

Jan. 5, 1943.

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2,307,188

TELEVISION SYSTEM

Filed Nov. 30, 1940

2 Sheets-Sheet 1

FIG. 1.

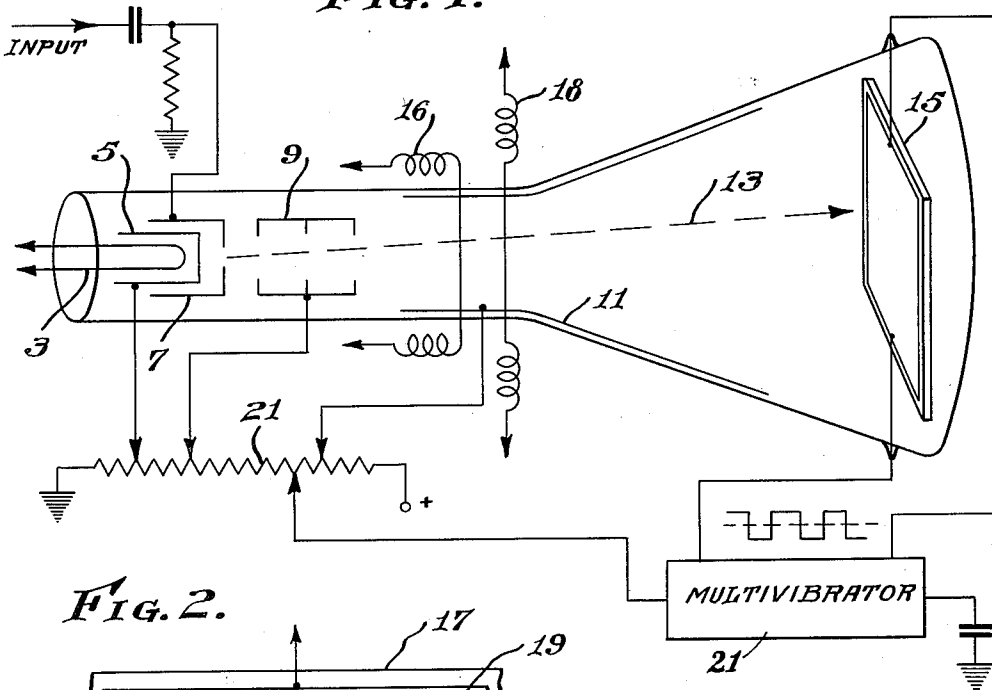


FIG. 2.

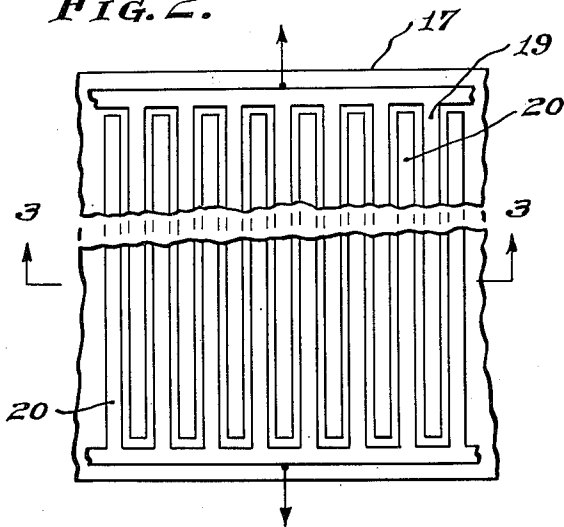


FIG. 3.

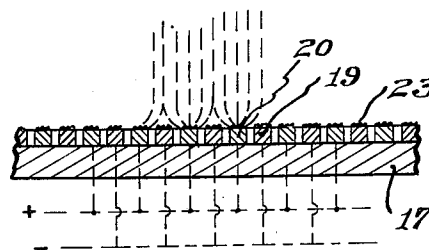
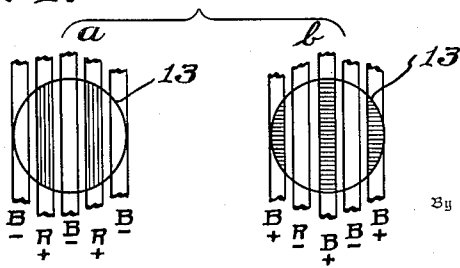


FIG. 4.



