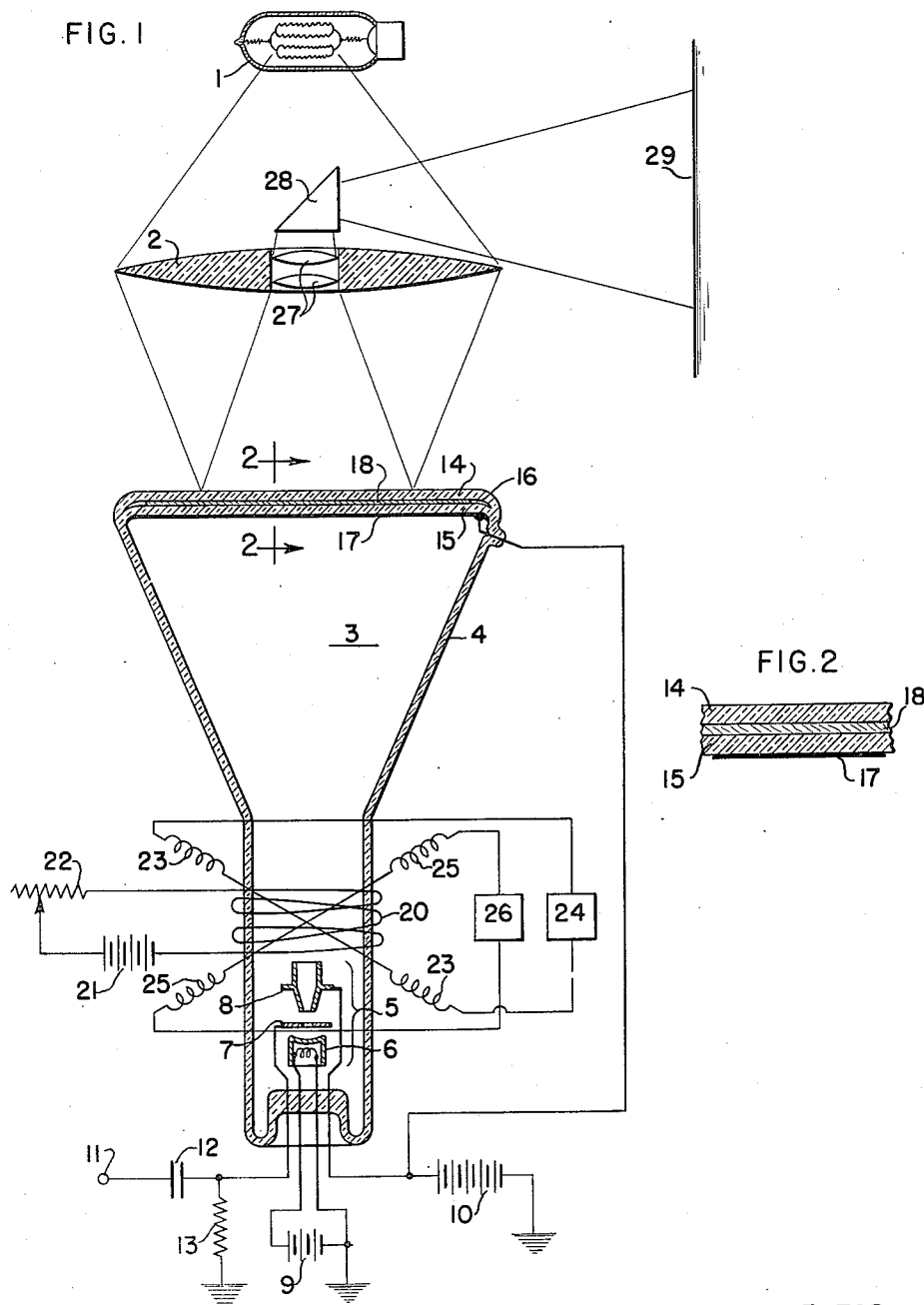


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P. T. FARNSWORTH
TELEVISION PROJECTION SYSTEM
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INVENTOR
PHILO T. FARNSWORTH
BY *Charles S. Martin*
ATTORNEY

