

Aug. 23, 1932.

H. E. IVES ET AL

1,873,411

TELEVISION

Original Filed June 26, 1929 2 Sheets-Sheet 1

FIG. 1.

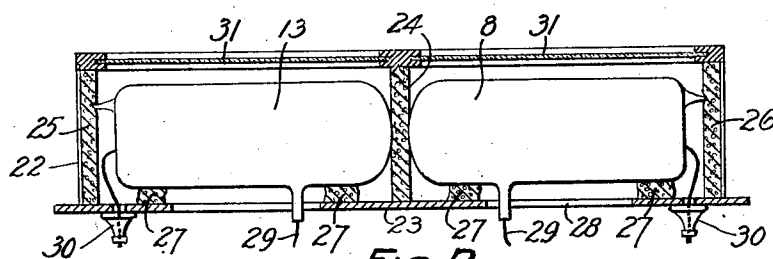
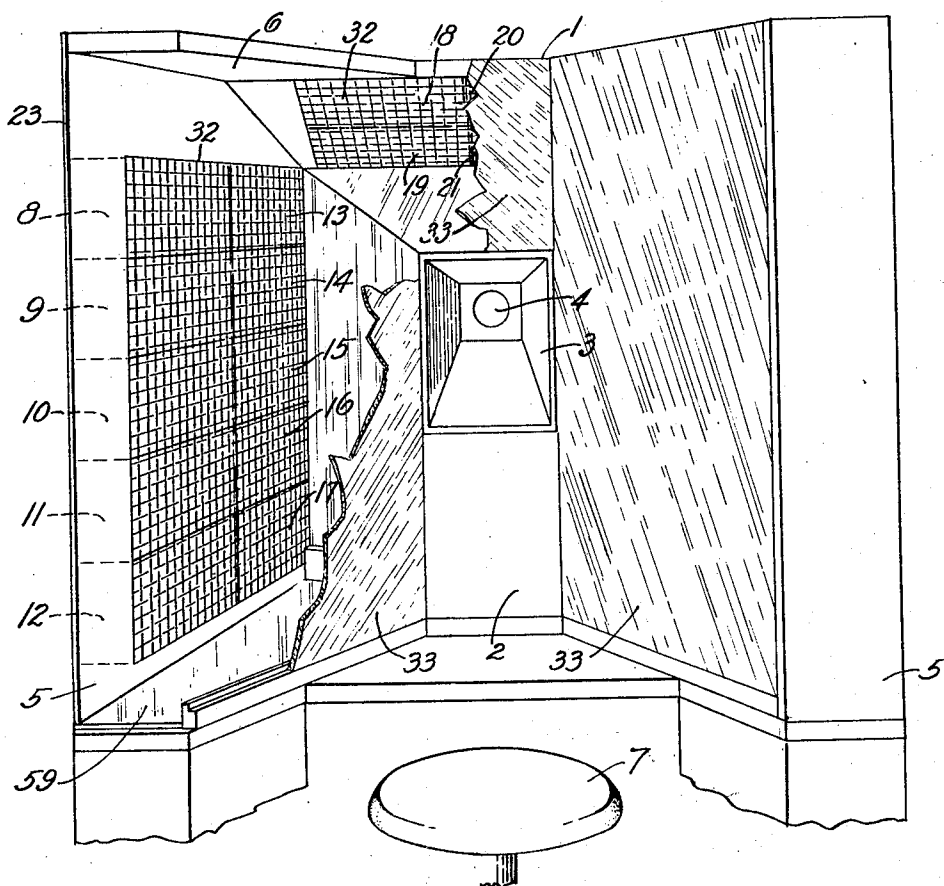


FIG. 2.

