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PULSE GENERATOR

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Fig. 1.

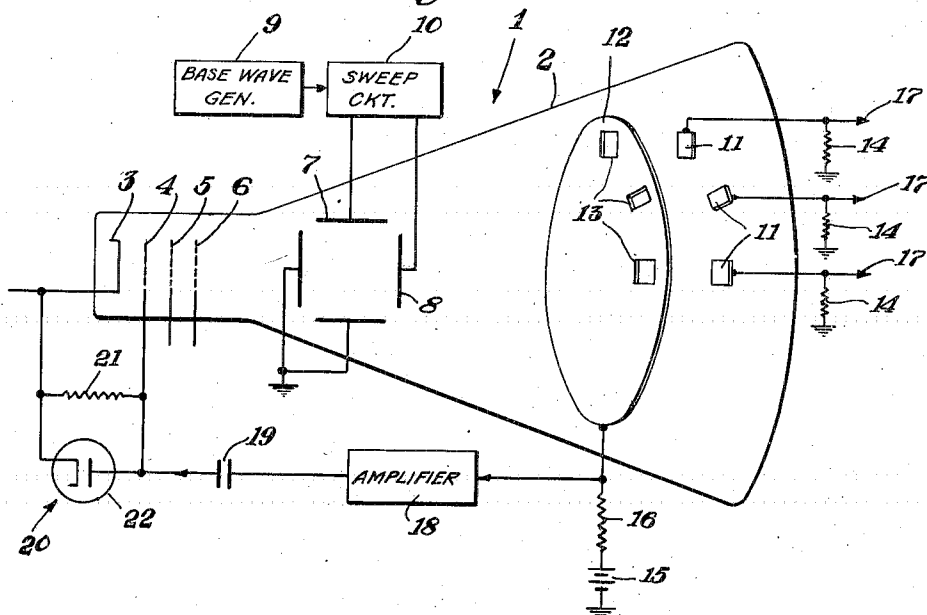
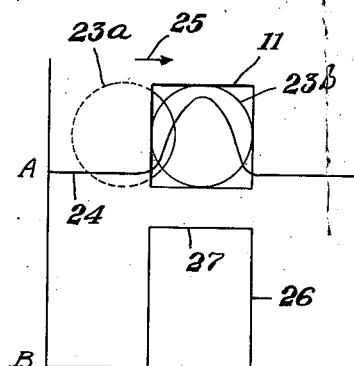


Fig. 2.



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PULSE GENERATOR

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5 Claims. (Cl. 315—21)

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This invention relates to electrical pulse generators, particularly of the type in which pulses are produced in a cathode ray tube by the deflection of electron beam with respect to a target element.

An object of the present invention is the provision of an improved pulse generator of the cathode ray tube type.

A feature of the present invention is the combination of a cathode ray tube pulse generator in which the produced pulses are fed to separate channels with the different channel pulses having a definite time relation to each other and in which use is made of feed-back to produce substantially rectilinear pulses having steep sides, and relatively high amplitude.

Another feature is the use, in a system of the type immediately hereinabove described, of secondary emission in conjunction with the feed-back and multi-channel pulse generation. A further feature is the provision, in such a system, of means adapted to maintain a relatively low current level in the beam between pulses, while providing a large current during pulse production.

The above-mentioned and other features and objects of this invention will become more apparent and the invention itself, though not necessarily defined by said features and objects, will be best understood, by reference to the following description of an embodiment of the invention taken in connection with the accompanying drawings, wherein:

Fig. 1 is a schematic diagram of a cathode ray tube pulse generator embodying my invention; and

Fig. 2 is a set of curves used in explaining the operation of the system of Fig. 1.

Referring now to Fig. 1, a cathode ray tube 1, has an envelope 2 within which is mounted a cathode 3, a control grid 4 and accelerating electrodes 5 and 6 respectively. The elements 3-6 serve to produce an electron beam which may be deflected by any suitable means, such as horizontal and vertical pairs of electrostatic deflection plates 7 and 8, respectively. These plates cause the beam to move in a circle when proper voltages are applied thereto. These voltages may be derived from a base wave generator 9 which produces a sine wave, the period of whose complete cycle is equal to one complete rotation of the beam, and whose output is fed to a sweep circuit 10, which may consist of a phase splitting arrangement to produce, at its output, two waves of equal amplitude and frequency 90° out

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of phase, the different phases being applied separately to sets of plates 7 and 8. The electron beam passing between said plates is thereby rotated so that it impinges successively on a plurality of target elements 11, which elements 11, being secondary electron emitters, give off secondary electrons when impinged upon. These secondary electrons are collected by a collector 12, which is a plate having apertures 13 therein arranged in front of the target elements 11 and through whose apertures 13 the beam passes each time it strikes one of the target elements 11.

Each of the target elements 11 is connected through a separate resistor 14 to ground, and from ground through a common source of potential 15 and common resistor 16 to the collector 12. Each of the target elements 11 is likewise connected to a separate output terminal 17. From the foregoing, it will be seen that when the beam strikes a target element, current flows in its associated one of the resistors 14 producing a voltage drop thereacross which is fed to the output terminal 17. The current flow from any of the target elements 11 also goes through common resistor 16, producing a drop of potential thereacross. The potentials developed across resistor 16 are fed back to the grid 4 to increase the amount of current in the beam. Since the pulses developed across resistor 16 are negative at the end thereof adjacent the collector 12, these pulses must be inverted and for this purpose, may be fed to an amplifier 18 which serves to invert the pulses. The inverted pulses are then fed through a condenser 19 to the grid 4 to produce a rapid rise in the beam current and therefore a rapid rise in the resultant output pulse produced by the beam.

