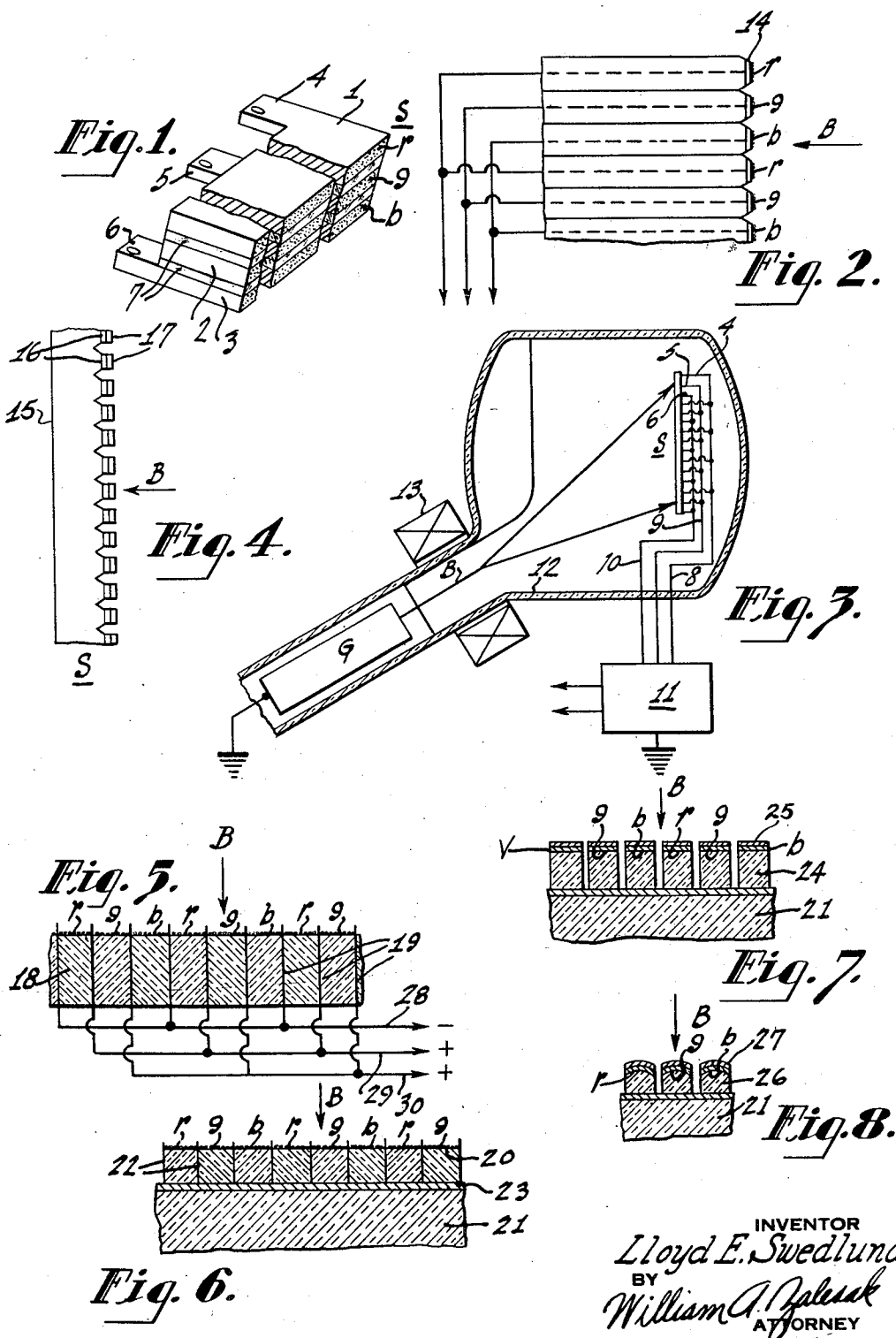


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COLOR TELEVISION TUBE
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COLOR TELEVISION TUBE

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This invention relates to cathode ray tubes for producing pictures in color.

In color television, signals corresponding in intensity to the colors of the light incident on the target are transmitted either in succession or simultaneously. At the receiver the phosphor screen reproduces the light in proportion to the intensities of the signals and in the sequential system the individual colors are produced by viewing the phosphor screen through color filters rotating in synchronism with the color scansions at the transmitter. This introduces movements of parts having inertia which make the controls difficult. Also, the filters necessarily absorb a high percentage of the light energy. Also, in simultaneous systems it is desirable to use three reproducing tubes to blend the images by optical projection.