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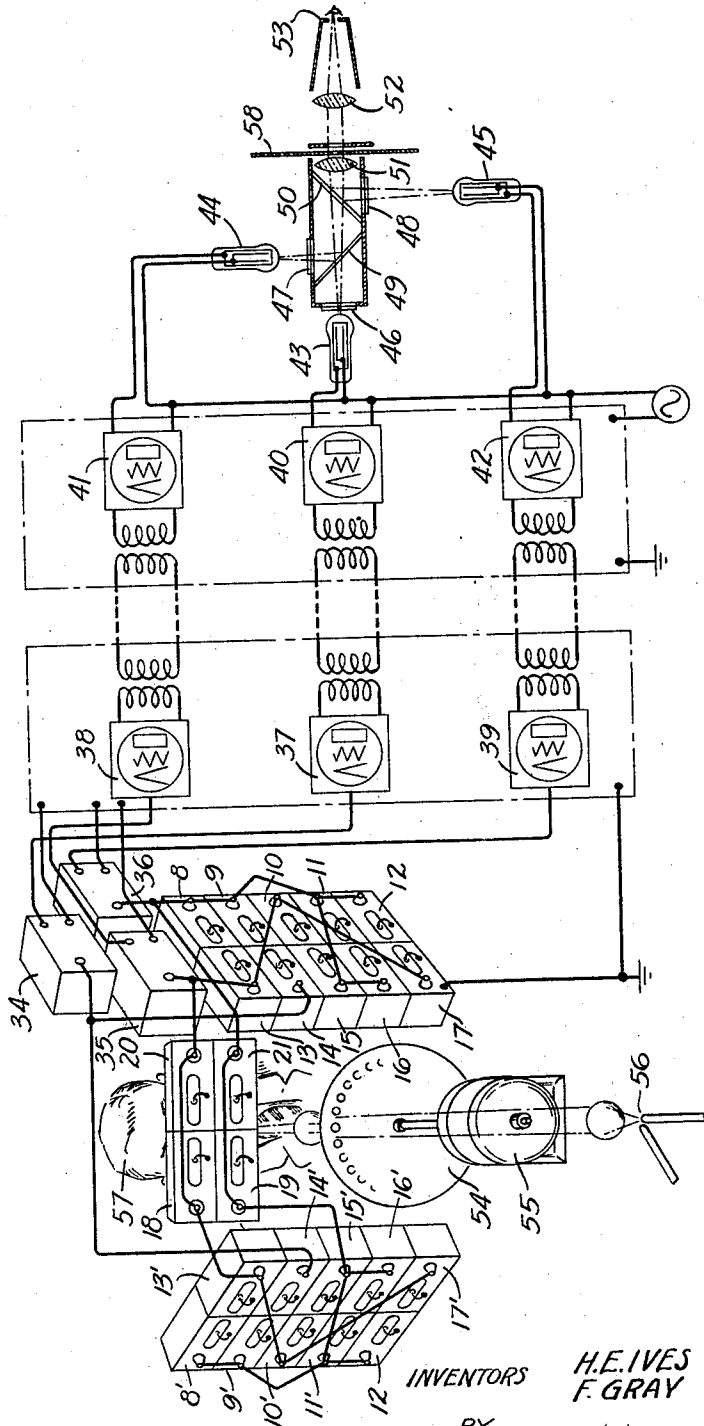
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FIG. 3.



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TELEVISION

Application filed June 26, 1929, Serial No. 373,769. Renewed October 6, 1931.

This invention relates to television and more particularly to scanning booths for television systems.

5 An object of the invention is to provide an improved arrangement for television scanning of the type in which the person or other subject is scanned by means of a traveling beam of light.

10 Another object of the invention is to provide an improved arrangement of photoelectric cells for receiving light reflected from the subject in the light beam method of scanning.

15 Another object is to effect improvements in booths employed in television systems, and more particularly in such systems for producing an image in natural color.

This invention pertains particularly to the type of television apparatus in which an intense beam of light from an arc lamp or other source is caused to traverse the person or other subject scanned in parallel adjacent lines and light reflected from the subject is collected upon large photoelectric cells. 20 These cells have heretofore been arranged in a general plane in front of the subject and at one side of, or more or less around, an opening which the subject faces and through which the scanning beam is projected. Such an arrangement is disclosed in an application of Frank Gray, Serial No. 227,649, filed October 21, 1927. A similar scanning system has been suggested for television in natural colors, in which case a portion of the photoelectric cells is provided with a red glass filter, a second portion with a blue filter and a third portion with a green filter. Photoelectric currents set up by the red, blue and green light thus selected are transmitted over 35 separate channels to the receiving station where they control red, blue and green sources of light, respectively, to produce the image in colors. See application of H. E. Ives, Serial No. 218,631, filed September 10, 1927.

