

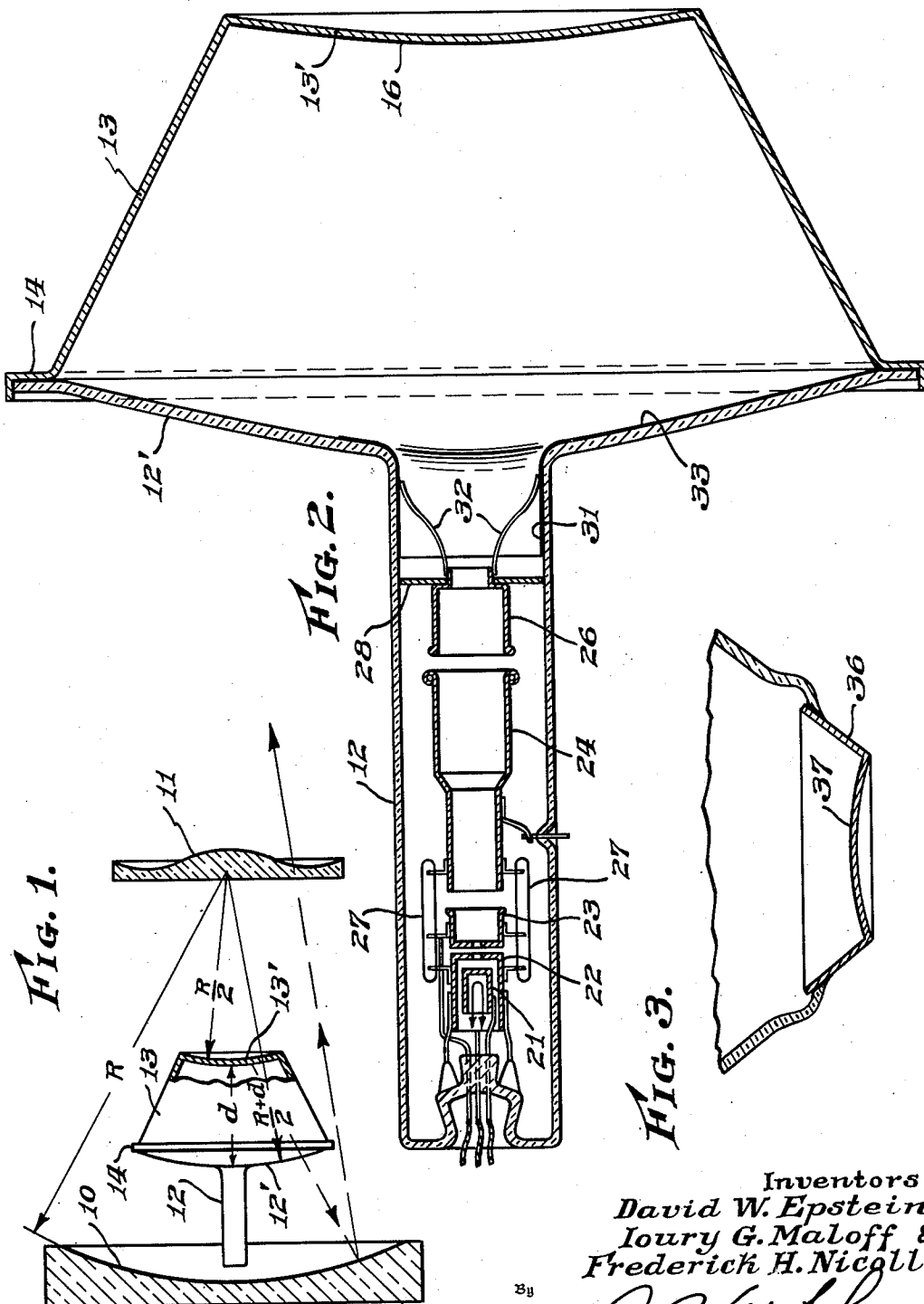
Dec. 22, 1942.

