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CATHODE RAY DEVICE

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This invention relates to image-to-signal translating devices and particularly to an electrode arrangement for a cathode ray tube of the type in which an optical image projected onto a plurality of photosensitive elements is transmuted by a scanning operation into a vision signal.

It has already been proposed to provide within the beam-receiving end of a cathode ray tube an array of elongated conductors, insulated from each other, the outer ends being rendered photo-emissive. When the photosensitized ends are differently illuminated as by the projection of an optical image thereon and the inner ends are swept by the cathode beam, secondary electrons are emitted from the inner ends which when collected on a suitably placed electrode, may be utilized as a signal.

Such apparatus in its known forms is open to certain defects. With known constructions it is impossible in practice to mount the individual conductors with the close spacing, for example one hundred to the inch, which is required for high resolution, and still keep them thoroughly insulated from each other. This is in part for the reason that when the front ends are rendered photosensitive or when the rear ends are rendered emissive of secondary electrons by an activation process in which suitable material is volatilized within the tube, the material is deposited on all surfaces which it can reach, the insulating supports for the conductors among others. Since the activating materials are usually semiconductive this deposition provides a current leakage path between adjacent conductors which acts as a partial short circuit and severely degrades the resolution obtainable with the apparatus. Furthermore, deposition, of this material in random manner on other insulating surfaces, for example, the inside walls of the tube, gives rise to stray fields which by induction in the conductors introduce distortion. Lastly, deposition of secondary-emissive material on any surface, whether insulating or conductive, may give rise to troublesome electron emission when these surfaces are impacted by stray electrons from any source.

Accordingly, it is an object of the invention to provide an improved electrode structure and arrangement for a cathode ray tube which shall be open to none of the defects above noted and in which the conductor support and other insulating or conducting surfaces are protected from the deposition of semi-conductive activating material.

The invention will be more fully understood from the following detailed description of a preferred embodiment thereof taken in conjunction with the appended drawing in which:

Fig. 1 is a diagrammatic view of a cathode ray tube in accordance with the invention as

viewed from the side, serving as a pick-up device for copy to be transmitted;

Fig. 2 is a diagrammatic view of the tube of Fig. 1 as viewed from above;

Fig. 3 is an enlarged side view of portions of the electrode assembly of Fig. 1;

Figs. 4 and 5 show the target assembly of the invention in various stages of its manufacture in accordance with a preferred method.

Referring now to Figs. 1 and 2 the cathode ray tube of the invention may comprise an evacuated vessel 10 containing an indirectly heated cathode 11, a beam-defining electrode 12, anodes 13 and 14 for accelerating and focussing a cathode beam originating at the cathode 11 toward and upon the target assembly, deflecting elements 15 and the target assembly described below. Operating potentials may be supplied to the electrodes from a suitable potential source such as a battery 18, the positive terminal of which may be grounded. The beam-receiving end of the tube may be provided with a conductive lining 16 which may be connected to an anode 14 or to another suitable potential source. A deflecting voltage of suitable wave form may be applied to the beam deflecting elements 15 by a sweep voltage generator which may be of any appropriate type and is indicated in the figure by the block 17.

In the preferred embodiment, the target assembly consists of a single row of discrete elements suitable for the scanning of one line image at a time. The structure as a whole is therefore elongated in one dimension (perpendicular to the paper in Fig. 1 and parallel to the paper in Fig. 2) but may be comparatively narrow in a direction perpendicular thereto. This permits the use if desired of an envelope whose beam-receiving end is flattened out into the form of a blunt wedge to conserve space, though an axially symmetrical bulb as shown is preferred.

An image of a single line of a sheet of typed copy 20, a map or the like may be projected as by a lens 21 onto the front ends of the elongated conductors of the target assembly, the copy sheet 20 being illuminated by light sources 22 and condenser lenses 23 as shown, stray light being prevented from reaching the tube by shields 24. If preferred, a transparent film may be substituted for the copy sheet, optical projection being carried out by transmitted light instead of by reflected light in well-known manner.

