

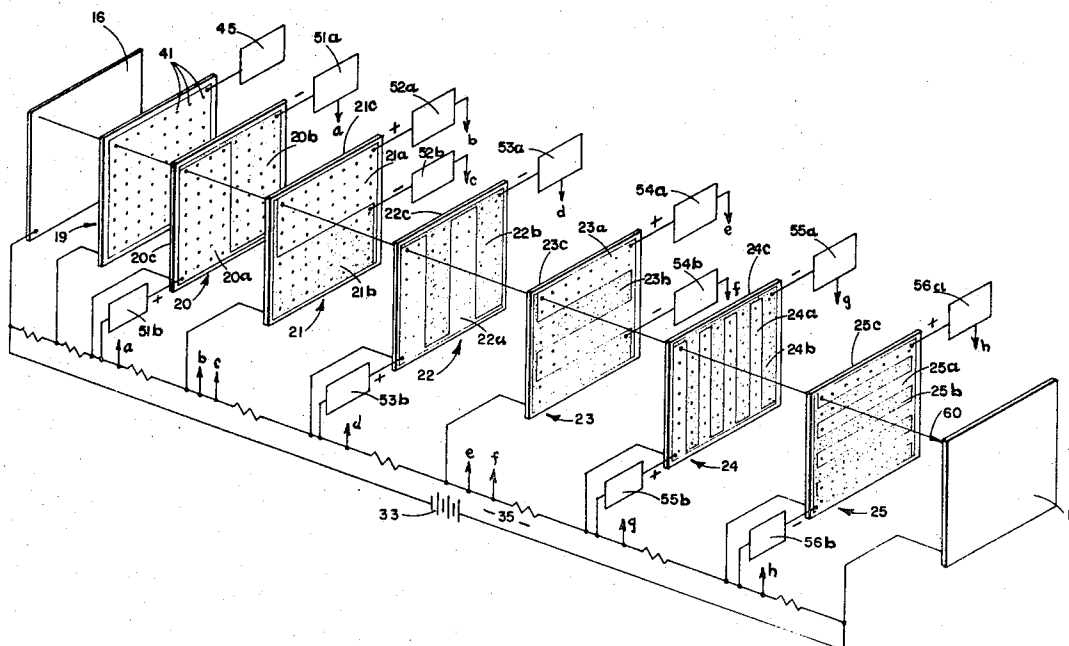
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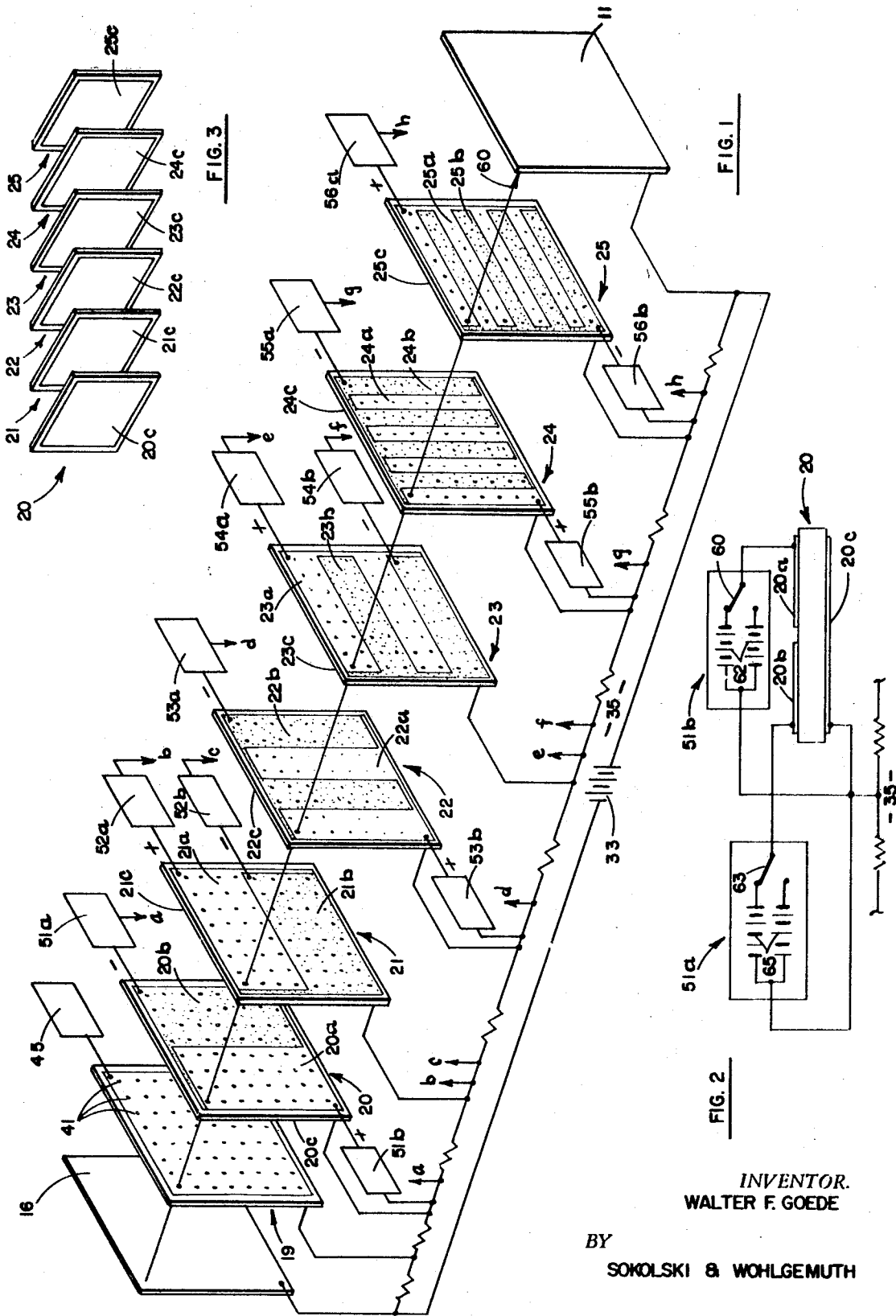
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UNITED STATES PATENTS
 3,421,042 1/1969 Hultberg 315/12
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[54] **ELECTRODE CONFIGURATION FOR ELECTRON BEAM SCANNER**
5 Claims, 3 Drawing Figs.