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2,305,855

TELEVISION APPARATUS

Filed July 31, 1941



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UNITED STATES PATENT OFFICE

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TELEVISION APPARATUS

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Application July 31, 1941, Serial No. 404,826

5 Claims. (Cl. 178—7.5)

Our invention relates to cathode ray tubes and associated optical systems and in particular to apparatus for projecting a large size television picture or the like.

One of the main problems in the projection of television pictures, especially pictures of theatre size, is that of obtaining sufficient illumination on the projection screen. This problem has been solved in part by employing a reflective optical system for projection as described in Landis Patent No. 2,273,801, issued Feb. 17, 1942, and entitled Television receiver. Even with an optical system of this type, however, the cathode ray projection tube is best operated at a high voltage and the fluorescent screen may become too hot for maximum light output and, also, for a reasonable life of the screen.

An object of the present invention is to provide an improved television projection system having relatively high light output.

A further object of the invention is to provide an improved television projection system in which the fluorescent screen of the projection tube will remain reasonably cool during operation.

A further object of the invention is to provide an improved television projection system in which the projected light is obtained from the same side of the fluorescent screen that is being scanned.

A still further object of the invention is to provide an improved cathode ray projection tube.

In practicing a preferred embodiment of the invention, the envelope of a cathode ray projection tube comprises a metal section which faces the electron gun of the tube and which is coated with a suitable luminescent or fluorescent material. The metal section will conduct heat away from the screen material much more rapidly than will the glass supporting area of the earlier tubes.

Our improved tube is also so designed that it does not require keystone correction even though the projected light is coming from the same side of the screen that is being scanned, this being the side that emits the most light. Such a design is obtained by properly combining our projection tube with a suitable projection optical system.

The invention will be better understood from the following description taken in connection with the accompanying drawing in which

Fig. 1 shows one embodiment of the invention comprising our improved projection tube in combination with a reflective optical system,

Fig. 2 shows in cross section, and on a larger scale, the projection tube shown in Fig. 1, and

Fig. 3 is a view illustrating another method of constructing a projection tube in accordance with the invention.

Referring to the embodiment shown in Fig. 1, the projection system comprises a reflective optical system consisting of a spherical mirror 10 and a spherical aberration correcting plate 11, this type of optical system being described in the above-identified Landis patent.

The cathode ray tube comprises a highly evacuated envelope consisting of a glass section 12 in which the electron gun is located, and a metal section 13 having a curved surface 13' facing the electron gun. The glass and metal sections are sealed at the rim 14.

As shown in Fig. 2, the curved metal surface 13' is coated inside the tube with a suitable fluorescent material to form a screen 16.

While various electron gun structures may be utilized, a specific structure is shown in Fig. 2, by way of example. It comprises an indirectly heated cathode 21, a control grid 22, a screen grid 23, a first anode 24 and a second anode 26. The electrodes 23 and 24 are supported by means of glass beads 27. The electrode 26 is supported by means of a mica washer 28. This particular gun is designed to have no first anode current as described and claimed in application Serial No. 338,058, filed May 31, 1940, in the name of David W. Epstein.

The portion of the envelope 12 facing the anode 26 preferably is coated with a suitable conducting material, as indicated at 31, which is connected to the anode 26 by conducting strips 32 of springy material. The coating 31 is also connected to the metal section 13 of the tube envelope by a conducting strip 33.

If desired, the second anode 26 and the conductive coating 31 may be supported on a re-entrant portion added to the glass section of the envelope to prevent high voltage breakdown between the coating 31 and the deflecting coils (not shown) as taught in application Serial No. 302,217, filed October 31, 1939, in the name of David W. Epstein.

It will be apparent that most of the light from a reproduced picture image on the screen 16 passes through the flange-like portion or face 12' of the glass section of the tube envelope (the narrow conducting strip 33 covering only a small area). Thus, the path of the light rays is as indicated by the dotted line in Fig. 1. The glass face 12' preferably is substantially concentric

with the spherical mirror, that is, its radius of curvature is $R/2+d$, where R is the radius of curvature of the mirror 10 and d is the radial distance between the screen 16 and the face 12'.