The target assembly of the invention, whose details are revealed in Figs. 3, 4 and 5, may consist of a parallel row of elongated wire conductors 30, preferably lying in the plane defined by the directions of projection and sweep of the cathode beam. These conductors, which may be of the order of 5 mils wide, may be spaced a like distance apart so that there are about one hundred of them to the inch. No attempt has

will be largely deposited on the hooked front ends 32 of the comb conductors. Due to the smallness of the opening 41 very little of the material will proceed as far as the insulating supporting rod 31 to be deposited thereon. Some of the material will also pass out of the front opening 44 to be deposited on the inside walls of the envelope 18 but due again to the narrowness of this opening and to the distance thereof from the wall of the vessel, the resulting deposit will be exceedingly attenuated and therefore comparatively harmless.

It is preferable to give to the rear ends of the comb a secondary electron emission characteristic which is greater than that afforded by the material of the comb conductors themselves, and so the rear ends 33 may be activated in like manner by volatilizing secondary emissive material in the region 45 defined by the rear end of the box 46 and its flange 48, and the rear plate 49. As before, much of this material will be deposited on the inside walls of this enclosure where it will be harmless. Of that which passes through the front opening, the major part will be deposited on the hooked rear ends 33 of the comb conductors, very little reaching the insulating rod 31. Due to the narrowness of the scanning aperture 47 and the comparatively long narrow path to the tube walls between the plate 49 and the flange 48, very little of the material will pass through the aperture or the passages to deposited upon the inside of the tube wall. Of the small amount of material which does reach the tube walls, substantially all of it will be deposited on the lining 16. Since this lining is conductive the deposit will be harmless as a semi-conductor, though, if substantial amounts were deposited, it might be harmful as a source of secondary electrons when bombarded by stray electrons. Therefore the construction of the invention, by restricting the deposit to minute quantities and localizing it in a region where beam electrons cannot strike it and stray electrons are rare, serves a useful purpose even when the tube is provided with the usual conductive lining 16.

In operation, a line image is projected through the slits 44 and 41 onto the hooked front ends 32 of the comb conductors 30. At the same time an electron beam projected through the slits 47 and 42 is caused by the deflecting field of the elements 15 to scan the rear ends 33 of the comb conductors. This process results in the emission of photoelectrons from the front ends of the comb conductors to change the potentials of the conductors in accordance with the intensity of the light focussed thereon so that the emission of secondary electrons from the rear ends 33 of the comb conductors upon the impact of the electrons of the primary beam varies in accordance with the light values of the line image and may constitute a signal which may be drawn off through the load impedance 51 to produce a signal voltage across this impedance to be amplified and transmitted or otherwise utilized in any desired manner.

It will be apparent that the arrangement and disposition of the conductors 30 of the comb, the insulating rod 31 which supports them and the shielding members 40, 43, 46 affords a compact and efficient structure for converting a line image into a vision signal with high efficiency, and with a minimum of degradation due to loss of resolution and distortion which might arise either from partial short-circuiting of the comb

conductors by semiconducting material deposited thereon, to induction on these conductors of unequal potentials due to random distributions of electric charges on the inside walls of the tube, or to spurious space charge effects due to the presence of photoemissive material in undesired localities.

Though described in connection with a cathode ray tube pick-up device for converting the image of a single line into vision signals, it will be apparent that certain features of the invention are also suitable for use in connection with a two dimensional array of conductors, and that the invention is by no means limited in its utility to image pick-up devices but may well find other uses.

What is claimed is:

1. In a cathode ray device comprising an insulating envelope and means within said envelope for projecting a cathode beam, a target assembly within said envelope in position to be impinged by said beam, which target assembly comprises a solid insulating support, a row of elongated conductors of self-supporting material fixed at points between their ends to said support and extending beyond said support in both directions for substantial fractions of their lengths, throughout which fractions they are not externally supported, and means for preventing the deposition of volatile material on said support in the course of the process of activating the ends of said conductors.

2. In a cathode ray device comprising an insulating envelope and means within said envelope for projecting a cathode beam, a target assembly within said envelope in position to be impinged by said beam, which target assembly comprises a solid insulating support, a row of elongated conductors of self-supporting material fixed at points between their ends to said support and extending beyond said support for substantial fractions of their lengths, throughout which fractions they are not externally supported, and a shield of conductive material substantially enclosing all of said conductors, said shield being provided with a slit-like opening adjacent to the outer row of conductor ends to admit the projection of an image onto said ends and another slit-like opening adjacent to the inner row of conductor ends to admit said cathode beam to said inner ends while it is being swept along the row of said inner ends.