[52] U.S. Cl. 315/12,
 315/13 R
 [51] Int. Cl. H01J 29/41
 [50] Field of Search 315/12, 13
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ABSTRACT: An electron beam scanner has a plurality of dynode members between a cathode and a target for controlling the flow of electrons therebetween. Each dynode member has a pair of electrodes formed on one side thereof in a finger pattern. The other side of each dynode has a single electrode covering substantially the entire surface thereof, to which a fixed bias potential is supplied. The fixed bias potentials applied to the dynodes are graduated from dynode to dynode between the cathode and the target. Means are provided to alternatively either forward or reverse bias each of the finger pattern electrodes with respect to its associated oppositely positioned fixed biased electrode, thus controlling the flow of electrons through each dynode.





ELECTRODE CONFIGURATION FOR ELECTRON BEAM SCANNER

This invention relates to an electron beam scanner device and more particularly to such a device utilizing flat dynode members having finger pattern electrodes which are used to control the electron beam.

In U.S. Pat No. 3,408,532 for an Electron Beam Scanning Device assigned to Northrop Corporation the assignee of the instant application, a scanning device is described utilizing a plurality of flat dynode members having finger pattern electrodes deposited on both of the opposite surfaces thereof which are biased in response to an addressing signal to control an electron beam between the cathode and target. In this patent, similar finger patterns are arranged in overlying relationship on the opposite sides of each dynode with forward or reverse biasing potentials being selectively applied between such oppositely positioned electrode patterns.

