

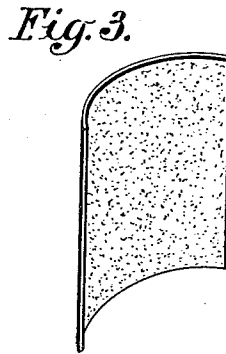
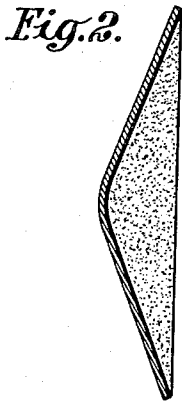
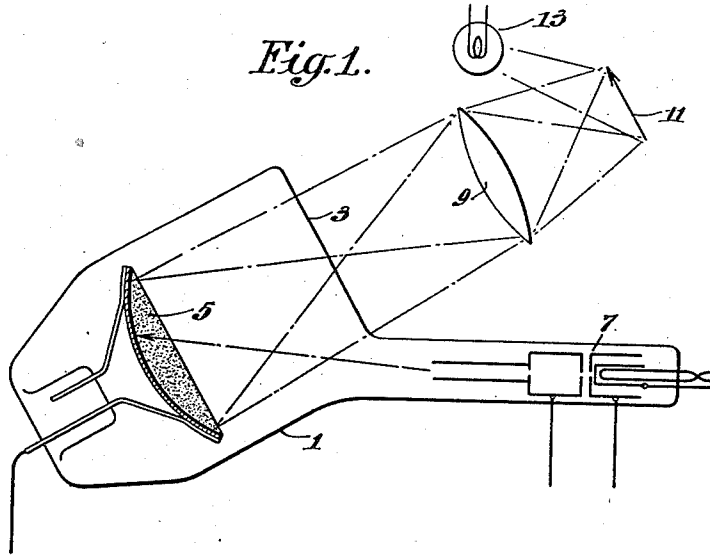
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2,139,296

CATHODE RAY TUBE

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CATHODE RAY TUBE

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4 Claims. (Cl. 250—150)

My invention relates to cathode ray tubes and more particularly to tubes of the type now generally utilized in television transmitters.

This application forms an improvement upon the structure set forth by my co-pending application Serial No. 574,772, filed November 13, 1931, now issued as U. S. Patent #2,021,907 granted November 26, 1935 and assigned to Radio Corporation of America.

A cathode ray transmitting tube as disclosed in my copending application is constituted by an evacuated container having at least one transparent wall, a planar photo-sensitive cathode of the mosaic type, and an electron gun for directing a cathode ray toward and against the cathode.

When such a device is utilized in a television transmitter or in an ultra-microscope of the type disclosed in the aforesaid application, it is necessary to interpose an optical system, constituted by one or more lenses, between the object and the photo-sensitive electrode for the purpose of forming upon the said electrode an optical image of the object. An image formed by an uncorrected or non-aplanatic lens upon a plane surface is more or less distorted by reason of various phenomena, including that of chromatic aberration. To the end that such distortion may be compensated it has heretofore been necessary, in television transmitters, to use compound lens systems wherein different lenses or different portions of a single compound lens are made from glass having differing indices of reflection. Such lenses are expensive and it is, accordingly, the primary object of my invention to provide a cathode ray transmitting tube of such type that it may be utilized with plain or uncorrected lenses.

Another object of my invention is to provide a cathode ray tube of the type described whereby distortion occasioned in the scanning operation shall be more or less compensated. This type of distortion is introduced by reason of the fact that the cathode ray, at the extreme ends of its vertical and horizontal paths upon the cathode, must traverse a greater distance between the gun and the cathode than at the midpoints of the several paths. This causes some de-focusing of the ray at the extreme ends of its paths.