3. In a cathode ray device comprising an insulating envelope and means within said envelope for projecting a cathode beam, a target assembly within said envelope in position to be impinged by said beam, which target assembly comprises a solid insulating support, a row of elongated conductors of self-supporting material fixed at points between their ends to said support and extending beyond said support for substantial fractions of their lengths, throughout which fractions they are not externally supported, a box-like shield of conductive material substantially enclosing all of said conductors, said shield being provided with a slit-like opening adjacent to the outer row of conductor ends to admit the projection of an image onto said ends and another slit-like opening adjacent to the inner row of conductor ends to admit said cathode beam to said inner ends while it is being swept along the row of said inner ends, a plate-like electrode provided with a slit-like opening to admit said image adjacent to said outer row, the separa-

tion of said shield and said electrode being small compared with their dimensions, the space between said shield and said electrode constituting a substantially closed region of such configuration that sensitizing material may be volatilized therein without substantial deposition on any insulating surface.

4. In a cathode ray device comprising an insulating envelope and means within said envelope for projecting a cathode beam, a target assembly within said envelope in position to be impinged by said beam, which target assembly comprises a plurality of elongated conductors aligned substantially parallel with the axis of said envelope, the outer ends of said conductors being photoemissive and the inner ends being emissive of secondary electrons in a ratio greater than unity, a box-like shield of conductive material substantially enclosing all of said conductors, said shield being provided with a slit-like opening adjacent to the outer row of conductor ends to admit the projection of an image onto said ends, and another slit-like opening adjacent to the inner row of conductor ends to admit said cathode beam to said inner ends while it is being swept over said inner ends, a plate-like electrode provided with an opening adjacent to said inner row to admit said beam, a plate-like electrode provided with an opening adjacent to said outer row to admit said image, each of said electrodes extending substantially throughout the cross section of said envelope to provide a substantially closed region adjacent to said outer ends and another substantially closed region adjacent to said inner ends, each of said regions being such that sensitizing material may be volatilized therein without substantial deposition on any insulating surface.

5. A cathode ray device which comprises an insulating envelope, means within said envelope for projecting a cathode beam, a target assembly within said envelope for said cathode beam, which target assembly comprises a plurality of elongated conductors arranged parallel to each other in a closely spaced row, each of said conductors being unsupported at its ends, a box-like shield of conductive material occupying at least the major part of the cross-sectional area of said envelope and surrounding at least the major part of the length of each of said elements, said box-like shield being provided with a slit-like opening adjacent to a row of ends of said conductors and another slit-like opening adjacent to the row of other ends of said conductors, means for sweeping said cathode beam along one row of said conductor ends, and means, including said beam sweeping means, for deriving vision signals dependent on the light-tone values of an image projected on the other row of conductor ends.

6. A cathode ray device which comprises a closed vessel, a plurality of closely spaced, mutually insulated conductors arranged in a single row in said vessel, one part of each of said conductors being emissive of secondary electrons upon bombardment by primary electrons and another part of each of said conductors being photosensitive, a metallic member disposed to shield the row of said photosensitive parts from stray electrical influences, said metallic member being disposed to collect photoelectrons emitted by said conductors and being provided with a slit-like opening disposed to permit a line image to be formed on said photosensitive ends by projection of light rays through said opening, another

metallic member disposed to shield the row of secondary emissive parts from stray electrical influences, said metallic member being disposed to collect secondary electrons emitted by said conductors and being provided with a slot disposed to permit said parts to be scanned by a cathode ray projected through said slot, and means for withdrawing secondary electrons collected by said second-named metallic member.

7. In apparatus for deriving vision signals from an optical image, an insulating support, a plurality of discrete closely spaced conductors fixed to said insulating support and extending beyond said support in both directions with their ends lying in a plane in position to have an optical image focussed on said ends, said ends being activated to render them photoemissive, means for preventing deposition of volatile material on said support in the course of the photosensitization process of said conductor ends, and means for drawing signal currents from each of said conductors in rapid succession.

