

Aug. 2, 1949.

L. W. PARKER

2,477,645

COLOR TELEVISION

Filed April 24, 1946

Fig. 2.

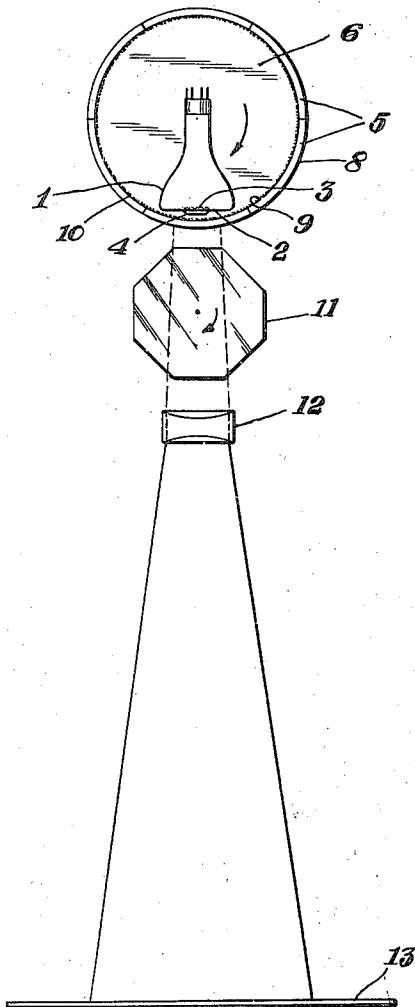
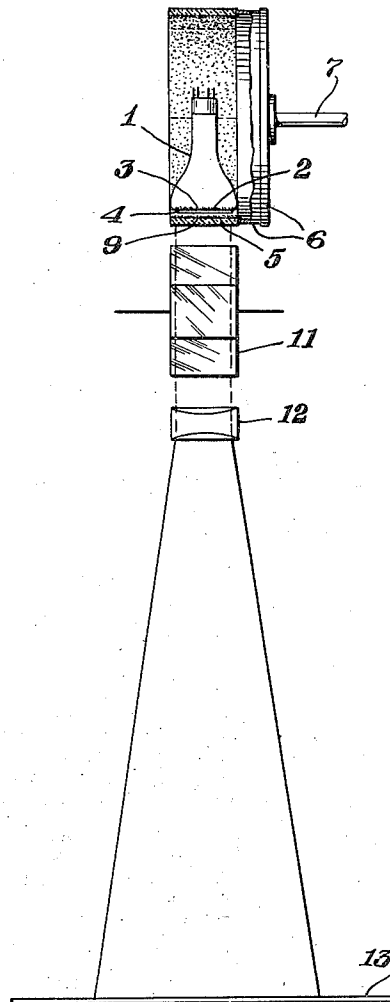


Fig. 1.



INVENTOR.
LOUIS W. PARKER

BY

RP Morris
ATTORNEY

UNITED STATES PATENT OFFICE

2,477,645

COLOR TELEVISION

Louis W. Parker, Jackson Heights, N. Y., assignor
to Federal Telephone and Radio Corporation,
New York, N. Y., a corporation of Delaware

Application April 24, 1946, Serial No. 664,487

7 Claims. (Cl. 178—5.4)

1

This invention relates to television systems and, more specifically, to an improved light source and optical apparatus for television image reproduction.

Principally, the present invention is directed to methods and means for increasing the light efficiency of television picture reproducing systems of both the black and white and multi-color classes. This result is achieved by the elimination of light waste due to filter action, by the increased lengths of time during which the television pictures are observable with the human eye, by the utilization of a cathode ray tube face capable of transmitting with little loss and distortion the light generated within the tube, and by a highly efficient light producing arrangement in which ultra-violet light is employed to generate visible light.

It is important to note that conventional color television receivers operating, for example, on a tri-color basis theoretically utilize only one third of the available light at any instant; practically, the efficiency is even less when it is considered that the colors on the screen of the television tube are rarely represented in exactly correct proportions and that the efficiency of the filters is not 100%. Also, persistence effects involved in the usual type of television receiver are detrimental to the resultant images. An additional disadvantage encountered with the use of the majority of present television systems is that both the intensity and angle of spread of light generated within the picture tube are reproduced on the outside surface of the tube face with considerable loss. These disadvantages are very effectively excluded from the apparatus disclosed herein.

It is one object of this invention, therefore, to provide method and means for increasing the light efficiency of television image reproducing systems, particularly of color television systems.