An improvement over a mechanical type of color producer is disclosed in the patent granted to Humboldt W. Leverenz, February 9, 1943, No. 2,310,863. In this disclosure, the screen comprises a plurality of strips of mica, glass, or other insulation material coated on one of their edges with a phosphor material adapted to fluoresce in light of different colors such as red, green and blue. These strips are arranged so that the screen consists of red, green and blue phosphors in succession from one side of the screen to the other in the direction of frame scansion. This is a satisfactory improvement but great accuracy is required in the scansion of the target by the beam to keep it on the proper strip edge. If care is not taken in constructing and operating the tube, the beam tends to pass from one strip to another before the end of the color scansion or else lands on two strips simultaneously.

It is an object of this invention to provide a novel type of phosphor screen for color television cathode ray beam tubes having different phosphor materials arranged for sequential scansion by the beam with voltage controls to confine the beam to the desired phosphor.

Another object of the invention is to produce a target for cathode ray tubes for producing color pictures that can be readily made in quantity and which will accurately reproduce the desired colors with minimum care and expense in manufacturing and operating the tube.

It is another object of this invention to produce simultaneously in the kinescope tube the component colors so flicker is avoided without color overlap.

Other objects of the invention will appear in

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the following specification with reference to the drawing, in which:

Fig. 1 is a perspective view, greatly enlarged of a small section of the screen of the tube of my invention;

Fig. 2 is an enlarged end view of a small section of a modified form of screen;

Fig. 3 is a diagrammatic illustration of a cathode ray tube embodying the screen of my invention;

Fig. 4 shows another modified form of screen;

Fig. 5 is a section of a modified form of the phosphor screen;

Fig. 6 is a section of a modification; and

Figs. 7 and 8 are sections of further modifications.

Referring to Fig. 1 of the drawing, the screen S comprises a plurality of metal strips 1, 2, and 3 having connector tabs 4, 5, and 6. Thin non-conducting strips 7 insulate the adjacent sectors. The metal strips are sufficiently thin to be substantially equal to the diameter of the beam spot. Hence, a large number of the strips is required to make up the entire screen. The edges of the gun side of the plurality of strips 1 are coated with a phosphor *r* adapted to fluoresce in red light, the edges of the strips 2 are coated with a phosphor *g* that fluoresces green, and the strips 3 are coated with a phosphor *b* that fluoresces in blue. The strips for the colors may be separately stacked and the color coatings applied by spraying or the like and when dried or set they may be separated and arranged with the colors in sequence as shown in Fig. 1. Other colors may be used to approximate the colors of the picture but the ones mentioned are commonly used for the purpose. Phosphors for producing these colors are known in the art and are disclosed in the patent to Leverenz as aforesaid.

The tabs 4 are all connected together by a conductor 8, tabs 5 are similarly connected to conductor 9 and tabs 6 are connected to conductor 10 (Fig. 3). These conductors are connected to a commutator device 11 operating in proper relation to the transmitter scansion so that conductor 8 is made positive and conductors 9 and 10 are negative relative to the gun cathode C when the "red" signals are being received. Thus, the beam cannot jump to or extend over the adjacent phosphors of different colors but is strictly confined to the red phosphor *r*. Similarly, when "green" signals are being received the conductor 9 will be made positive and conductors 8 and 10 are made negative. This rigidly confines the

beam to the green phosphor edges and only green light can be produced and so on.

Since the improved screen as described is opaque the luminous image on the phosphor coatings is observed from the gun side as indicated in Fig. 3, which shows diagrammatically the various tube elements. The gun G may be of the usual construction having a focusing system for forming and focusing the beam B on the picture elements of the phosphor.

The inner walls of the tube may have the usual wall coating anode 12 or equivalent. Deflection yoke 13 may comprise coils having fields at right angles to each other and to the axis of the gun for vertical and horizontal deflection of the beam to scan the screen S composed of the phosphor coated metal strips. Other known types of scan-sion may, of course, be used. Electrostatic deflecting means as well as electromagnetic focusing may be used when desired as my improved screen is not limited to any particular type of cathode ray tube.

Instead of making the composite screen of metal strips, they may be made of insulation and preferably beveled at the edges to provide spacing between the metal films 14 on which the phosphors *r*, *g*, and *b* are located in sequence (Fig. 2). The metal film strips located beneath the phosphors that produce the same colors are connected together and operated as described in connection with Figs. 1 and 3. The connections would most readily be made at the end of strips *r*, *g*, and *b*, as indicated.