40 In accordance with the present invention a cabinet or booth is provided for the person or other object to be scanned and the photoelectric cells are arranged in the cabinet in a manner to give improved results. It has been found that the appearance of depth of

an image of three dimensional objects can be greatly improved by placing a portion at least of the cells on the side walls or top or bottom of the cabinet rather than having all of the cells on the front inner wall of the cabinet toward which the subject faces. In accordance with the preferred arrangement of the invention three groups of large photoelectric cells are provided. One group is at the right of the subject, one at the left and one above. The ones at the right and left may be arranged in vertical planes coincident with or parallel to the sides of the cabinet, and the one at the top may be in a horizontal plane. The preferred arrangement is to have all of these planes converge somewhat toward the front of the cabinet. Preferably, there is a considerable space on the front wall of the cabinet, on which no cells are placed, which arrangement has the advantage that eyeglasses worn by a person being scanned does not cause troublesome light reflection. Mirrors may be employed within the cabinet to increase the amount of light gathered by the cells from the subject.

Also, in the preferred arrangement the photoelectric cell material extends backward from the front of the cabinet to such a distance that portions of it lie at the sides of the object or objects in the field so that a large part of the light reflected from the scanned elemental areas which are most remote from the front of the cabinet will be collected by the light sensitive material. If all of the light sensitive material is in front of a plane parallel to the front of the cabinet relatively less light from this area reaches the photoelectric material than from the elemental areas which are nearer the front of the cabinet. That is, when the head of a person is being scanned it is necessary for best results that the photoelectric material lie both to the sides of the person's head and well in front thereof. This has not been the practice heretofore with the result that the sides of the head in the image appear dark and indistinct as though insufficiently illuminated. For the most natural reproduction it is essential also that the light sensitive material be so distributed that a considerable por-

tion of it lies above the subject and nearer the front wall of the cabinet than any portion of the field. If there are several subjects in the field or if more latitude of movement forwards or backwards is to be permitted the subject or subjects, it is desirable that the photoelectric material be positioned not only at the sides or rear of the field but that it extends from there forward to the front of the field. Such distribution of photoelectric material would be particularly advantageous if the field were of considerable depth as for example a theater stage. In the embodiment of the invention hereinafter described the system is designed particularly for scanning a person in a relatively fixed position so that a relatively more lateral extent of the photoelectric material is sufficient. If a field of great depth is scanned it is desirable also to extend the portion of the photoelectric material which is at the front of the field or above the subject or subjects backward toward the rear of the field.

A form of the invention herein chosen for purposes of illustration will now be described, reference being made to the accompanying drawings in which:

Fig. 1 is a perspective view partly broken away, of a cabinet or booth in accordance with the invention;

Fig. 2 is an elevation partly in section of a photoelectric cell compartment containing two cells;

Fig. 3 is a diagram of the electrical and optical circuits of a three channel system for television in natural colors.

Referring to Fig. 1, the cabinet or booth 1 comprises the front wall 2 on the outside of which is a box-like projection 3 having an opening 4 through which the scanning beam is projected. At each side of the cabinet is a compartment 5 containing photoelectric cells and additional cells are placed in compartment 6 in the top of the cabinet. A seat 7 is provided for the person to be scanned. A bank of cells 8 to 17 is provided in the compartment 5 at the left (as shown) and a similar bank (not shown) is placed in compartment 5 at the right. Similarly a bank of cells 18 to 21 are contained in compartment 6.

Fig. 2 shows the mounting of two of the cells, for example, cells 8 and 13. A box-like container 22 is mounted upon the vertical wall 23 of the cabinet and contains a sponge rubber partition 24 which serves as a partial support for the cells 8 and 13. The other ends of the cells are supported at the container ends by sponge rubber inserts 25, 26. Sponge rubber elements 27 are in the form of segments of a circle and support the tubes underneath, in the rear and at the tops. Slots 28 are provided in the wall 23 to provide a partial view of the cells from the outside of the cabinet and to provide for the attachment of lead wires 29. The other terminals of the photo-