A second object is to provide a multi-color television picture reproducing system wherein color filtering apparatus is not required and wherein light waste due to filtering action is thus eliminated.

Another object is to provide a television picture reproducing system wherein a highly efficient television tube screen and high persistence auxiliary light-producing screens are employed to improve the light intensity and flicker characteristics of the resultant images.

Further, it is an object to provide a picture reproducing system, for television receivers, in which ultra-violet light generated on the face of

2

a cathode ray tube causes visible radiation of desired wavelengths from surfaces having the required light generating characteristics.

The present invention discloses one embodiment of a color television picture reproducer which operates substantially in agreement with the last-mentioned arrangement. Each line of a television picture is traced by a cathode ray tube electron beam on a screen material which emits ultra-violet light under electron bombardment, calcium tungstate being a representative material. External to the tube are located a series of phosphor-coated transparent screens mounted on a rotatable drum, each of the screens being capable of producing visible radiation of desired colors when excited with ultra-violet rays from the tube. Due to the rotation of the drum, successive lines of the picture, which are in substantially the same position on the tube face are properly displaced when they appear on the phosphor-coated screens. The drum rotation is additionally synchronized such that one complete frame of a picture may be reproduced on only a single phosphor-coated screen, and such that this screen will produce the color of radiation corresponding to the color represented by the frame being traced at any instant. The viewing arrangement used with this system includes equipment for making the rotating picture frames appear stationary to the observer for certain lengths of time.

The objects and features disclosed above should be made more clear and a fuller understanding of the entire invention should be obtained from the following detailed description and discussion of one preferred embodiment, reference being had to the drawings in which:

Fig. 1 is a view, partially in section and elevation, of a multi-color picture reproducing apparatus associated with a cathode ray tube in accordance with the color television system of this invention; and

Fig. 2 is a left side view of the equipment diagrammed in Fig. 1.

Each line of a television picture is reproduced by a cathode ray tube 1, the face 2, of the tube being coated internally with a layer of material 3, which emits ultra-violet light in response to electron bombardment. A narrow window 4, constructed of some material translucent to ultra-violet light, quartz for example, is provided in the tube face, permitting light generated by the material 3, to be transmitted therethrough. The dimensions of the quartz window may be those of a narrow rectangular parallelepiped since the

horizontal picture lines are all traced in substantially the same position on the tube face.

Transparent curved screens 5, are attached to a rotatable drum 6, such that different screen sections are successively rotated past the quartz window 4, when the drum is turned by driving means, shown as a shaft 7, in this embodiment. Individual screens are surfaced, preferably on the sides adjacent the tube face, with phosphor materials 8, 9, and 10, which emit visible light of 10 different wavelengths. A typical tri-color television system might employ phosphors which produce red, green, and blue radiations.

The driving shaft 7, must revolve drum 6, at the synchronous speed at which one frame of a 15 picture will be traced on one screen attached to the drum, and an additional phasing must be secured in order that the screen with the proper color-radiating surface may be rotated past the quartz window during any frame tracing interval. 20 Rotative motion with the required synchronism may be imparted to the driving shaft by any of the many well known television motive systems, of which an induction motor synchronized with a phonograph motor or magnetic brake is representative. 25

Pictures traced on the curved screens must be made to appear stationary to an observer, and the arrangement shown in the accompanying figures is typical of those which may be applied to this invention. A glass octagonal shaped rectangular parallelepiped 11, rotates between the screens and a projection lens 12, in such a manner as to neutralize the motion of the image for certain lengths of time. Rotative motion for this parallelepiped may be obtained from a motive 30 system such as that previously mentioned. Resultant color television images are viewed on screen 13, which may be either opaque or translucent, depending upon which side of the screen the observer is to be located.

The phosphor coated glass screens 5, may, and preferably should, have long persistence characteristics in order that lines traced thereon may be viewed for considerable lengths of time. Since the eye integrates short duration light pulses, the foregoing feature enhances the impression of light for the observer and produces more brilliant television images. Flicker effects, even when only one color is predominant in a scene, may be lessened in some cases almost to the point of extinction, when screen persistence is of sufficient duration. Picture frames appearing on the screens need not completely disappear until nearly a complete revolution of the drum 6, has been accomplished.

Only a single line appears on the face of the cathode ray tube 1, at any instant. This necessitates the use of short persistence materials for emitting ultra-violet light from the tube face 4. In order to increase the life of these materials, some means, not illustrated, may be utilized to apply a vertical sweep to the electron beam and to obtain a rotary motion of screens 5, which compensates for the line displacement on the tube face. An additional advantage of this invention hitherto not apparent nor mentioned is that a rectangular picture may be secured having as its smaller dimension the length of the line on the face of the cathode ray tube. A considerable economy in tube size for a desired rectangular color image may therefore be realized.

