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KINESCOPE PROJECTION BY REFRACTIVE OPTICAL SYSTEM MOUNTED ON TUBE NECK

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FIG. 1.

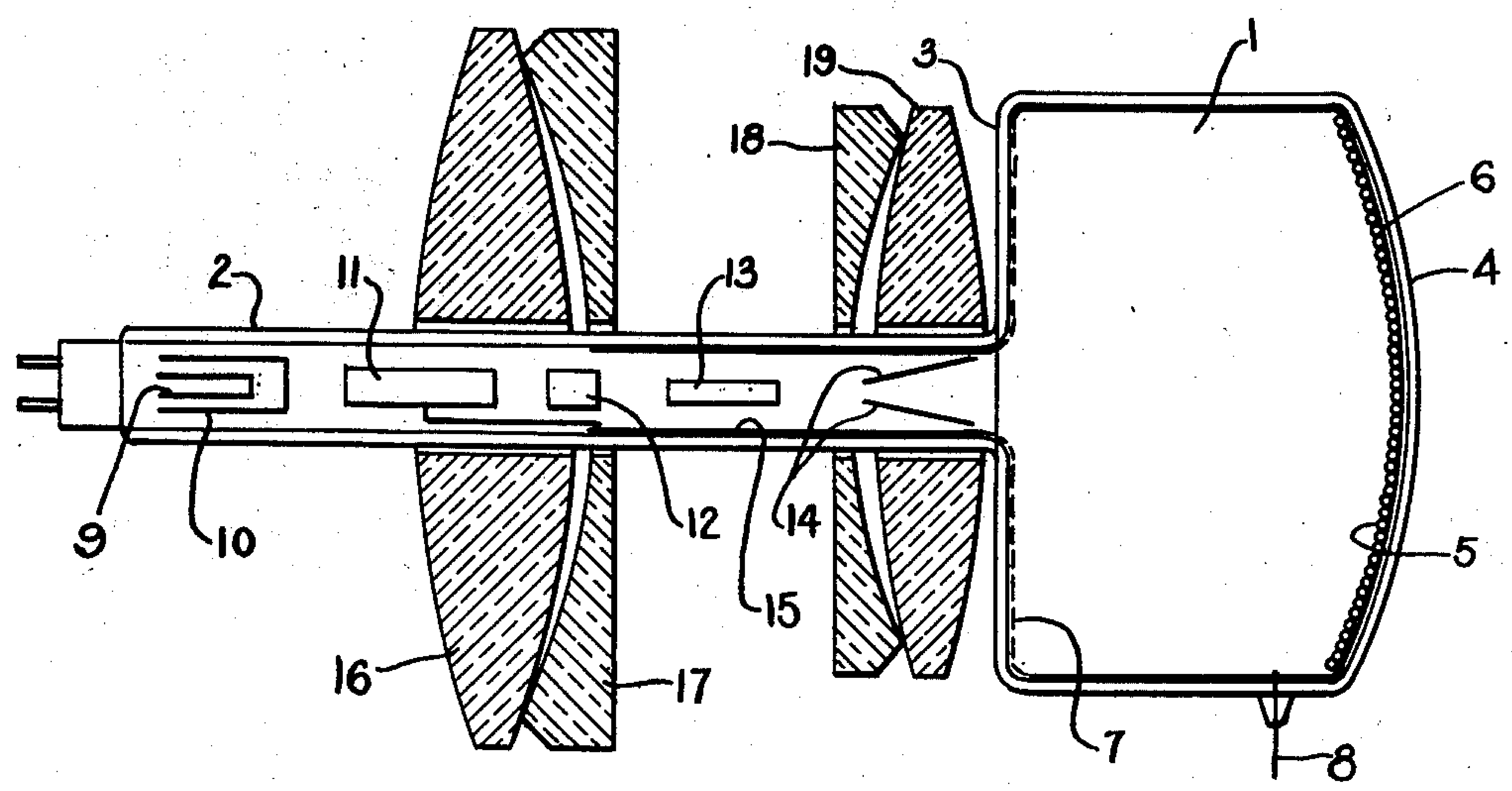
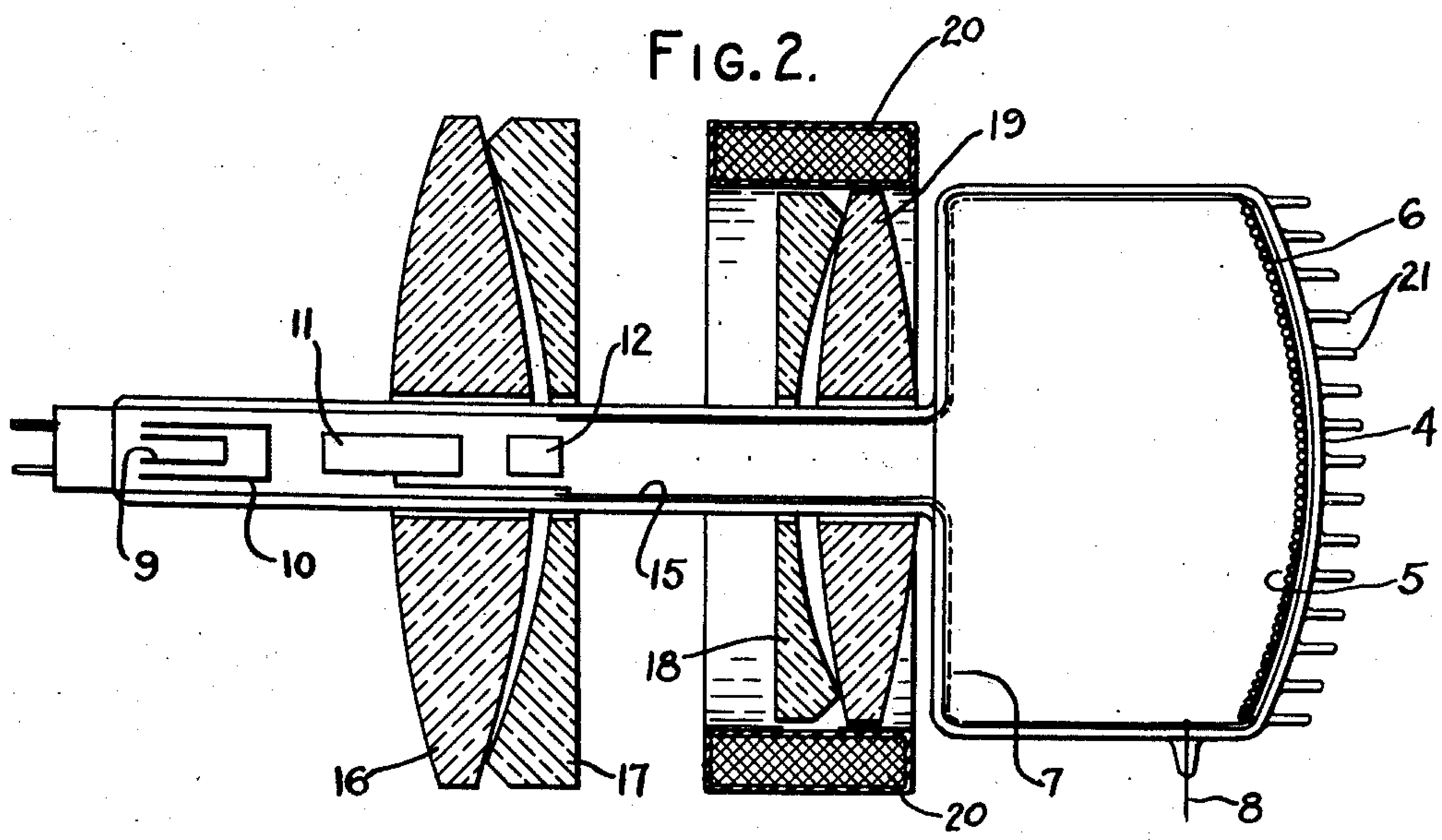