The foregoing objects and other objects ancillary thereto I accomplish, in a preferred embodiment of my invention, by giving to the cathode such configuration that when an image is focused thereon the phenomena of spherical and chromatic aberration are not made manifest. Specifically, I prefer to make the cathode concave toward the lens system, giving it either a

spherical curvature or a curvature corresponding to a surface generated by rotating a parabola or a hyperbola around the optical axis of the lens system. In some instances the cathode may be trough shape, that is, it may have a surface equivalent to that produced by the movement of an arc of a circle, a parabola or a hyperbola in a direction at right angles to the optical axis of the system instead of a surface of rotation.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention, however, both as to its organization and its method of operation, together with additional objects and advantages thereof will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawing, in which—

Fig. 1 is a highly conventionalized view, partly sectionalized, of my improved cathode ray tube exemplifying its utilization in an ultra-microscope, and

Figs. 2 and 3 are views of modified cathodes.

Referring now to the drawing, my improved cathode ray tube is constituted by an evacuated envelope 1, having a transparent end portion 3, in which envelope is mounted a target in the form of a photo-electric cathode 5 of the mosaic type and in which is also mounted a cathode ray source 7 commonly designated in the art as a "gun".

In order to simplify the drawing, I have purposely omitted some of the electrical connections through which energy is supplied to the tube and over which pulsations or impulses representing the optical image are led out from the photo-electric cathode. I have also omitted details of the mosaic surface of the cathode as well as the devices such as coils, electrostatic plates, or the like, by which the cathode ray is caused to rapidly scan each element of the photo-electric cathode horizontally and vertically.

In the drawing I have shown a sectional view of the cup-shaped cathode, it of course, being understood that the said electrode is preferably circular.

When my improved cathode ray tube is utilized, for example, in an ultra-microscope, I interpose a quartz lens or a quartz lens system, exemplified in the drawing by a single lens 9, between the photo-electric cathode and the object 11, which object is illuminated from a source 13 of monochromatic light, preferably ultra violet. By reason of the use of monochromatic light, chromatic aberration is not introduced into the optical im-

age on the cathode by the lens system and the cathode, therefore, need only be curved to an extent sufficient to correct for other aberration.

It is, of course, apparent that the configuration of the photo-sensitive cathode depends upon the curvature of the lens or upon the curvature of the imaginary surface on which the lens system focuses sharply. It is not feasible to illustrate all possible cathode shapes since the curvature thereof is a matter that can best be determined through experiment with the particular lens system it is desired to use.

From a consideration of the foregoing, it will be apparent that I have provided an improved cathode ray tube through the use of which the optical system necessary to produce an optical image for television transmission, or to permit the tube to be utilized as an ultra-microscope, is materially cheapened.

An additional advantage accruing from the concave cathode is the minimization of de-focusing of the cathode ray during the scanning operation. Since the prevention of de-focusing of the cathode ray spot on the cathode is substantially equal in importance to the compensation for spherical or chromatic aberration of the optical image, I sometimes find it advisable to give to the cathode a curvature that is a compromise between the curvature which would give best de-focusing correction and best optical correction. As hereinbefore stated, under such conditions the cathode might be hyperbolic, parabolic, elliptical, and either trough or cup-shape as further exemplified by Figs. 2 and 3.

Although I have chosen a particular embodiment of my invention for purposes of explanation, it is to be understood that I am not restricted thereto since many modifications will be obvious to those skilled in optics and in electron-

optics. My invention, therefore, is not to be limited except insofar as is necessitated by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. In combination, a cathode ray image transmitting tube provided with an electrode in the form of a mosaic photosensitive target and with means for developing a ray of electrons and directing the ray at a surface of said target for scanning the same, a lens system for focusing an optical image of an object on the scanned portion of the surface of the target, such portion of said surface being concave toward the lens system with a curvature corresponding substantially to that of an imaginary spherical surface on which the lens system is able to focus the optical image sharply.

2. The invention set forth in claim 1 additionally characterized in that the lens system is permeable to monochromatic light.

3. The invention set forth in claim 1 additionally characterized in that the lens system is permeable to ultra-violet light.

4. A cathode ray image transmitting tube comprising a container provided with a photosensitive mosaic electrode in the form of a target and with means for developing a ray of electrons and directing the ray at a surface of said photosensitive mosaic target for scanning the same so as to produce image signals, the scanned portion of said surface being concave toward said ray-developing means to prevent distortion due to scanning, and additionally characterized in that the scanned portion of the surface of the photosensitive target is substantially a spherical surface of revolution.

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