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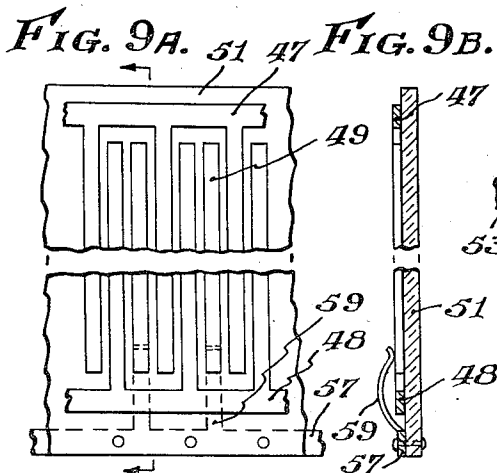
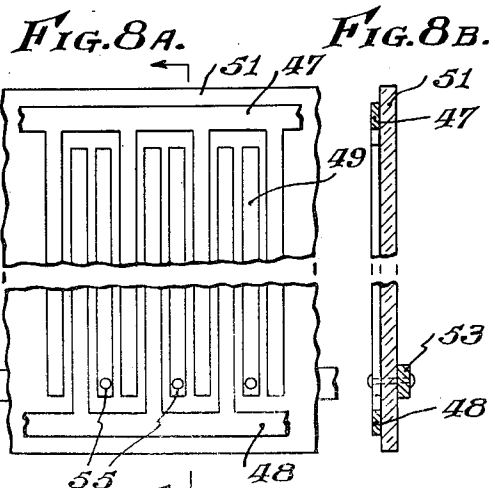
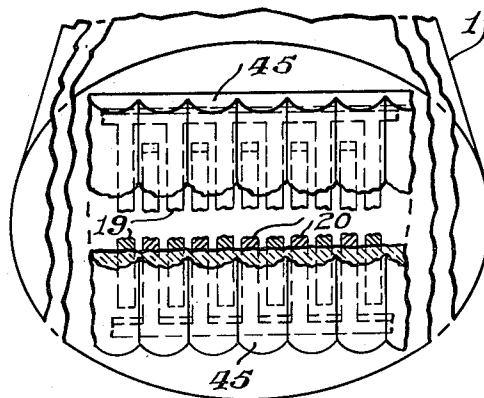
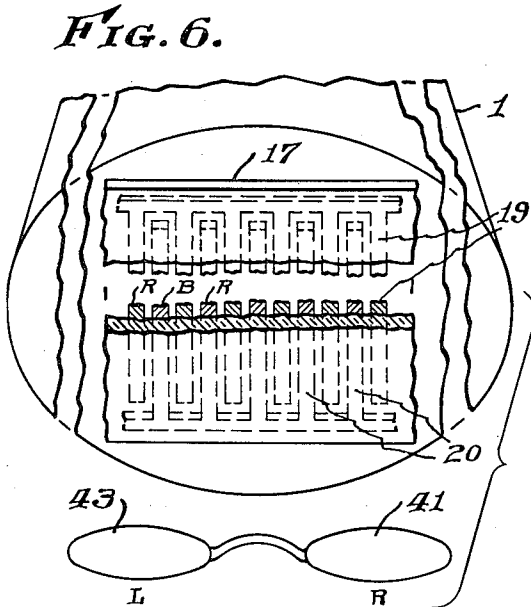
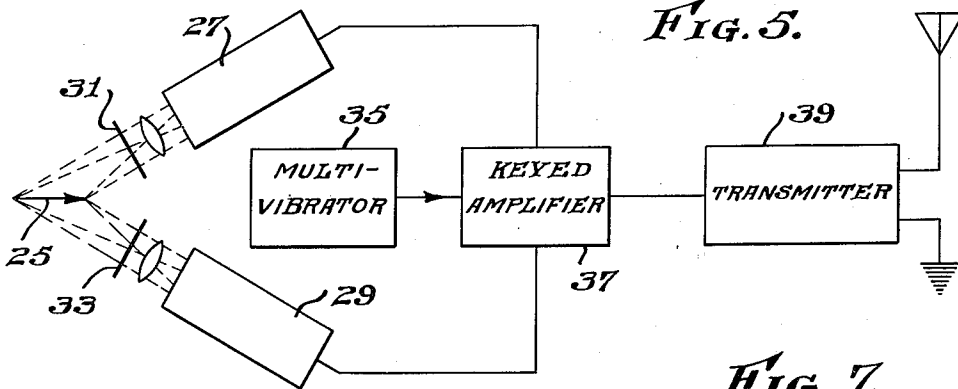
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TELEVISION SYSTEM

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2 Sheets-Sheet 2



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2,307,188

TELEVISION SYSTEM

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Application November 30, 1940, Serial No. 367,887

3 Claims. (Cl. 178—5.4)

This invention relates to television systems and more particularly to a method and means for producing television images in their natural color or in perspective.