UNITED STATES PATENT OFFICE

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TELEVISION PROJECTION SYSTEM

Philo T. Farnsworth, Fort Wayne, Ind., assignor
to Farnsworth Television and Radio Corpora-
tion, a corporation of Delaware

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6 Claims. (Cl. 178—7.5)

This invention relates to television signal reproducing devices and more particularly relates to a device in which the light emanating from a constant source is modulated in accordance with a television signal to reproduce a picture.

It has been conventional practice to reproduce television pictures by scanning with an electron beam modulated in accordance with a picture signal, a fluorescent screen to excite it to fluorescence, and thereby to reproduce the television picture. The fluorescent image may then be projected, by means of a projection objective, upon a viewing screen to provide an enlarged television picture. The brightness of enlarged pictures reproduced in this manner is ordinarily of a relatively low degree due to the inherent limitations of cathode ray tubes of the fluorescent type, which are well known in the art.

In accordance with another method of reproducing television pictures which has been practiced, the light emanating from a constant source, such as an arc lamp or an incandescent lamp, is modulated in accordance with a picture signal. Various light-modulating devices have been proposed for this purpose. Practically, however, these light-modulating devices have in general been characterized by certain limitations, such as failure to yield the resolution required for a high definition television picture and too sluggish operation.

It has heretofore been proposed to provide a light-control element having a variable light-dispersing characteristic, which is variable in accordance with the picture signal. In one known device, use is made of a thin layer of paraffin or wax, which is an excellent light diffuser at normal temperatures and which, when heated to the melting point, does not disperse light but is transparent. Since an extremely thin layer of such light-dispersing material must be chosen in order to fulfill the heating and cooling requirements within comparatively short time intervals, the light-dispersing characteristic of such a layer is not as pronounced as desired.

It is an object of the present invention to provide an improved television picture reproducing device of the light-modulation type capable of yielding a high degree of modulation of the light in accordance with a television picture signal.

In accordance with the present invention, there is provided a television picture reproducing device comprising a source of light and means for projecting an image of this source. A control means, including an element having variable

light-dispersing characteristic, is disposed in the projection path of the light from the source in such a manner as to permit its passage there-through. Means are also provided adjacent the control means for reflecting the projected light through the light-dispersing element. Means are further provided for altering the light-dispersing characteristic of the dispersing element in accordance with the television picture signal, and a projection objective is arranged to project only the dispersed light passing through a predetermined path.

For a better understanding of the invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the accompanying drawing:

Fig. 1 is a schematic diagram, certain parts being shown in section, of a television picture reproducing device embodying the present invention; and

Fig. 2 is an enlarged fragmentary cross section of the light-control element in the device of Fig. 1.

Referring now more particularly to Fig. 1, there is provided an incandescent light source 1 and a condensing lens 2 for projecting an image of the source in a predetermined plane. For the purpose of providing control means having a light-dispersing characteristic varying in accordance with a television picture signal, there is provided a cathode ray tube 3 comprising an envelope 4, having at one end thereof an electron gun 5 of conventional design, and including an indirectly heated cathode 6, a control member 7 and an anode 8. For providing operating voltage for the electron gun, a filament battery 9 or other suitable source of voltage is connected to the filament of the indirectly heated cathode 6 and a voltage source or battery 10 is connected to the anode 8 in the conventional manner, as shown. For modulating the electron beam developed by the gun 5 in accordance with a television picture signal, there is provided a terminal 11 to which the signal may be applied, this terminal being coupled to the control member 7 by means of a condenser 12 and a grid leak resistor 13.