The tube end 13', and the screen 16 thereon, have a spherical curvature with a radius of approximately $R/2$ where R is the radius of curvature of the spherical mirror 10. This curvature of the screen 16 is required if the field of the projected image is to be flat, as it should be for projection on the usual projection screen.

It will be apparent that the screen 16 can be cooled by blowing air against the tube end 13' or even by water cooling the end of the tube, if desired.

Various modifications may be made in the construction of our improved cathode ray tube. For example, Fig. 3 shows the screen end of a tube having an envelope which is made entirely of glass except for a comparatively small end section 36 of metal. On the inner surface of the curved area of section 36 there is a luminescent screen 37 corresponding to the screen 16 in Fig. 2.

From the foregoing it will be understood that various other modifications may be made in our invention without departing from the spirit and scope thereof.

We claim as our invention:

1. A cathode ray tube having an envelope which comprises a glass section and a metal section, said metal section having an area on which there is a coating of luminescent material to form a screen, an electron gun in said tube positioned on the longitudinal axis thereof and substantially normal to said screen to direct a scanning beam against said screen, a portion of said glass section which surrounds said longitudinal axis forming a window through which light from said screen may leave the tube, said screen coated area of the metal section being convex as viewed from the inside of said tube.

2. In combination, a cathode ray tube having an envelope which comprises a glass section and a metal section, said metal section having an area on which there is a coating of luminescent material to form a screen on which a received picture may be reproduced, an electron gun in said tube positioned on the longitudinal axis thereof and substantially normal to said screen to direct a scanning beam against said screen, a portion of said glass section which surrounds said longitudinal axis forming a window through which light from said screen may leave the tube, and an optical projection system positioned to project said reproduced picture upon a projection screen.

3. In combination, a cathode ray tube having an envelope which comprises a glass section and a metal section, said metal section having an area on which there is a coating of luminescent material to form a screen on which an image may be reproduced, an electron gun in said tube positioned on the longitudinal axis thereof and substantially normal to said screen to direct a

scanning beam against said screen, a portion of said glass section which surrounds said axis forming a window through which light from said screen may leave the tube, a light reflecting surface of revolution positioned to project said reproduced picture upon a projection screen and a spherical aberration correcting plate positioned to correct its spherical aberration, said screen coated area of the metal section being convex as viewed from the inside of said tube.

4. In combination, a cathode ray tube having an envelope which comprises a glass section and a metal section, said metal section having an area on which there is a coating of luminescent material to form a screen on which a received picture may be reproduced, an electron gun in said tube positioned on the longitudinal axis thereof and substantially normal to said screen to direct a scanning beam against said screen, a portion of said glass section which surrounds said axis forming a window through which light from said screen may leave the tube, a spherical mirror positioned to project said reproduced picture upon a projection screen and a spherical aberration correcting plate positioned at least approximately at the center of curvature of said mirror to correct its spherical aberration, said screen coated area of the metal section being convex as viewed from the inside of said tube and having a radius of curvature which is at least approximately equal to one-half the radius of curvature of said mirror.

5. In combination, a cathode ray tube having an envelope which comprises a glass section and a metal section, said metal section having an area on which there is a coating of luminescent material to form a screen on which a received picture may be reproduced, an electron gun in said tube positioned on the longitudinal axis thereof and substantially normal to said screen to direct a scanning beam against said screen, said glass section having a flange-like portion surrounding said axis and forming a window through which light from said screen may leave the tube, a spherical mirror positioned to project said reproduced picture upon a projection screen and a spherical aberration correcting plate positioned at least approximately at the center of curvature of said mirror to correct for its spherical aberration, said screen coated area of the metal section being convex as viewed from the inside of said tube and having a radius of curvature which is at least approximately equal to one-half the radius of curvature of said mirror, and said flange-like portion being concave as viewed from the inside of said tube and having a radius of curvature equal at least approximately to one-half the radius of curvature of said mirror plus the radial distance from said luminescent screen to said flange-like portion.

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