In so-called "additive" systems wherein it is desired to produce images in their natural color, it is necessary to superimpose a plurality of images representative of the object, each of the images representing one of the primary colors. By superimposing each of the images on the other there is produced a composite image having colors and shades like that of the object.

For the reproduction of television images in their natural color, it has been proposed to employ a picture screen having a plurality of extremely narrow adjacent strips of fluorescent material and providing every third strip with a filter adapted to pass light of one of the primary colors. By using the three primary colors, red, blue and green in succession across one dimension of the image screen, it is possible to reproduce in color a train of picture signals representative of a colored object.

By transmitting a series of three successive trains of signals, each train representing a distinct primary color image, cyclically at a rate sufficiently rapid to cause each of the images to appear persistent to the human eye and so directing the electron beam in the image tube that it strikes only the strip of fluorescent material adapted to produce a colored light corresponding to the color represented by the particular train of signals at any one time, it is possible to reproduce the televised object in color.

This requires a very fine and precise adjustment in the deflection in the receiving tube electron beam because it is necessary that the individual strips be so small that one strip is not discernible from another by the unaided human eye at the useful viewing distance of the screen. Heretofore, it has been impossible to adjust the scanning of the receiving tube electron ray so finely.

According to this invention, a plurality of mutually insulated conducting strips of extremely small width are used to make up a picture screen. In the case of three color picture transmission every third of the conducting strips are electrically connected together whereby three sets of separately connected strips result. Each set of these strips contains a fluorescent material having a light filter means adapted to transmit one primary color under the influence of the impact of the electron beam.

By charging one set of strips more positively

than the other sets of strips, the electron beam will be attracted to the set of strips with the positive charge. Thus it will be seen that by charging the set of strips containing the red filter positive during the interval of time occupied by the transmission of the signal representative of the red colors in the object being televised and doing likewise for the other primary colors, a composite color image results.

The primary object of this invention is to provide a method and means for the reproduction of television images in color.

Another object of this invention is to provide a method and means for the reproduction of television images in perspective.

Still another object of this invention is to provide more accurate scanning of an electron beam.

Other and incidental objects of the invention will be apparent to those skilled in the art from a reading of the following specification and an inspection of the accompanying drawings in which

Figure 1 is a block diagram showing one form of this invention,

Figure 2 is a greatly enlarged portion of one form of the image screen adapted to be used in one form of this invention,

Figure 3 is a greatly enlarged cross sectional view of Fig. 2 at 3—3,

Figure 4 shows the operation of one form of this invention,

Figure 5 shows one form of a transmission system adapted to transmit signals representing stereoscopic images to be reproduced by the use of this invention,

Figure 6 shows one form of this invention adapted to reproduce images in perspective,

Figure 7 shows another form of this invention adapted to reproduce images in perspective,

Figure 8A is a front view of one form of image screen adapted for the reproduction of three color images,

Figure 8B is a side view of the image screen shown in Fig. 8A,

Figure 9A shows a front view of another image screen adapted for the reproduction of three color images, and

Figure 9B shows a side view of the screen shown in Fig. 9A.

Referring in more detail to Fig. 1, a receiving tube 1 contains an electron gun made up of a filament 3, cathode 5, a control electrode 7, a first anode 9 and a second anode 11. The electron gun generates an electron beam 13 adapted to strike the image screen 15 and to be deflected

across its area in synchronism with the transmission system by the current in horizontal deflection coils 16 and vertical deflection coils 18. The necessary potentials are supplied to the electron gun through resistance 21 which is connected to a suitable power supply.

The structure of the image screen 15 may be better understood by referring to Fig. 2, which is a greatly enlarged view of a portion of the image screen 15. An insulating member 17 supports a series of extremely narrow transparent conducting strips 19, each strip insulated or separated from its adjoining strip.

The width of these individual strips is such that they cannot be detected by the unaided human eye. Thus, the image screen appears to be a solid area. The strips may be applied to the insulating member 17 by any well known process such as, for example, coating the insulating member 17 with a light sensitive silver emulsion and photographing a large image of the desired mosaic pattern so that when the image on the insulating member 17 is developed and fixed, there will remain thereon an extremely thin layer of transparent conducting silver emulsion in any desired form. The fluorescent material 23 is then applied.

