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COLOR TELEVISION TUBE

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This invention relates to cathode ray tubes for producing colored pictures.

Colored pictures have been produced by cathode ray tubes by rotating color filters in front of the fluorescent screen of a tube in synchronism with the production of "color" signals at the pick-up tube, but rotating parts in a television system are objectionable and should be avoided wherever possible.

It is an object of this invention to produce colored television pictures without mechanically moving parts.

Another object of the invention is to produce colored pictures solely by electron means.

Another object of the invention is to produce colored pictures by passing white light through an alkali metal halide target of a cathode ray beam tube and producing in the target a series of laminar dark traces spaced apart to produce color by light wave interference.

Other objects of the invention will appear in the following specification, reference being had to the drawings, in which:

Figure 1 is a sectional view of a cathode ray beam tube of my invention.

Figure 2 is an enlarged section of the screen illustrating the theory of operation.

It is well known that an alkali halide screen exhibits dark traces under bombardment by electrons, such as produced by a cathode ray beam. It is now generally thought that these dark traces are produced by electrons bombarded from the crystal lattice of the halide anion and that these displaced electrons absorb energy from light incident thereon, which moves the electrons to a place in the screen having excess of positive potential. This excess of positive potential may be due to non-uniform distribution of the positive alkali cations, or it may be produced by electric fields applied to the screen for this purpose. As heretofore used, particularly in radar, the dark traces were used merely to produce visible signals giving position of an object and the movement of the electrons back to a bound position in the lattice had no function except to determine the length of time the dark trace was visible. In my invention I cause the electrons to move through the screen in successive waves, so that the series of dark sheets in the target product light wave interference that enables one to produce any desired color by control of the frequency of production of such lines.

Any desired tube may be used for producing colored pictures, but in Fig. 1 I have shown more or less schematically a tube having my improved

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target T. This tube has the usual evacuated envelope 1 containing a screen electrode 2 having a slit aperture, a grid electrode 3, an indirectly heated cathode 4 shown grounded and a first anode 5. A second anode 6 may also be used. In front of the second anode 6 may be placed electrostatic vertical deflection plates 7 and 8 for scanning the cathode ray beam vertically over the raster of the target T, line by line. No horizontal deflection is required, as the beam is spread out the full length of a line, as by use of long slits for apertures in the various electrodes, or in any other way. The beam is preferably thick enough to cover several lines in a vertical direction of the target.

The target T may consist of a plate 9 of any alkali metal halide, such as potassium chloride, for example. Preferably, the target also has a transparent metal film 10 in front of the potassium chloride plate, which has a suitable positive potential applied thereto for controlling the passage of the sheet of electrons through the plate.

The operation of the invention is as follows:

A suitable generator 11 is connected to the grid 3 to block the cathode beam or otherwise vary its intensity at definite frequencies. As the beam sweeps from top to bottom over the potassium chloride screen 9, electrons enter the screen and these, or electrons displaced thereby, or both, move toward the positive plate 10. These electrons absorb light energy coming from the fluorescent screen 12 of kinescope 13 and produce dark traces, which are viewed by the observer's eye at E. The interruption of the beam by the grid produces a series of electrons moving in spaced sheets 14 toward the positive plate 10. When the cathode beam is interrupted or otherwise modulated at a certain frequency while the beam covers each element area of the raster, the spacing of the sheets 14 in the target screen will produce interference to the light passing through the target and a certain color will be produced, say red, as in the well-known Lippmann system of color photography. By changing the frequency of the generator 11, the frequency of production of free electrons, and therefore the spacing of the dark sheets, moving through the screen 9 will be changed to another distance, which will produce by interference another color, say green. In this way, one produces color from white light coming from the kinescope phosphor screen 12.

Usually a transmitting pick-up tube scans an object to be televised one complete frame for transmitting signals proportional to, say, the red

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colors in the object. At the receiver the generator 11 would be controlled in synchronism with the distant pick-up tube, so that it likewise would maintain the frequency of interruption of the cathode ray beam for one complete frame scansion. Then, during the next frame scansion at the transmitter, the generator 11 at the receiver would be operated to interrupt the cathode ray beam at a frequency to produce the color being televised by the pick-up tube, say green. In the next scansion, if blue is being transmitted from the pick-up tube, the generator 11 will operate at such frequency that the interference produced by the dark sheets 14 in the target will produce blue color.

While I have described potassium chloride as the alkali halide from which the dark trace target is constructed, it may be also constructed of the fluorides, chlorides, bromides and iodides of lithium, sodium, potassium, rubidium and caesium, as these are known to produce similar results. Also, other ways of producing interfering barriers to light waves may be employed in cathode ray tubes for converting white light to various colors.

I claim:

1. A color television device comprising, a cathode ray beam tube having an alkali halide target, and a cathode ray beam gun, field producing means for scanning the beam of said gun over one surface of said target to produce dark traces at said surface, a transparent positive potential electrode on the other surface of the target, means connected to said cathode ray beam gun for interrupting the beam a predetermined constant frequency during one scansion of the beam over the target and at a different constant frequency during each of a predetermined number of successive scansions and a source of polychromatic light positioned to pass light through the target.

2. The method of producing color television pictures, said method comprising the steps of, successively scanning a cathode ray beam of constant intensity over one side of an alkali halide target, interrupting the electron beam at different predetermined frequencies while the beam covers each elemental area of said target surface, and simultaneously passing a visual image of substantially white light through said target to produce a colored picture of said image.

3. The method of producing a colored television picture from black and white images produced on the luminescent screen of a television tube, said method comprising the steps of, passing the light of said black and white images through an alkali halide target, scanning one side of said alkali halide target with a cathode ray beam of constant intensity, interrupting the electron beam at different predetermined frequencies while the beam covers each elemental area of said target surface throughout respectively each of said scansions to produce a colored picture of said images.

4. The method of producing color television images, said method comprising the steps of,

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producing on a white luminescent screen of a television viewing tube a visual image on each frame scansion corresponding respectively to a different color signal, passing the light of said images through an alkali halide target, scanning in synchronism with the frame scanning of the television viewing tube one side of said alkali halide target with a cathode ray beam to produce dark traces on said target surface, sequentially interrupting said cathode ray beam at a constant frequency for each frame scansion of said viewing tube, the frequency of interruption for each frame scansion differing from each of the others, and producing an electric field at the other surface of the target to move said dark traces through said target.

5. A color television device comprising, a light valve tube including an alkali halide target and electron gun for producing an electron beam within said tube, field producing means for frame scanning the electron beam over one surface of said target to produce dark traces at said surface, a transparent electrode on the other surface of said target, lead means contacting said electrode for connecting said transparent electrode to a source of potential during tube operation, to move the dark traces through said target, a source of modulated polychromatic light positioned to pass light through said target, and means connected to said electron gun for interrupting said beam at predetermined frequencies for each frame scanning of said target.

6. A color television device comprising, a light valve tube including an alkali halide target and electron gun for producing an electron beam within said tube, field producing means for frame scanning the electron beam over one surface of said target to produce dark traces at said surface, a transparent electrode on the other surface of said target, lead means contacting said electrode for connecting said transparent electrode to a source of potential during tube operation, to move the dark traces through said target, a television viewing tube having a white fluorescent screen and means responsive to sequential television color signals for producing on said fluorescent screen during each frame scansion of said halide target an image corresponding to signals representing a single color, and means connected to said electron gun for interrupting said beam at predetermined frequencies for each frame scanning of said targets.

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