Dec. 18, 1934. F. W. HEHLGANS 1,985,093

CATHODE RAY TUBE

Filed May 23, 1933

Fig. 1.

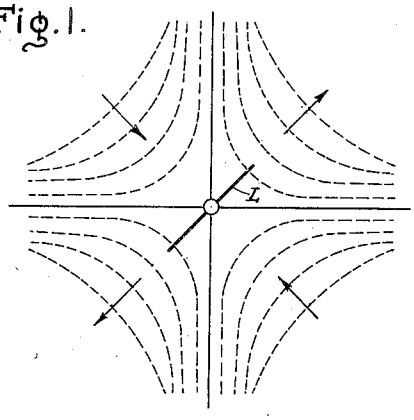


Fig. 2.

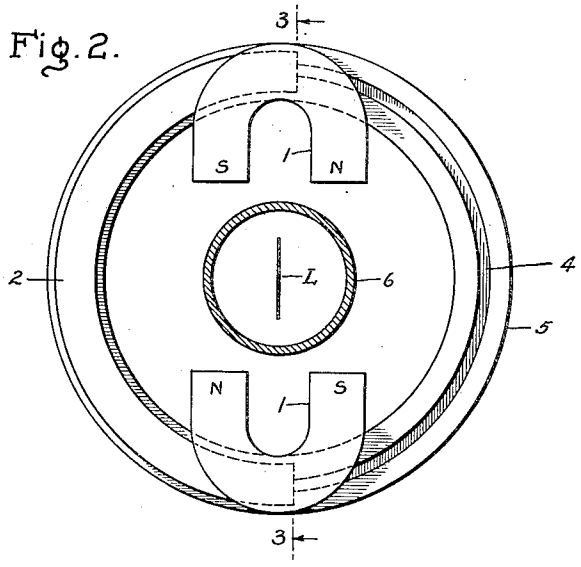
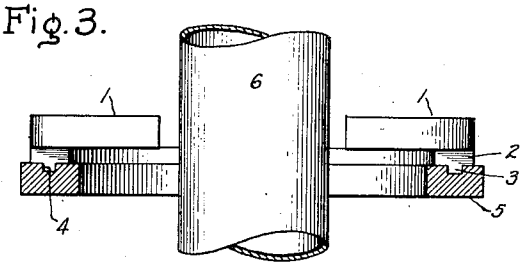


Fig. 3.



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CATHODE RAY TUBE

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Application May 23, 1933, Serial No. 672,488
In Germany June 1, 1932

6 Claims. (Cl. 250—27.5)

The present invention relates to tubes in which a beam of electrons is employed and more particularly to a tube of this sort in which the electrons are focussed by a magnet system.

The Drewanz et al. application, Serial No. 644,716, filed November 28, 1932, and entitled "Cathode ray tubes" describes and claims a cathode ray tube structure provided with a plurality of magnets for constraining a circular beam of electrons to a flat rectangular elongated shape. A tube of this character together with the magnet focussing arrangement is particularly well adapted for sound recording and sound pictures. When the fluorescent spot is elongated in this manner and suitably controlled, the fluorescent screen presents narrow strips of light, the length of the strip and its light intensity being variable according to the voltage of the microphone current impressed on the control member. When a film is moved past the end of the cathode ray tube, these narrow lines cause corresponding undulations to appear on the film, and due to their extreme narrowness, production of sound from the film constitutes a faithful reproduction of the original sound propagated into the microphone. The present invention constitutes an improvement on the magnet system shown in the patent application referred to.

An object of the present invention is to provide a simple and cheap means for rotating a beam of electrons which has been linearly-focused by a magnet system, the movement of the beam to be accomplished without change in its shape. In the patent application referred to, there are no means provided for causing the electron beam to move. It is evident that under certain conditions, it may be desirable to move and to adjust the position of the electron beam relatively to the optical axis of the projection system, also relatively to the direction of motion of the film.

In order that the highest quality of light image may be produced on a photographic film by a cathode ray tube, the strip of light as seen on the fluorescent screen must be symmetrical to the optical axis of the system as a whole. It must also intercept this axis. The light strip must also be positioned at right angles to the optical axis of the projecting system and to the direction of motion of the film. In order to satisfy these conditions, the strip of light must move in a single plane, when the fluorescent screen and the plane of the film are parallel. Furthermore, the light strip may be moved only angularly, i. e., rotatably about the optical axis as the center of movement.

The invention is based upon observations made with the magnet system described in the patent application referred to and these observations are as follows:

(1) When the four pole system is symmetrically arranged in a plane parallel to the fluorescent screen and therefore parallel to the plane of the film, the strip of light is symmetrical to the axial plane of the system. This plane is derived from the direction of motion of the film and from the position of the optical axis.