At the opposite end of the cathode ray tube, the envelope 4 possesses an outer wall portion 14 and an inner wall portion 15, leaving an evacuated space 16 therebetween. The area of the wall portions 14 and 15 and the evacuated space 16 is at least as great as that enclosed by

the boundary rays of the light from the source 1 transmitted through the condenser lens 2 at the plane of members 14 and 15. The side of the inner wall portion 15 facing the electron gun 5 is provided with a layer of silver 17 presenting a reflecting surface to light from the source 1 entering through the outer wall portion 14. The silver layer 17 is preferably conductively connected to the anode 8, as shown, in order to maintain both elements at the same potential.

For the purpose of providing an element having a variable light-dispersing characteristic, there is provided a thin layer 18 of paraffin, or other suitable wax, in the evacuated space 16 between the wall portions 14 and 15. In order to heat successive points of the silver layer 17 and the paraffin layer 18, the electron beam developed by the electron gun 5 is focused upon the layer 17 by means of a focusing coil 20 connected in series relation with a voltage source or battery 21 and a variable resistor 22. For scanning the electron beam across the silver layer 17 at frame-scanning frequency, there is provided a pair of deflecting coils 23, 23, connected to a source of deflecting current 24 of frame-scanning frequency, and a pair of deflecting coils 25, 25 is connected to a source of deflecting current 26 for scanning the electron beam at line-scanning frequency in a direction normal to the frame-scanning deflection.

In order to project only the dispersed light reflected by the silver layer 17 which passes through a predetermined path, there is provided a projection objective 27, preferably disposed in a central aperture within the condensing lens 2. A prism 28 is provided for deflecting the light rays passing through the projection objective 27 upon a suitable viewing screen 29 to develop thereon the enlarged television picture.

Fig. 2 is an enlarged sectional view of the outer wall portion 14 of the cathode ray tube envelope 4, the paraffin layer 18, the inner wall portion 15 and the silver layer 17.

In the operation of the device of the present invention, light emanating from the source 1 is condensed by means of the condensing lens 2 and directed through the paraffin layer 18 upon the silver layer 17, from which it is reflected back through the layer 18 upon the projection objective 27. The condensing lens 2 is preferably so designed that an image of the light source 1 is formed in the entrance pupil of the projection objective in the absence of any light dispersion, in order to avoid any waste of light. In the absence of a television picture signal and, therefore, in the absence of any heat developed at the layer 17, the paraffin layer 18 is in solid condition and highly disperses light transmitted therethrough. The light coming from the source 1 is first dispersed in its transmission through the paraffin layer onto the reflecting surface of the layer 17 and is again dispersed, when reflected by the layer 17, back through the paraffin layer 18 in the direction of the projection objective 27. Hence, the light-dispersing qualities of the solid paraffin layer are twice utilized, so that the dispersion angle is greatly increased over that obtainable by a single transmission through an equivalent light-dispersing layer.

When the paraffin layer 18 is in solid condition and highly light-dispersive, the light reflected from any elemental area of the reflecting surface of the layer 17 emanates onto a large space angle. Only the portion of the dispersed light passing through a predetermined path en-

ters the entrance pupil of the projection objective 27 and is projected through the prism 28 onto the viewing screen 29. A light spot is then developed on the viewing screen 29 having a brightness considerably less than that corresponding to the intensity of the light source without dispersion.

In the presence of a television signal, the electron beam is modulated in its intensity in accordance with a television picture signal applied to the control member 7 of the electron gun 5, and is directed upon the layer 17 to raise the temperature thereof to an amount determined by the intensity of the electron beam. For the strongest television picture signal, this temperature should be just sufficient to melt the paraffin of the layer 18 at the point opposite that of the layer 17 impacted by the electron beam. In the liquid state, the paraffin no longer has any light-dispersing qualities but is perfectly transparent. In this case, the light from the source 1 transmitted through the paraffin layer 18 does not suffer any dispersion and all of the light reflected from the elemental area of the reflecting surface of the layer 17 is gathered by a projection objective 27 and projected upon the viewing screen 29 to develop thereon a light spot of the greatest intensity which the arrangement is capable of yielding, determined by the intensity of the source 1.