FIG. 2.



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KINESCOPE PROJECTION BY REFRACTIVE OPTICAL SYSTEM MOUNTED ON TUBE NECK

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5 Claims. (Cl. 177—319)

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This invention relates to new and useful improvements in cathode ray tubes and particularly in cathode ray tubes of the projector type.

Until recently, the use of refractive optical systems for projecting images from cathode ray tube screens has been impeded by the difficulty of fulfilling simultaneously the requirements of good electrical and optical image quality. Because of the flexibility in the electrical design, it is possible to construct tubes which compensate the more or less invariable shortcomings of the lens systems. However, these special tubes are likely to require extra elements for controlling the electrical picture. For example, it is necessary to employ special magnetic fields to shape the scan in such a way that it compensates for distortion of a wide aperture lens. Or, to cite another example, in pipe-shaped tubes in which the beam has to travel different distances, i. e. the type of tube in which the bulb portion and the neck portion are not coaxial, it is necessary to provide special means to compensate for the varying focus at the top and the bottom of the scan as well as means to compensate for keystone effect.

The object of the present invention is to solve these problems without providing said extra elements or special compensating means.

With this object in view, according to one feature of my invention, a portion, e. g. the neck, of a cathode ray tube passes through a perforation in the cooperating lens system.

Another feature provides for a window in the wall of the tube through which light, which originates from a concave target preferably carried by an opposite concave wall of the tube, may pass out of the tube. Since the target is concave towards the electron gun various parts thereof will tend to be more equidistant from the point of beam deflection than otherwise. Moreover, once the target curvature is selected the deflecting means may be placed at such a distance from the target that the deflection of the electrons emitted by the gun follows substantially the same radius of curvature as that of the target.