Another method of constructing such a mosaic structure is to spray a conducting layer onto the supporting element 17 through a screen adapted to produce the desired shape of the grid-like structure. The fluorescent material 23 may then be applied.

Alternate strips are interconnected and each set provided with a terminal which is connected to one terminal of a multivibrator 21 which supplies each of the sets of the strips with a potential having a square wave. The potential on each set is displaced 180° so that one set of the interconnected strips 19 is charged positively, while the other set of interconnected strips is charged negatively.

The frequency of the multivibrator 21 is high enough that no flicker is apparent to the human eye.

As different sets of strips 19 are charged positive, the electrons of the electron beam 13 are attracted to the positively charged set of strips whereby the electrons strike only that set of strips. It follows that during half the time electrons will strike one set of strips and during the other half the time the electrons will strike the other set of strips so that, by synchronizing the multivibrator 21 with the transmitter which is adapted to transmit, for example, two complete images, the complete images as transmitted may be individually established over the same area, on each of the two sets of strips in the image screen 15.

Fig. 3 shows a greatly enlarged cross-section portion 3-3 of Fig. 2 of the image screen 15. The insulating member 17 supports sets of strips 19 and 20. Alternate strips are interconnected as described above under Fig. 2. The fluorescent material 23 on the surface of the strips 19 and 20 produces light when the surface is struck by electron beam 13. There is a light emitted which can be viewed through the transparent conducting strips 19 and 20 or from the direction of the electron beam, in which case the strips may be of an opaque conducting material.

It will be seen that the electron beam 13 will split up as it approaches the image screen and be directed to only one set of strips at a time or that set of conducting strips which is charged

positive. The other set of strips is not affected by the electron beam while their charge is negative with respect to the positive charge on the other set of strips.

It may be readily understood that, by alternately charging the sets of strips 19 and 20, a composite image may be reproduced which is representative of two individual images.

According to this form of the invention, the screen 15 is shown supported on a plate. The screen may also be applied on the end of the envelope.

By coating one of the interconnecting sets of conducting strips 19 with a fluorescent material which produces a red light under the influence of the electron beam, and a coating of blue light producing fluorescent material on the other interconnected set of strips 20, a red image will be produced when the set of strips 19 is charged positive, while a blue image will be reproduced when the set of strips 20 is charged positive with respect to the other set of strips.

Fig. 4a shows an enlarged front view of a portion of image screen structure under the influence of an electron beam 13 when the strips including a red fluorescent material are charged positive. As previously explained, this will cause an electron beam to intersect only those strips containing the red fluorescent material.

Fig. 4b shows the effect caused when the strips containing blue fluorescent material are charged positively. It will be noted that, in the case shown in Fig. 4b, the electron beam confines itself to the strips containing blue fluorescent material.

It is well known in the art that stereoscopic images may be reproduced by the use of two-color photography in conjunction with a two-color filter placed in front of the eyes of the observer.

A transmission system readily adapted for the transmission of stereoscopic images is shown in Fig. 5 wherein the scene 25 is transmitted by cameras 27 and 29. Camera 27 has, for example, a red filter 31, while camera 29 has a blue filter 33. A multivibrator 35 running in synchronism with the multivibrator 21 shown in Fig. 1 is adapted to key an amplifier 37 whereby during half the time a single train of energy is passed from camera 27, while during the other half the time the train of signal energy from camera 29 is passed to the transmitter 39. Such a keying amplifier is shown and described in U. S. Patent No. 2,221,115, issued November 12, 1940, to Francis H. Shepard, Jr.

In Fig. 6, there is shown the well known stereoscopic principle as adapted to the viewing of a picture tube for the reception of stereoscopic television images. During the time which signals from camera 27, Fig. 5, are passed by the keyed amplifier 37, multivibrator 21 is charging the red set of strips 19 with a positive potential, so that a red image is produced in the receiving tube 1 of Fig. 6.

A red filter 41 is placed in front of the right eye of the observer so that the light from each of the red strips 19 is visible by the right eye, and a blue filter 43 is placed in front of the observer's left eye so that only light from the blue set of strips 20 of the receiving tube 1 are visible to the left eye.