For temperatures between that corresponding to the solid condition of the silver and that corresponding to the melting point thereof, the paraffin goes through various stages between the solid and the liquid condition correspondingly altering its light-dispersing characteristic. With decreasing light dispersion, that is, increasing television signal and increasing temperature of the silver layer 17, the space angle, into which the light incident upon the reflecting surface of the layer 17 is reflected, becomes smaller and more of the dispersed light travels through the predetermined path to be gathered by the projection objective 27 and an increasingly bright light spot is obtained on the viewing screen 29.

Obviously, when the electron beam modulated in accordance with a television picture signal is scanned across the silver layer 17 by means of the deflecting fields developed by the coils 23, 23 and 25, 25 energized by the sources of deflecting current 24 and 26, respectively, the light-dispersion characteristic of the layer 18 varies point by point in accordance with a television picture signal. Hence, the light gathered by the projection objective from elemental areas of the reflecting surface of silver layer 17 varies in accordance with the television picture signal, and light spots of intensity varying in accordance with a television picture signal and in image relation with respect to each other are developed upon the viewing screen 29, thereby providing a bright enlarged television picture by modulation of the light from the first source 1 in accordance with the television picture signal.

Obviously, the projection objective 27 need not be located necessarily in a central aperture within the condenser lens 2 but can be arranged, together with the prism 28, between the outer wall portion 14 of the cathode ray tube 3 and the condenser lens 2. The arrangement described may also be used for direct viewing, in which case the axis of the cathode ray tube 3 is preferably arranged under an angle with respect to the optical axis of the condenser lens 2, thereby to permit unobstructed viewing of the

paraffin layer 18 by an observer. In this case, an image of the light source is preferably focused in the plane of the observer.

While there has been described what is at present considered the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A television picture reproducing device comprising a source of light, means for projecting an image of said source, control means including an element having a variable light dispersing characteristic adapted to be altered in accordance with heat applied thereto, disposed in the projection path of said light to permit its passage therethrough, means disposed adjacent said control means for reflecting said projected light through said element, and means for heating successive points of said last-named means in accordance with a television picture signal thereby to vary said light dispersing characteristic.

2. A television picture reproducing device comprising a source of light, means for projecting an image of said source, control means including an element having a variable light dispersing characteristic adapted to be altered by application of heat thereto, disposed in the projection path of said light to permit its passage therethrough, means disposed adjacent said control means for reflecting said projected light through said element, said last-named means adapted to be heated by electron bombardment, and means for bombarding said last-named means point by point with a beam of electrons modulated in accordance with a television picture signal.

3. The method of reproducing a television picture which comprises projecting an image of a

source of light through an element having a variable light dispersing characteristic, reflecting said projected light through said element, and heating said element thereby to alter the light dispersing characteristic thereof in accordance with a television picture signal.

4. The method of reproducing a television picture which comprises projecting an image of a source of light through an element having a variable light dispersing characteristic, reflecting said projected light through said element, and heating said element thereby to alter the light dispersing characteristic thereof in accordance with a television picture signal, and projecting only the dispersed light passing through a predetermined path to reproduce said television picture.

5. A television picture reproducing device comprising a source of light, means for projecting an image of said light source, control means including a light dispersing element disposed in the projection path of said light to permit its passage therethrough, said element being of such character that its light dispersing properties may vary from maximum dispersion to zero dispersion, means disposed adjacent said control means for reflecting said projected light through said element and means for altering the light dispersing characteristic of said element in accordance with a television picture signal.

6. A television picture reproducing device comprising a source of light, means for projecting an image of said light source, control means including a light dispersing element disposed in the projection path of said light to permit its passage therethrough, said element being of such character that its light dispersing properties may vary from maximum dispersion to zero dispersion, and means for altering the light dispersing characteristic of said element in accordance with a television picture signal.

PHILO T. FARNSWORTH.