The luminescent image may be observed from the side opposite to the scanned side by making the conducting strips of transparent films. This modification is shown in Fig. 4 in which a transparent glass plate 15 has a thin transparent coating of metal applied by known processes. One process is called Corning "ER Coating" and another produces a film having the trade name "Nesa Coating." The coating is converted into strips 16, preferably, by scratching or ruling. The strips 16 are coated with the red, green, and blue phosphor materials designated 17. The metal film strips would be connected as in Fig. 2 for operation as described in connection with Fig. 3 except that the image may be viewed from the side opposite the gun.

In the modification of Fig. 5, the strips 18 are made of transparent material such as glass and the voltage control strips 19 are sandwiched between them. These metal strips are very thin and may either extend only to the exterior surface of the red, green, and blue phosphors *r*, *g*, and *b* or extend therebeyond as shown.

In Fig. 6 the transparent strips 20 bearing the red, green, and blue phosphors *r*, *g*, and *b* are rectangular in cross-section and are applied to a transparent base 21. The voltage strips 22 are connected as in Fig. 2 at their ends which lie parallel to the plane of the drawing. The strips 20 are cemented to the transparent vase 21 by so-called glass solder 23 which is also transparent.

In the modifications shown in Fig. 5, the control potentials would be operated in the following way:

When "green" signals, for example, are received the conductor 28 will be negative, and the other two conductors 29 and 30 will be slightly positive to, or at about the same potential as, the phosphor screen. This, it will be observed, places the green phosphor in the middle of the positive potential area and farthest from the negative potential area. The field distribution is such that

the beam strikes the green area only. At the next instant the "red" phosphor, for example, will be in a similar situation and the beam will strike the "red" phosphor. The blue signals will operate in a similar way. The potentials of the conductors 28, 29 and 30 will be determined by the commutating device run in synchronism with the signals.

The modification in Fig. 6 will operate in the same way as that in Fig. 5.

In Fig. 7 the transparent strips 24 are isolated as by spacing them apart and the voltage control strips consist of metal films 25 on top of the red, green, and blue phosphors *r*, *g*, and *b*. These films may be aluminum and may be deposited as from aluminum vapor in known ways. The metal films are transparent to electrons of around 3000 volt velocity and higher so the beam reaches the phosphors lying underneath. The thin conducting film, however, may be made with considerable light reflecting power so the light passing through the transparent strips 24 and base 21 can be increased.

In Fig. 8 the transparent strips 26 have a curved surfacing facing the beam B and hence the phosphors *r*, *g*, and *b* and the overlying aluminum films 27 take the same curvature. This reflects the light in more or less parallel rays toward the observer.

In the modifications shown in Figs. 7 and 8 the conducting films 25 and 27 will be connected to the commutating device as in Fig. 2 and the operation will be similar.

The screens in Figs. 4 to 8 inclusive have the advantage that the image may be viewed from the side opposite the gun. They also have the further advantage that their capacitance is less which requires less charging time and less amplifying power.

The phosphors may be applied in other ways, for example, by printing and silk screen processes, or by electrostatic deposition. In the latter process the strip films to be coated with the phosphor, say red, would have the proper potential to attract the phosphor particles blown thereon while the green and blue phosphors would have potentials repelling the phosphor powder. By changing the potentials of the film strips each color may be deposited.

It is practical to operate the screens with simultaneous production of the three colors instead of by successive color scan-sions. In this case the transmitter would send out in known ways the "red," "green," and "blue" signals simultaneously for each picture element and these signals would be applied to the proper color strips. The combined signal voltages would be applied to the grid of the gun to intensity modulate the beam in a known way. The beam should then cover at least three color strips so that each strip would receive the electrons of the beam in proportion to the "color" potential applied to the color strips.

My improved targets not only eliminate moving mechanical parts but they also obtain substantially 100% efficiency in converting the signal energy into light at the viewer's eye whereas the rotating filter method converts only about 10% of the signal energy to light of the desired colors.

I have disclosed a number of embodiments of my invention but they have been given by way of example and various other modifications may be used without departing from the spirit of the invention.

What I claim as new is:

1. A cathode ray tube for color television hav-

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ing a screen comprising a plurality of strips transparent to light, different color producing phosphors on said strips positioned in sequence with respect to color and conducting films on said phosphors transparent to beam electrons above a predetermined velocity, said metal films being spaced from each other, the metal films over the phosphors that produce the same color being electrically connected.

2. A cathode ray tube for color television having a screen comprising a plurality of strips transparent to light, different color producing phosphors on said strips positioned in sequence with respect to color, conducting films on said phosphors transparent to beam electrons above a predetermined velocity, said films being con-

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vex toward the beam and being spaced from each other, the conducting films over the phosphors that produce the same color being electrically connected.

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