(2) The strip of light may be displaced parallel to itself over the fluorescent screen by displacing the neutral zone of the magnetic four pole system.

When employing two permanent magnets, the neutral zone may be displaced by altering the spacing between the oppositely-facing dissimilar poles of the two magnets. When using electromagnets instead of permanent magnets, this effect may be obtained by changing the number of ampere turns on the two poles of a magnet. The neutral zone, and therefore the strip of light on the fluorescent screen, may likewise be angularly moved about the optical axis as the center by rotating the four pole system about this optical axis. These conditions may be explained with reference to Fig. 1 of the accompanying drawing which is a diagrammatic representation of the lines of force of a four pole system of the type disclosed in the patent application referred to hereinbefore.

Fig. 2 is a plan view of the magnet system, improved in accordance with the present invention, also showing the cathode ray tube envelope in cross section.

Fig. 3 is a view, partly in section, taken along the line 3—3 in Fig. 2.

In Fig. 1, the dotted lines are the magnetic lines of force between the opposite poles of a magnet system forming a neutral zone at the center of the axes. A circular beam of electrons emanating from the center and moving in a direction at right angles to the plane of the paper is influenced by the lines of force in the direction shown by the arrows and is consequently drawn down to a thin line L which occupies the position shown in the figure. When the poling of the magnets is reversed to that indicated, the strip L is given a position 90° removed from its original position.

In accordance with the present invention, the magnet system for adjusting the spot of light

on the fluorescent screen is so designed that its neutral zone may be rotated and displaced in a plane parallel to the screen. The manner in which this is accomplished will be apparent from an inspection of Figs. 2 and 3 in which the permanent magnets, which form the four pole system, may be secured to an arcuate metal strip 2 provided with a tongue 3. This tongue fits slidably in a circular groove 4 cut in the metal base plate 5 which conveniently takes the configuration of a ring. The combination of the magnets and base plate on which the magnets rest is then positioned centrally about the cathode ray tube 6 which may be of the ordinary construction and containing a cathode, an anode, an electrostatic control member, and a fluorescent screen, as is well known in the art. Obviously, if the ring 5 is rigidly positioned with respect to cathode ray tube 6 and the magnets are symmetrically spaced about the tube, these magnets maintain their symmetrical relation, regardless of their angular position with respect to the tube. The arcuate strip 2 constrains the magnets to move in a circular path which is defined by the tongue-groove arrangement so that as one magnet is moved the other magnet takes up its corresponding position on the opposite side of the tube. It is also apparent that the entire magnet system may be moved along the length of the cathode ray tube and may take a position at any angle with respect to the optical axis of the tube and the magnets may still be caused to maintain their symmetrical relation on account of the rigid base member. Thus, by moving the magnets through their circular path, the light strip is caused to rotate about its center and other adjustments of the light strip may also be obtained by the use of improved ring member.

The permanent magnets may be replaced by electro-magnets, if desired, in which case the alteration of the distance between the two magnets may be supplemented by a change in the ampere turns of the magnets. In this case, the electromagnets may be secured to the arcuate strip 2 in the same manner as the permanent magnets. It is also apparent that if desired more than one pair of either permanent or electromagnets may be employed in which case the arcuate strip 2 is completed to form a whole ring with the magnets secured thereto at equidistantly spaced positions.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In combination, a cathode ray tube, a plurality of magnets mounted about said tube and having opposite poles facing one another, said magnets adapted to rotate about the tube, and means for maintaining the same relative positions of the magnets while being rotated.

2. In combination, a cathode ray tube, a plurality of magnets mounted about said tube and having opposite poles facing one another, said magnets adapted to rotate about the tube and to move lengthwise thereof, and means for maintaining the same relative positions of the magnets while being moved.

3. In combination, a cathode ray tube, a plurality of magnets mounted about said tube, said magnets having the opposite poles thereof facing one another and adapted to move about the tube, and means for constraining the motion of the magnets to a circulatory path.

4. In combination, a cathode ray tube of circular configuration, a four-pole magnetic structure mounted about the tube with opposite poles facing one another, said structure adapted to move about the tube, means for constraining the movement of said structure to a circular path, concentric with the envelope.

5. In combination, a cathode ray tube, a plurality of magnets mounted about said tube and having opposite poles facing one another, said magnets rigidly mounted on a frame, said frame adapted to rotate about the tube and to move lengthwise thereof.

6. In combination, a cathode ray tube of circular configuration, a pair of magnets rigidly mounted on a frame and positioned on opposite sides of the tube, the opposite poles of said magnets facing one another, said frame adapted to move about the tube and means for constraining the movement of the frame to a circular path concentric with the envelope.

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