This prior art electrode configuration, in view of the alternate switching involved between the two finger pattern halves on each dynode, is incapable of providing a "flooding" or activation of the entire target at a time. Such flooding is desirable to facilitate degassing by allowing all of the individual channels to be operated at a DC level before initiating switching operation, thus minimizing voltage breakdown problems. It further enables the use of the device as a storage member, such flooding operating as a "erase-read" signal.

The device of this invention provides an improvement over the electrode configuration of the aforementioned prior art patent wherein flooding of the screen is possible in addition to normal scanning operation and in which the following other additional advantages accrue: Firstly, the device of this invention uses a finger pattern on only one surface of the dynode thereby simplifying fabrication. Secondly, by utilizing a fixed reference bias on one side of the dynode, the switching voltages utilized over an average period of operation are significantly decreased thereby increasing the operational life of the device and lowering power dissipation as well as lessening voltage breakdown problems. In addition, the lowering of the maximum interstage voltage appearing at any place in the dynode stack increases the gain cutoff ratio considerably. Further, the use of the technique of this invention enables the ready conversion from single to multiple beam addressing, allowing the user with a selector switch to alternatively select 1, 2, 4, 8 or 16 beams interchangeably.

It is therefore the principal object of this invention to provide an improved dynode electrode configuration for an electron beam scanner.

Other objects of the invention will become apparent as the description proceeds in connection with the accompanying drawings of which,

FIG. 1 is a schematic drawing illustrating the operation of one embodiment of the device of the invention, and

FIG. 2 is a schematic drawing illustrating the application of bias control signals to a typical dynode of the device illustrated in FIG. 1, and

FIG. 3 is a schematic drawing illustrating the dynodes of the device of FIG. 1.

It is first to be noted that other than for the fixedly biased electrodes and the mode of application of control voltages to the finger pattern electrodes, that the device of this invention is otherwise similar in all respects to the device described in the aforementioned U.S. Pat. No. 3,408,532 and the disclosure of that patent is therefore incorporated herein by reference.

Briefly described, the device of the invention comprises a cathode for emitting electrons, a target plate for receiving electrons, and a plurality of dynode members sandwiched between these two elements for controlling the passage of electrons therebetween. Each of the dynodes has a pair of electrodes and a predetermined finger pattern on one surface thereof and an overall electrode covering substantially the entire opposite surface thereof. Affixed bias potentials are ap-

plied to each of the covering electrodes of the dynodes. These biasing potentials being graduated upwardly in going from the cathode to the target. To control the electron flow, means are provided to selectively switch forward or reverse biasing potentials between the finger pattern electrodes of each dynode and its associated fixed biased electrode. In this manner all or any portion of the target can be excited at a time.

Referring now to FIGS. 1 and 2, one embodiment of the device of the invention is illustrated. Electrons emitted from cathode 16 are modulated by control grid 19. The addressing of these electrons to target 11 is controlled by dynode members 20-25 through which the electrons must pass to get to the target. Dynodes 20-25 and control grid 19 have a plurality of apertures 41, the respective apertures on each of these members being aligned to form electron beam channels. Deposited on one of the surfaces of each of the dynodes are a pair of electrodes, 20a, 20b-25a, 25b respectively, these electrodes being arranged in a predetermined coded finger pattern. The surfaces of the dynodes opposite to those on which the finger pattern electrodes are formed are covered substantially in their entirety by single electrode members 20c-25c. The electrodes 20c-25c are in the form of sheets which cover an area substantially equal to and located opposite to their associated finger pattern electrodes as shown in FIGS. 2 and 3.

Control grid 19 may be modulated by means of a video signal source 45. A control voltage is applied to the finger patterns of each of the dynodes by means of an associated bias switching control unit 51a, 51b-56a, 56b. A voltage for accelerating the flow of electrons between cathode 16 and target 11 is provided by means of power source 33 connected therebetween, a voltage divider 35 being connected across this power source. A fixed voltage is supplied from voltage divider 35 to each of electrodes 20c-25c, this voltage being graduated from dynode to dynode between the cathode and the target.