These and other features of the invention will more clearly appear from the following description of two embodiments thereof which are illustrated in Figs. 1 and 2 of the drawings in diagrammatic side views. The same reference numerals in the two drawings designate identical parts.

The cathode ray tube is generally of conventional design and the elements thereof are enclosed within an envelope having a bulb portion 1 and a neck portion 2. The neck 2 opens cen-

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trally through a wall 3 of the bulb 1. Facing the wall 3 is a wall 4 on which a fluorescent screen 5 of any suitable composition is deposited. The wall 3 must be transparent. It is shown as being perpendicular to the longitudinal axis of the neck 2, though it may be suitably curved. The screen 5 is deposited either directly on the wall 4 or on a conductive coating 6 thereon. The wall 4 and, therefore, the screen 5 are concave when viewed from the neck 2.

The wall 3 has a transparent conductive coating 7 which is electrically connected with the coating 6 with which connection may be established from the outside through lead-in wire 8.

The neck encloses the customary electron gun structure in which 9 is the cathode, 10 the grid, 11 the accelerating anode, 12 the focusing anode, 13 one of the two horizontal deflection plates, and 14 the vertical deflection plates.

Part of the inside surface of the neck portion 2 has a conductive coating 15 which is connected with the accelerating anode 11 as well as with the transparent coating 7.

The light produced on the screen 5 by the electron beam is projected through the window formed by transparent wall 3 and coating 7, and the light rays are projected on an outside screen by a centrally perforated lens system through which the neck projects. Except for the central perforation, the lens system which I have shown in the drawing is conventional. It is composed of two crowns 16 and 19 and two flints 17 and 18, which are so dimensioned and positioned as to obtain the desired magnification of the image which is projected from the screen 5 through the window 3.

The diameter of the neck portion 2 must be as small as possible so that the holes in the elements of the lens system may be of minimum size to secure maximum light transmission. With a neck diameter of approximately three-fourths of an inch, the light loss will be only about 4% to 25% of the total.

The entire envelope 1, 2 of the cathode ray tube may be made of glass and evacuated, or the envelope may be made partly of glass and partly of metal. Only the wall 3 need be transparent. Also, instead of using a permanently evacuated envelope, the cathode ray tube may be connected with a pump and continuously evacuated during operation. The adjustment and focusing of the lens system may be performed in any suitable way, and the gun structure may be modified as desired. One such modification is shown in Fig. 2 in which the electrostatic deflecting plates 13 and 14 are replaced by magnetic deflecting coils 20 which are provided around the outer periphery of lens elements 17 and 19. Otherwise the tubes shown in the two figures are identical, except that the wall 4 in this modification is provided with cooling fins 21 which are particularly desirable in a high voltage tube.

The lens system can include aspherical elements and may be partly or wholly of glass or any other suitable plastic. Plastic is particularly recommended because the center holes can be bored exactly and without difficulty.

Among the desirable features of this invention are the following: The lens system and the cathode ray tube have the same axis of symmetry. The light of the fluorescent screen is taken from the bombarded and, therefore, brighter surface of the target. The fluorescent screen can be deposited on a conductive support formed on or separate from the envelope, from which charges can be removed. The screen may be easily cooled. The fluorescent screen can be made concave to both the lens and electron beam which permits both compensating for the inherent curvature of field of the lens system and attaining good electrical focus on different parts of the target. The over-all length of the system from viewing screen to the rear of the projector is shorter than in conventional refractive projectors. In fact, the lens system does not add at all to the length of the tube. Mechanical dimensions of the tube may permit higher speed lenses to be used.

What I claim is:

1. In a cathode ray tube projector, an evacuated envelope having a bulb and a neck portion, the latter opening into the former through a central opening in a substantially flat transparent side wall facing a concave wall, a conductive layer on the concave wall, a fluorescent layer on the conductive layer, said side wall being substantially perpendicular to the longitudinal axis of the neck portion and being of the same order of magnitude as that of the fluorescent layer, an electron gun within the neck portion cooperating with the fluorescent layer, an accelerating anode system comprising a transparent conductive coating on the flat side wall connected to said conductive layer, and a refractive lens system having a plurality of elements at least one of which has a central perforation through which the neck portion passes, the lens system, the

electron gun and the concave wall having a common axis of symmetry.

2. In a television projector as in claim 1, and means for scanning the fluorescent layer with a beam of electrons from the gun, said means being at a distance from the concave wall approximately equal to the radius of curvature thereof.

3. In a television projector as in claim 1, in which at least one of the elements of the lens system is made of plastic material other than glass.

4. In a television projector as in claim 1, and means for magnetically scanning the fluorescent layer with a beam of electrons from the gun, the means for scanning comprising magnets supported around the neck portion beyond the outer periphery of elements of the lens system.

5. In a television projector as in claim 1, and means outside of the wall which has a curved inside surface for cooling said wall and the fluorescent layer on said surface.

CONSTANTIN S. SZEGHO.

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