electric cells are brought out through insulators 30. Colored glass filters 31 form the front of the cell compartment. The cells may be of the type disclosed in United States application of G. R. Stilwell, Serial No. 181,552, filed April 6, 1927. Filters 31 for cell 14 are blue, for cells 13, 10 and 17 are green, and for cells 8, 9, 11, 12, 15 and 16 are red. A corresponding arrangement of filters occurs in the compartment 5 at the right. The filters for cells 18 and 20 are green and for cells 19 and 21 are red. A metallic grating 32 covers the cell banks. This is connected to ground and provides an electrostatic shield for the cells. Translucent glass plates 33 are provided between the subject and the various banks of cells and in part form the innermost walls of the cabinet.

Referring to Fig. 3 the cell banks, scanning discs, motor therefore, and light source are shown in perspective. The cell bank at the right hand compartment 5 of Fig. 1 is shown at the left in Fig. 3 and comprises cells 8' to 17'.

All of the cells having blue filters are electrically connected in parallel as shown and to a common amplifier 34. Similarly the cells having green filters are connected together and to amplifier 35 and the cells having red filters are connected together and to amplifier 36. These three amplifiers are connected respectively to amplifiers 37, 38 and 39 and the latter amplifiers are respectively connected to the three transmission lines B, G and R. At the receiving station the currents received over the three channels are associated respectively with amplifiers 40, 41 and 42 which control glow discharge lamps 43, 44 and 45. These lamps are of the type disclosed in an application of H. W. Weinhart Serial No. 373,818, filed June 26, 1929. In front of the lamps are light filters 46, 47 and 48 respectively. Filter 46 transmits blue light, filter 47 green light, and filter 48 red light. Lamps 43 and 44 are argon filled lamps and lamp 45 is filled with neon. Any suitable known light sources for producing the primary colors may be substituted for those here shown. Transparent mirrors 49 and 50 receive light from the lamps in the manner shown to obtain a composite or mixed beam of light of the three primary colors which is transmitted through lenses 51 and 52 to a point of observation 53. The usual form of scanning disc 54 is driven by motor 55. A beam of light from arc 56 illuminates the effective field of the scanning disc 54 and causes a narrow beam of intense light to traverse object 57 in adjacent horizontal lines. A receiving scanning disc 58 has its effective field within the beam of composite light at the receiver. The scanning discs 54 and 58 are maintained in exact synchronism by any suitable means such as the system disclosed in an application of H. M. Stoller and E. R.

Morton, Serial No. 181,314, filed April 6, 1927.

The operation of the system should be apparent from the above description. Reflected light from the person scanned falls upon the light filters 31 thus setting up photoelectric currents which are transmitted to the receiving station and operate the glow lamps 43, 44 and 45. The intensity of the light produced by each of these lamps at any instant is proportional to the intensity of the component of the corresponding color in the light reflected from the elemental area at the transmitter which is at that instant being illuminated. Since the observer at that instant observes only that elemental area of the receiving field of view which corresponds to the illuminated elemental area at the transmitter the color of the elemental area at the receiver corresponds to that at the transmitter. This process is repeated as the successive elemental areas are scanned so that the entire image is produced in natural color.

An initial adjustment of the receiving amplifiers is ordinarily made such that the composite beam of light produced by the three glow lamps appears white.

Preferably the direct current components of the photo-electric currents are transmitted to the receiver along with the alternating current components. If, however, the direct current components are suppressed at the transmitter the receiving operator may adjust the grid biases of the receiving amplifiers as the general tone of the transmitting field changes, instructions for this purpose being transmitted from the transmitting operator to the receiving operator over a telephone line not shown. An application of H. E. Ives and F. Gray, Serial No. 181,511, filed April 6, 1927, discloses adjustment of the receiving amplifiers for the reinsertion of the correct amount of direct current component.

While it is not essential to the operation of this system, improved results are obtained by the use of mirrors 59 which direct light to the photoelectric cells which would otherwise not reach them. Color patches are sometimes apparent in the image due to the large size of the light filters 31 and the proximity to the subject unless the translucent screen 33 is placed between the object and the light filters. This screen may be made up of two thicknesses of glass of the kind in which one surface is plain and the other contains parallel ribs. The ribs of one plate are preferably at right angles to those of the other. This forms a very efficient translucent screen.