The embodiment as proposed relates to a multi-color projection type television system; however, it should be understood that a black and white image may be obtained in accordance with the

foregoing principles, provided the proper screen coating materials are used, and a direct viewing system may be employed also. It should thus be apparent that many changes in the arrangement shown may be made by those skilled in the art without departing either in principle or scope from the present invention, and although only a single preferred embodiment has been diagrammed and described, the entire invention should not be considered limited thereby.

I claim:

1. A method for reproducing color television images on light responsive surfaces which comprises producing picture lines in ultra-violet light at a relatively fixed position with an intensity proportional to the intensity of an electron beam impinging on said surfaces, converting at said surfaces said ultra-violet light into visible light of different wavelengths with variations in intensity corresponding to said ultra-violet light impinging thereon, and moving said surfaces relative to the relatively fixed position so that successive visible lines of a picture frame are spaced correctly on said screens and such that certain picture frames are reproduced only on screens emitting visible light of desired wavelengths.

2. A color television picture reproducing arrangement comprising a cathode ray tube capable of tracing television picture lines with an electron beam in substantially one dimension, a cathode ray tube face which freely transmits ultra-violet light, a coating for said tube face which emits ultra-violet light responsive to bombardment by said electron beam, a plurality of movable screens external to said tube, a rotatable prism and lens system external to said screens, phosphor coating materials for said screens, capable of generating and radiating visible light of certain wavelengths responsive to ultra-violet light impinging thereon, and means for moving said screens and coatings before said tube face and rotating said prism to enable successive television picture lines to be reproduced on said screens with the required spacing and to enable picture frames to be reproduced on screens having desired visible light wavelength characteristics, said frames appearing stationary for a predetermined time responsive to said rotation of said prism.

3. A color television picture reproducing arrangement according to claim 2, wherein said coating for said tube face comprises a deposit of calcium tungstate.

4. A color television picture reproducing arrangement comprising a cathode ray tube capable of tracing television picture lines with an electron beam in substantially one plane, a cathode ray tube face which freely transmits ultra-violet light, a coating for said tube face which emits ultra-violet light in response to bombardment by said electron beam, a plurality of movable screens external to said tube, phosphor coating materials for said screens, capable of generating and radiating visible light of certain wavelengths responsive to ultra-violet light impinging thereon, means for moving said screens and coatings before said tube face to enable successive television picture lines to be reproduced on said screens with the required spacing and to enable picture frames to be reproduced on screens having desired visible light wavelength characteristics, and prismatic means for causing the picture frames to appear stationary to an observer during certain time intervals.

5. A color television picture reproducing ar-

5

rangement according to claim 4, further comprising optical means for projecting the stationary picture frames to a viewing screen.

6. A system for reproducing color television pictures, comprising a cathode ray tube having a screen at one end thereof, means for producing television picture lines in ultra-violet light in substantially one position on said screen, movable screens positioned externally of said tube for reproducing picture frames according to their visible light wavelengths, coatings for said external screens capable of generating and emitting visible light of certain wavelengths in response to ultra-violet light falling thereon, driving means for moving said screens past said one position to allow successive picture lines of ultra-violet light to impinge on said coatings with a desired spacing, and rotatable prismatic means responsive to said driving means for causing said pictures to appear stationary for a predetermined time.

7. A color television image reproducing system, comprising a cathode ray tube having a face capable of transmitting ultra-violet light and a coating on said face for generating ultra-violet light in response to the electron beam impinging thereon, said tube being capable of producing picture lines in substantially one position on said face, a plurality of movable screens for reproducing

6

picture frames according to their visible light wavelengths, coatings on said screens which generate and emit visible light of certain wavelengths responsive to ultra-violet light impinging thereon, a rotatable prism, and means for moving said screens with respect to said one position on said face and rotating said prism such that ultra-violet light from said tube may impinge on said coatings and such that visible picture lines on said screens may be properly spaced, the images appearing stationary for a predetermined time responsive to the rotation of said prism.

LOUIS W. PARKER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

20	Number	Name	Date
	2,319,804	Dyer	May 25, 1943
	2,336,134	Szegho	Dec. 7, 1943

FOREIGN PATENTS

25	Number	Country	Date
	105,944	Australia	Dec. 8, 1938
	490,029	Great Britain	Aug. 4, 1938
	517,483	Great Britain	Jan. 31, 1940