It, therefore, follows that, during the time the signal from the camera 27 is passed by amplifier 37, the image produced on the screen of tube 1 is visible only to the right eye and, during the time

signals from camera 29 are passed, the image produced on the screen is visible only to the left eye. Therefore, if these individual images are produced at a rate which is sufficiently rapid that the eyes' persistence of vision prevents objectionable flicker, a stereoscopic view results.

Still another form of the stereoscopic theory may be applied to the transmission of stereoscopic television images.

It has been proposed to print two superimposed images in a single plane whereby alternate extremely narrow strips are part of the same image. A layer made up of extremely small cylindrical lenses is then placed on the surface of the image so that each cylindrical lens overlaps two adjacent strips. The size of these lenses is so small that it is impossible to distinguish them individually one from the other by the unaided human eye.

Referring to Fig. 7, such an image screen is made up of a plurality of alternately connected transparent strips 19 and 20 and a mask of a large number of cylindrical lenses 45 is placed between the observer and the strips and adjacent to the strips so that each cylindrical lens covers two adjacent strips. Because of the fact that only the strips 19 are visible to the right eye through the cylindrical lenses 45 and the strips 20 are visible only to the left eye by reason of the refraction caused by the cylindrical lenses 45, the right eye sees only the image produced by the camera 27 of the transmitter shown in Fig. 5 and the left eye sees only the image produced by the camera 29 of the transmitter shown in Fig. 5 because during the time that the scanning beam is attracted to the sets of strips 19 the train of signals from the right hand camera 29 is being used and vice versa. The two independent images then produce a stereoscopic effect to the observer, as is well known in the optical art.

Referring now to Fig. 8, there is shown a screen structure adapted to reproduce images in three colors. It will be noticed that there are three sets of interconnected strips 47, 48 and 49. The set of strips 49 may be interconnected by the use of a conducting strip on the opposite side of the insulating supporting member 51, such as shown by the conducting strip 53. Each of the strips 49 may be connected to the conducting strip 53 by rivets 55. Each of the sets of conducting strips 47, 48 and 49 may include fluorescent material of one of the three primary colors,—red, blue and green.

By charging each of the respective sets of interconnected strips with a positive potential successively, a three-color image may be reproduced from a train of signals such as that transmitted from a three-color transmission system.

Figs. 9a and 9b show another means for making contact with the intermediate set of strips 55 of Fig. 8. The bar 57 contains small extending spring members 59 separated by a distance which is equal to the separation of every third strip 55 of Fig. 8. The conducting strip 57 is supported so that its extensions 59 will make contact with the set of strips 55.

The screen as shown in Fig. 8 may be constructed by a process similar to that used in three-color printing wherein the ink will include the required fluorescent material and a transparent conducting material.

While several systems for carrying this invention into effect have been indicated and described, it will be apparent to one skilled in the art that this invention is by no means limited to the particular organizations shown and described, but that many modifications may be made without departing from the scope of this invention as set forth in the appended claims.

I claim as my invention:

1. In a television system including a luminescent image screen, the combination of a plurality of mutually insulated strips of conducting material in a plane parallel to and closely adjacent said screen and wherein the width of each of said strips is so small that the plane including the strips appears to the unaided eye to be a solid area, means for sequentially applying to alternate strips a charge relatively positive with respect to the other of said strips, and means for causing only one set of said strips to be visible from one side of an imaginary plane parallel to one of said strips and perpendicular to and intersecting the plane of said mosaic near its center and the other of said sets of said strips to be visible only from the other side of said imaginary plane, said last mentioned means comprising a plurality of cylindrical lens each of said lenses positioned adjacent to and parallel with two of said strips.

2. In a television system including a luminescent image screen, the combination of a plurality of mutually insulated strips of conducting material in a plane parallel to and closely adjacent said screen and wherein the width of each of said strips is so small that the plane including the strips appears to the unaided eye to be a solid area, a grating whose plane is adjacent to and parallel with said screen comprising a plurality of closely adjacent cylindrical lens whose axis of curvature are mutually parallel and so positioned that each of said cylindrical lens are opposite two adjacent of said strips, and means for alternately applying to each group of alternate strips a charge relatively positive with respect to the other group of said strips.

3. An image tube for television systems and the like, comprising an evacuated envelope including therein an electron stream producing means, a screen having a plurality of mutually insulated strips of conducting material and wherein the width of each of said strips is so small that the plane including the strips appears to the unaided eye to be a solid area, a lenticular grating closely adjacent to said screen comprising a plurality of closely adjacent cylindrical lens whose axis of curvature are parallel to each other and to said strips and each of said lens being adjacent two of said strips.

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