While it is stated above that the filters 31 transmit primary colors, a more correct statement is that each of the filters transmits a band in which the primary color is present. An amount of primary color is transmitted so that by proper adjustment at the receiver

and proper selection of the light beams at the receiver, a combination of light may be there obtained which will when mixed give the appearance of white.

While the cell banks in the embodiment of the invention above described are in planes which converge toward the front of the cabinet, it is to be understood that the invention is not limited in this respect since obviously it would be desirable in certain cases to have the light sensitive material distributed in planes substantially parallel to the main horizontal axis of the field or to employ some other distribution of the light sensitive material in conformity with the general principle laid down above.

What is claimed is:

1. A scanning cabinet for television systems comprising a wall provided with an opening through which a beam of light may pass for traversing the object and banks of large photoelectric cells within said cabinet and on different sides of said opening and in different planes respectively.

2. A scanning cabinet for television systems comprising a wall having an opening through which passes a beam of light for traversing the object and a bank of large photoelectric cells at either side of said opening and in planes intersecting said wall at a considerable distance from said opening.

3. A scanning cabinet for television systems comprising a wall having an opening for passing a beam of light which traverses the object to be scanned, banks of large photoelectric cells on different sides of said opening and in different planes, said photoelectric cells receiving reflected light from the object, and mirrors within said cabinet for reflecting light from said object to said cells.

4. A scanning cabinet for television systems comprising a wall having an opening therein for a beam of light for traversing the object, and three banks of large photoelectric cells for receiving reflected light from the object, one of said banks being at one side of the object within the cabinet, another bank on the opposite side of the object, and the third bank above the object, said banks being in planes which intersect said wall and which are generally convergent toward said wall.

5. In a television system, means for scanning an object comprising means for traversing a beam of light over the object and light sensitive surfaces for receiving light reflected from said object, said surfaces being arranged in intersecting planes.

6. In a television system, means for scanning an object comprising means for traversing a beam of light over the object, and means for receiving light reflected from the object comprising light sensitive elements of large effective area arranged in different planes on two sides of the object respectively.

7. In a television system, means for scan-

ning an object comprising means for traversing a beam of light over the object, light sensitive means for receiving light from within a wide solid angle reflected from one side of said object and similar light sensitive means for receiving light from within a wide solid angle reflected from another side of said object, said light sensitive means being widely spaced apart and in different planes.

8. A television system comprising a light source, means including said light source for producing a moving beam of light for illuminating three dimensional objects in a field of view, light sensitive material for receiving reflected light from said field, portions of said material lying on one side of said field and so positioned as to be intersected by a plane perpendicular to the central position of said beam and passing through or behind the scanned elemental areas most remote from said light source and other portions of said material being so positioned as to be intersected by a second plane parallel to the first and nearer to the light source than any scanned elemental areas, and means for setting up image currents corresponding to the amount of light received by said light sensitive material.

9. The method of operating a television system comprising a light source, means including said light source for producing a moving beam of light for illuminating three dimensional objects in a field of view, light sensitive material portions of which are widely separated in the general direction of said beam for receiving reflected light from said field, and means for setting up image currents corresponding to the amount of light received by said light sensitive material, which method comprises positioning the object or objects in said field so that the scanned elemental areas most remote from said light source lie near to or in front of a plane perpendicular to the central position of said beam and passing through the portion of the light sensitive material most remote from said light source.

10. The method of operating a television system comprising a light source, means including said light source for producing a moving beam of light for illuminating three dimensional objects in a field of view, light sensitive material for receiving reflected light from said field, a part of said light sensitive material being distributed laterally of said field and having portions widely separated in the general direction of the scanning beam, and means for setting up image currents corresponding to the amount of light received by said light sensitive material, which method comprises positioning the object or objects in said field so that the scanned elemental areas most remote from said light source lie near to or in front of a plane perpendicular to the central position of said

beam and passing through the portion of the light sensitive material most remote from said light source.