Each of the bias switching control units 51a-56a is connected to the same tap on voltage divider 35 to which an associated one of electrodes 20c-25c is connected. Those connection points not directly made in FIG. 1 are indicated by the matching letters "a"- "h" shown coming respectively from the voltage divider and the bias switching units.

Referring now to FIG. 2 a typical one of the switching units i.e., the one associated with dynode 20 is shown for illustrative purposes. As can be seen, bias switching unit 51b includes a switching member 60 which alternatively can be actuated to connect the positive or negative terminal of power source 62 to finger pattern electrode 20a. Similarly bias switching unit 51a includes a switching element 63 which is capable of alternatively connecting the positive or negative terminal of power source 65 to finger pattern electrode 20b. Electrode 20c is connected to the common terminal of both power sources. Switching elements 60 and 63 would typically comprise semiconductor switching circuits which could be controlled by means of digital addressing logic as described in the aforementioned patent.

For illustrative purposes, the device is illustrated in FIGS. 1 and 2 with a particular bias potential being applied to the electrodes of each of the dynodes. For this example, the particular outputs of each of the bias switching circuits 51a, 51b-56a, 56b are indicated by appropriate plus and minus signs. For this particular actuation pattern, only a single electron beam 60 will pass through from cathode 16 to target 11, all other electron beam paths being blocked by one or more of the dynodes. It can be seen that by appropriately actuating the bias switching units in various manners, that any portion or portions, as well as the entire surface of target 11 can be activated. Thus, for example, all of the dynodes can be forward biased to "flood" the target. or the top half of the target can be activated by forward biasing electrode 21a, back biasing electrode 21b, and forward biasing all of the remaining dynode electrodes; etc.

The device of this invention thus provides great versatility in controlling the electron beam pattern. As already noted, it also provides significant advantages along such lines as economy of fabrication less power dissipation, less likelihood of voltage breakdown, and increased life expectancy.

I claim:

1. In an electron beam scanning device including an electron source, a target member mounted opposite said source, a power source connected between the target member and the electron source for providing an electron accelerating potential therebetween, a plurality of dynode members sandwiched between the electron source and the target member for controlling the flow of electrons therebetween, the electron source the target member and the dynode member being aligned opposite each other, the dynode members each having a plurality of aperture means formed therein for channeling the flow of electrons between the electron source and the target member,

the improvement wherein said dynode members each have a plurality of conductive electrodes arranged in a finger pattern on one of the broad surfaces thereof which are insulated from each other and a single conductive electrode covering substantially the entire opposite broad surface thereof, and comprising means for providing a fixed bias potential to each of said single electrodes and means for selectively alternatively applying a first or second potential to each of said finger pattern electrodes, only one of said potentials providing a forward bias with respect to the associated oppositely positioned single electrode.

2. The device of claim 1 wherein said means for selectively applying a first or second potential comprises means for apply-

ing a forward biasing potential with respect to the associated oppositely positioned single electrode to all of said finger pattern electrodes simultaneously.

3. The device of claim 1 wherein said means for selectively applying a first or second potential to each of said finger pattern electrodes comprises a first and second potential source, the positive terminal of said first source and the negative terminal of said second source being connected to said fixed bias potential means and switch means for alternatively connecting the negative terminal of said first source or the positive terminal of said second source to the associated finger pattern electrode.

4. The device of claim 1 wherein said means for providing a fixed bias potential to each of said single electrodes comprises a voltage divider having a plurality of taps connected across said power source, each of the taps of said voltage divider being connected to a separate one of said single electrodes so as to provide a graduated voltage from dynode member to dynode member between the electron source and the target member.

5. The device of claim 4 wherein said means for selectively applying a first or second potential to each of said finger pattern electrodes comprises a power supply including first and second potential sources the positive terminal of said first source and the negative terminal of said second source being connected to an associated one of said taps and switch means for alternatively connecting the negative terminal of said first source or the positive terminal of said second source to the associated finger pattern electrode.

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