To prevent the grid 4 from becoming more than slightly positive with respect to the cathode and thereby prevent harm to the target elements 11, use is made of a D. C. restorer 20, consisting of a resistor 21 and diode 22, arranged in parallel with each other and connected between the grid 4 and the cathode 3, with the anode of the diode toward grid 4. Each time the beam strikes one of the target elements producing a voltage across resistor 16, which is fed back through amplifier 18 to condenser 19, the condenser 19 is charged by current flowing through the diode 22, so that the potential of the condenser 19 opposes the potential fed back through amplifier 18 and limits the resultant potential between the grid 4 and cathode 3, so that at its highest level, the grid 4 is only slightly positive with respect to cathode 3. After the beam passes the target

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element, and no potential is being fed back through amplifier 18, the charge on condenser 19 operates to substantially reduce the value of the current in the beam. The condenser 19 slowly discharges through resistor 21 while the beam is travelling between target elements and is recharged to a given level each time the beam striking a target element causes energy to be fed back through amplifier 18.

Referring now to curve A of Fig. 2 representing conditions existing when no feed-back is employed, with the target element designated by the numeral 11, the beam designated by the numerals 23a and 23b and the current flow across one of the resistors 14 being designated by the numeral 24, it will be seen that as the beam moves into the target element in the direction indicated by the arrow 25, toward position 23a, current gradually rises, and when the beam is in position 23b in the center of the target, the current is at a maximum. As the beam moves out of the target element, the current slowly declines. The current pulse thus produced is of relatively small amplitude and its leading and trailing edges are rounded instead of steep. Referring now to curve B of Fig. 2, the pulse 26 there produced has steep leading and trailing edges. This is brought about by the use of feed-back. As the beam first strikes the target element, the feed-back causes the current to rise rapidly, instead of slowly as in curve A, until a maximum level 27 is reached, which level is maintained until the beam moves away from the target element 11.

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of my invention.

I claim:

1. A pulse generator comprising a cathode ray tube having beam forming means, beam deflecting means, a plurality of target elements over which the beam is adapted to be successively deflected, means responsive to the impingement of the beam on any of the target elements for increasing the current in said beam, said target elements being secondary electron emitters, a collector, and a common resistor arranged in series between each of the target elements and the collector, said responsive means including means for feeding back the voltages developed across said resistor to said beam forming means.

2. A pulse generator comprising a cathode ray tube having beam forming means, beam deflecting means, a plurality of target elements over which the beam is adapted to be successively deflected, means responsive to the impingement of the beam on any of the target elements for increasing the current in said beam, said beam forming means including a control grid and cathode, and said responsive means including means for feeding back voltages produced by the impingement of the beam on any of the target elements to said control grid, and means for limiting the potential developed between said control grid and cathode to thereby limit the maximum current in the beam to a predetermined value.

3. A pulse generator comprising a cathode ray tube having beam forming means, beam deflecting means, a plurality of target elements over

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which the beam is adapted to be successively deflected, means responsive to the impingement of the beam on any of the target elements for increasing the current in said beam, said beam forming means including a control grid and cathode, the responsive means including means for feeding back potentials produced by the impingement of the beam on any one of the target elements to said grid to increase the current in the beam, and means including a direct current level restorer for limiting the maximum positive potential of the control grid with respect to the cathode to thereby limit the maximum current in the beam.

4. A pulse generator comprising a cathode ray tube having beam forming means, beam deflecting means, a plurality of target elements over which the beam is adapted to be successively deflected, means responsive to the impingement of the beam on any of the target elements for increasing the current in said beam, said beam forming means including a control grid and cathode, the responsive means including means for feeding back potentials produced by the impingement of the beam on any one of the target elements to said grid to increase the current in the beam, and means including a direct current level restorer for limiting the maximum positive potential of the control grid with respect to the cathode to thereby limit the maximum current in the beam, said direct current restorer including a diode having its cathode connected to the cathode of the cathode ray tube and its anode connected to the grid of the cathode ray tube and a resistor arranged across the diode.

5. A pulse generator comprising a cathode ray tube having beam forming means, beam deflecting means, a plurality of target elements over which the beam is adapted to be successively deflected, means responsive to the impingement of the beam on any of the target elements for increasing the current in said beam, said beam forming means including a control grid and cathode, said target elements being secondary emitters, a collector associated with all of said target elements, means coupling each of said target elements to a separate output terminal, a plurality of resistors each coupled at one end thereof to one of the target elements, a common resistor, a common source of potential connected in series with the other end of said resistors and the collector, the responsive means including means for feeding back the voltages developed across said common resistor to said control grid including a phase inverting amplifier, and means for limiting the maximum positive potential of the control grid with respect to the cathode to limit the maximum current in the beam including a direct current restorer having a diode and a resistor coupled in parallel between the control grid and the cathode of said cathode ray tube.

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