11. The method of operating a television system having a light source, means including said light source for producing a moving beam of light for illuminating three dimensional objects in a field of view, light sensitive material for receiving reflected light from said field, part of said light sensitive material being positioned laterally of said field at one side, another part being positioned near the front of and above said field and having a portion widely separated in the general direction of the scanning beam from a portion of said first part, and means for setting up image currents corresponding to the amount of light received by said light sensitive material, which method comprises positioning the object or objects to be scanned in said field near to or in front of a plane perpendicular to the central position of said beam and passing through a portion of said first part of said light sensitive material.

12. The method of operating a television system having a light source, means including said light source for producing a moving beam of light for illuminating three dimensional objects in a field of view, light sensitive material for receiving reflected light from said field, part of said light sensitive material being positioned laterally of said field at one side, another part being positioned near the front of and above said field and having a portion widely separated in the general direction of the scanning beam from a portion of said first part, and a third part of said material being positioned on the opposite side of said field from said first part, and means for setting up image currents corresponding to the amount of light received by said light sensitive material, which method comprises positioning the object or objects to be scanned in said field near to or in front of a plane perpendicular to the central position of said beam and passing through a portion of said first part of said light sensitive material.

13. A television system comprising means for defining a three dimensional field of view in which a three dimensional object or objects to be scanned are to be positioned, means including a light source for projecting into said field from the front thereof a moving scanning beam, light sensitive material for receiving light reflected from said field, said material being distributed laterally of said field on both sides thereof and extending at least to a point near the rear of said field on at least one side, and means for setting up image currents corresponding to the amount of light received by said light sensitive material.

14. A television system comprising means for defining a three dimensional field of view

in which a three dimensional object or objects to be scanned are to be positioned, means including a light source for projecting into said field from the front thereof a moving scanning beam, light sensitive material for receiving light reflected from said field a portion of which is distributed laterally on at least one side thereof and to a point near the rear thereof and another portion of which is distributed in front of said field, and means for setting up image currents corresponding to the amount of light received by said light sensitive material.

15 A television system comprising means for defining a three dimensional field of view in which a three dimensional object or objects to be scanned are to be positioned, means including a light source for projecting into said field from the front thereof a moving scanning beam, light sensitive material for receiving light reflected from said field having a portion distributed laterally on at least one side thereof and extending at least to a point near the rear thereof, light reflecting means for increasing the amount of light received by said light sensitive material from said field, and means for setting up image currents corresponding to the amount of light received by said light sensitive material.

16. Television apparatus for scanning three dimensional objects comprising a light source, means including said light source for producing a moving beam of light for successively and repeatedly illuminating elemental areas of the object or objects in a three dimensional field of view, and means for setting up image currents including means positioned laterally of the field for receiving light reflected laterally from illuminated elemental areas within the field.

17. Television apparatus for scanning three dimensional objects comprising a light source, means including said light source for producing a moving beam of light for successively and repeatedly illuminating elemental areas of the object or objects in a three dimensional field of view, and means for setting up image currents including reflected-light-receiving means portions of which are positioned forwardly of the field and other portions of which are positioned laterally of the field whereby the effect of similar illumination of differently oriented illuminated elemental areas of three dimensional objects within the field may, if desired, be obtained.

18. Television apparatus for scanning three dimensional objects comprising a light source, means including said light source for producing a moving beam of light for successively and repeatedly illuminating elemental areas of the object or objects in a three dimensional field of view, and means for setting up image currents including light

sensitive material positioned laterally of the field for receiving light reflected laterally from illuminated elemental areas within the field.

19. Television apparatus for scanning three dimensional objects comprising a light source, means including said light source for producing a moving beam of light for successively and repeatedly illuminating elemental areas of the object or objects in a three dimensional field of view, and means for setting up image currents including light sensitive material portions of which are positioned forwardly of the field and other portions of which are positioned laterally of the field.

20. Television apparatus for scanning three dimensional objects comprising a light source, means including said light source for producing a moving beam of light for successively and repeatedly illuminating elemental areas of the object or objects in a three dimensional field of view, and means for setting up image currents including reflected-light-receiving means portions of which are positioned forwardly of the field and other portions of which are respectively positioned laterally of the field on at least two sides thereof.

In witness whereof, we hereunto subscribe our names this 26th day of June, 1929.

HERBERT E. IVES.
FRANK GRAY.

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