8. A target assembly for use in an electron discharge device which comprises an insulating support, a plurality of substantially parallel elongated conductors fixed at points between their ends to said support, each of said conductors extending beyond said support in both directions for a part of its length and being unsupported externally throughout each of said parts, an end of each conductor being bent into a small hook.

9. An electric-beam device comprising a closed vessel, a target for the beam comprising a comb-like structure with electrically conducting teeth extending from an insulating backing portion, a coating of electron emitting material on the outermost parts only of said teeth, and a shielding element having an elongated opening the periphery of which is closely adjacent to said coated parts of said teeth, the space between adjacent ones of said teeth and between said periphery and said teeth being small and the distance between said coating and said backing member being relatively great, whereby negligible amounts, at most, of said coating material in vapor form used in the process of producing said coating can pass through said spaces to said insulating backing portion and be deposited thereon between the bases of said teeth.

10. The combination of claim 9 in which the beam is electronic and passes through an aperture in an accelerating electrode before impinging on said target, with means for maintaining said shielding element and said accelerating electrode at substantially the same potential.

11. A target arrangement for use in an electric-beam device comprising an insulating support, a linear array of discrete, substantially parallel, closely spaced conductive elements attached to said insulating support and extending therefrom, without other support, a distance many times greater than that between adjacent elements, and means forming a nearly closed space at the outermost portions of said conducting elements, said means comprising a boundary wall for said space having an opening therein the periphery of which is closely adjacent said outermost portions, said space being adapted to have sensitizing vapor released therein for sensitizing said outermost portions, a boundary wall of said space having a second opening through which an energizing beam may pass to said outermost portions of said conductive elements.

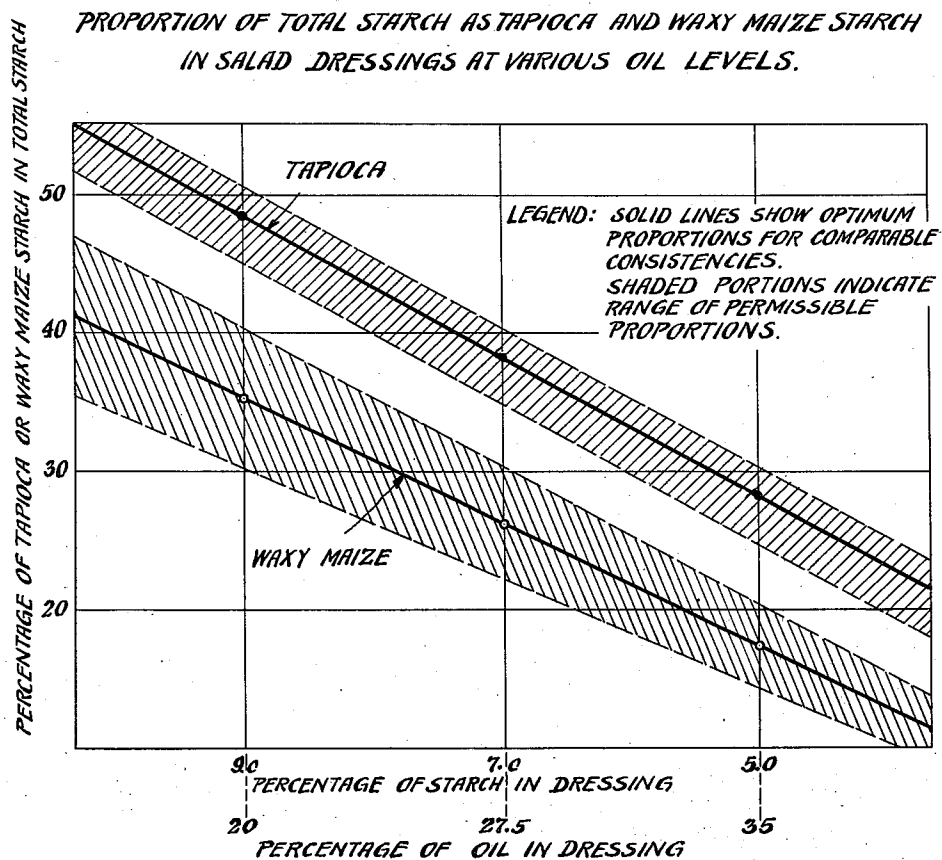
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SALAD DRESSING

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