magnitudes to be summed.

According to the invention, this difficulty is overcome in a particularly simple manner by employing an electron discharge electrode by means of which electrons may be accelerated in the form of a beam to an anode, there being provided a plurality of substantially independent deflecting means to which deflecting potentials may be applied, said anode being of such a form that it provides an output dependent on the deflection of said beam so that the magnitude of said output represents the combined effect of said deflecting potentials.

In order that the said invention may be better understood, and more readily carried into effect, the same will now be described by way of example with reference to the accompanying drawing:

Figure 1 shows in diagrammatic form a tube in accordance with the invention in which a resistance target anode is employed, and

Figure 2 illustrates a modified form of target anode which may be used in the place of the resistance anode of Figure 1.

Referring to Figure 1, there are located within the evacuated envelope 10 an emitting cathode 11 heated by the heater element 12; a pair of electrodes 13 and 14, which when suitably biased have at least a rough focusing effect upon the stream of electrons emitted by the cathode 11, the electrode 14 also acting as an accelerating electrode; the pairs of deflecting plates 15—15', 16—16', 17—17', 18—18' shielded from one another by the screening electrodes 19, 20 and 21; and the target anode 22 formed by a strip of resistance material and having one end 24 connected to a point of positive potential with respect to the cathode, the other end 23 providing a point from which an output may be taken from the tube.

The deflecting potentials may be applied to the deflecting plates in various ways. Thus, if the sum of a number of potential differences is required, each potential difference may be applied across a pair of plates, in push-pull fashion, though this is not necessary: an essentially necessary condition if the undistorted sum of the potential differences is desired is that the sensi-

tivity of all the plates shall be substantially the same. If each potential difference is to be multiplied by a separate constant, this can easily be effected by suitable spacing of the deflection plates of the respective pairs or by choice of their distances from the target. The same effect may be achieved by suitably dimensioning the sizes of the plates. The deflection sensitivity of the plates may also be controlled by the application of suitable biasing potentials to the screening electrodes 19, 20, 21. Such potentials may also be employed to aid the focussing of the electron beam, though no particularly sharp or well defined spot is required upon the anode 22. For this reason the total accelerating potential may be kept quite small, with the advantage that a high deflecting sensitivity is obtained.

The operation of the anode 22 will be evident from the figure and the previous description. Thus the potential of the end 23 will always be less than that of the end 24 by the fall in potential due to the beam current flowing through that part of the anode between the point at which the beam impinges and the end 24. If as stated the anode is a uniform resistance strip, changes in potential will be proportional to changes in the angle of deflection of the beam.

In Figure 2 another form of anode is shown. This anode comprises a plate 25 partially overlapping the plate 26, and it is supposed that a very large spot is employed, so that part falls on either plate. Plate 26 is connected directly to a source of positive potential while plate 25 is connected to this source through the resistance 27. By means of this resistance an output is obtained at the output terminal 28, this output being determined by the extent to which the spot falls on the plate 25. If desired, the collecting anode may be in the form of a plate or sheet adapted to be rendered luminous by the impact of the electron beam so as to afford an indication of the combined effect of the deflecting potentials.

The invention is of particular application as part of a network which forms the subject-matter of co-pending British cognate applications Nos. 19096/38 and 4939/39, wherein it is necessary to provide means for the summation of a number of potentials or potential differences without appreciably coupling or loading the sources from which they are derived. The invention may also be applied to the synthesis of wave-shapes from the various harmonic components. In one particular form of this application the tube may possess a fluorescent screen and a deflection at right angles may be applied which is proportional

to the magnitude of the fundamental frequency, the target-anode being omitted. The invention is, of course, not limited to these examples, and it has application wherever positive or negative magnitudes required to be added: nor is it limited to the use of an anode providing an output directly proportional to the beam deflection; by suitably constructing the anode the device may be arranged to provide an output which is a predetermined function of the sum of variables.

I claim:

1. An electron discharge tube comprising an elongated envelope, an electron emitting cathode at one end of said envelope, a target electrode positioned at the other end of said envelope and in register with said cathode, an electrode system for focusing electrons from said cathode into a beam, said electrode system being positioned intermediate said cathode and said target electrode and in register therewith, at least three deflecting systems each adapted to be excited by an individual source of energy positioned intermediate said electrode system and said target electrode, said deflecting systems being adapted to additively deflect said beam of electrons in a single common plane across said target, and terminal means connected to said target electrode to derive an output potential in accordance with the deflection of said beam.
2. An electron discharge tube comprising an elongated envelope, an electron emitting cathode at one end of said envelope, a target electrode positioned at the other end of said envelope and in register with said cathode, an electrode system for focusing electrons from said cathode into a beam, said electrode system being positioned intermediate said cathode and said target electrode and in register therewith, at least three deflecting systems positioned intermediate said electrode system and said target electrode, said deflecting systems being adapted to additively deflect said beam of electrons in a single common plane across said target electrode, and electrostatic shielding members intermediate adjacent deflecting systems.
3. An electron discharge tube comprising an elongated envelope, an electron emitting cathode at one end of said envelope, a resistive target electrode positioned at the other end of said envelope and in register with said cathode, an electrode system for focusing electrons from said cathode into a beam, said electrode system being positioned intermediate said cathode and said target electrode and in register therewith, at least three deflecting systems positioned intermediate said electrode system and said resistive target electrode, said deflecting systems being adapted to additively deflect said beam of electrons in a single common plane across said target electrode, and terminal means connected to said target electrode to derive an output potential in accordance with the deflection of said beam.
4. An electron discharge tube comprising an elongated envelope, an electron emitting cathode at one end of said envelope, a resistive target electrode positioned at the other end of said envelope and in register with said cathode, an electrode system for focusing electrons from said cathode into a beam, said electrode system being positioned intermediate said cathode and said resistive target electrode and in register therewith, at least three deflecting systems positioned intermediate said electrode system and said resistive target electrode, said deflecting systems

being adapted to additively deflect said beam of electrons in a single common plane across said target electrode, and electrostatic shielding members intermediate adjacent deflecting systems.

5. An electron discharge tube comprising an elongated envelope, an electron emitting cathode at one end of said envelope, a resistive target electrode positioned at the other end of said envelope and in register with said cathode, an electrode system for focusing electrons from said cathode into a beam, said electrode system being positioned intermediate said cathode and said target electrode and in register therewith, and at least three electrostatic deflecting systems positioned intermediate said electrode system and said resistive target electrode, said electrostatic deflecting systems being adapted to additively deflect said beam of electrons in a single common plane across said target electrode, and means connected to said target electrode for deriving output potential proportional to the deflection of said beam.

6. An electron discharge tube comprising an elongated envelope, an electron emitting cathode at one end of said envelope, a resistive target electrode positioned at the other end of said envelope and in register with said cathode, an electrode system for focusing electrons from said cathode into a beam, said electrode system being positioned intermediate said cathode and said resistive target electrode and in register therewith, at least three electrostatic deflecting systems positioned intermediate said electrode system and said resistive target electrode, said electrostatic deflecting systems being adapted to deflect said beam of electrons in a single common plane across said target electrode, and electrostatic shielding members intermediate adjacent deflecting systems.

7. An electron discharge tube comprising an elongated envelope, an electron emitting cathode at one end of said envelope, a resistive target electrode positioned at the other end of said envelope and in register with said cathode, an electrode system for focusing electrons from said cathode into a beam, said electrode system being positioned intermediate said cathode and said resistive target electrode and in register therewith, at least three electrostatic deflecting systems positioned intermediate said electrode system and said resistive target electrode, said electrostatic deflecting systems being adapted to additively deflect said beam of electrons in a single common plane across said target electrode, electrostatic shielding members intermediate adjacent deflecting systems, and terminal means for applying potential across said resistive target electrode.

8. An electron discharge tube having an elongated envelope, an electron emitting envelope positioned at one end thereof, a cylindrical electrode surrounding said cathode, a conical accelerating electrode in register with said cathode and displaced longitudinally from said cylindrical electrode, a resistive target member positioned at the end of said envelope opposite to said cathode, said resistive electrode being in register with said cathode, at least three pairs of electrostatic deflecting plates, half of said plates lying in one common plane, the other half of said plates lying in a second common plane, said plates being positioned intermediate said conical electrode and said target electrode, and electrostatic shielding members positioned intermediate adjacent pairs of plates.

9. An electron discharge tube having an elongated envelope, an electron emitting envelope positioned at one end thereof, a cylindrical electrode surrounding said cathode, a conical accelerating electrode in register with said cathode and displaced longitudinally from said cylindrical electrode, a resistive target member positioned at the end of said envelope opposite to said cathode, said resistive electrode being in register with said cathode, at least three pairs of 10

electrostatic deflecting plates, half of said plates lying in one common plane, the other half of said plates lying in a second common plane, said plates being positioned intermediate said conical electrode and said target electrode, electrostatic shielding members positioned intermediate adjacent pairs of plates, and terminal means for applying potential drop across said target electrode.

HEINZ ERWIN KALLMANN.