ELECTRON TUBES

RCA Application Note

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Component Considerations and Centering Adjustments For Kinescope RCA-16GP4

The purpose of this Application Note is to discuss some of the important factors to be considered in the design and adjustment of the deflecting yoke, focusing coil, and ion-trap magnet used with the short metal kinescope RCA-16GP4.

Deflecting Yoke Adjustment

When the deflecting yoke is placed on the neck of the kinescope, the screen end of the yoke is centered by pushing the yoke forward so that the windings are pressed firmly against the glass cone. In order to center the base end of the yoke and maintain its axial alignment with the tube neck, a small cylindrical wedge of insulating material should be inserted between the base end of the yoke windings and the tube neck. The yoke should be mounted so that it may be rotated for alignment of the raster with the tube mask. Grounding of the yoke core is advisable to keep radiation to a minimum.

Focusing Device Considerations

A focusing field, supplied by an electromagnetic coil, permanent magnet, or a combination of the two, is required to concentrate the electron beam into a focused spot at the screen. The field should have excellent radial symmetry. When a coil is used, it should be supplied with direct current from a well-filtered source. The focusing field should be spaced at least one-half inch from the deflecting coils to reduce interaction between the focusing and deflecting fields. If the focusing field is placed too close to the deflecting fields, interaction between them may produce reduced deflection sensitivity and corner resolution, as well as objectionable rotation of the fluorescent pattern as the focus is varied. On the other hand, if the focusing field is located

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too close to the electron gun, resolution will be reduced and pattern distortion may occur as a result of interaction of the focusing field with the ion-trap-magnet field.

As the air gap of the focusing device is moved away from the deflecting yoke, the corner resolution will be improved at the expense of a slight loss in center resolution. The strength of the focusing field required for focus will increase as the distance between the deflecting yoke windings and air gap of the focusing device becomes greater.

Ion-Trap-Magnet Requirements

The RCA-16GP4 employs a tilted gun in order to provide correct beam alignment with a single-field ion-trap magnet. The ion-trap magnet should be placed on the neck of the kinescope approximately opposite grid No.1 as shown in Fig. 1. The direction of the magnetic field of the

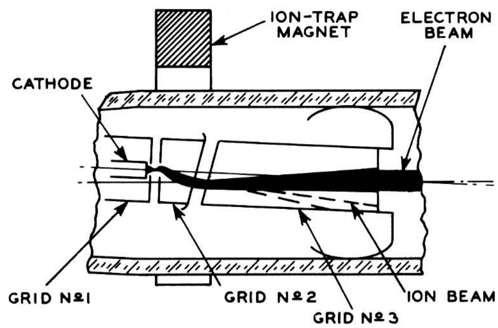

Fig. 1 - Effect of Ion-Trap Magnet on Beam Path.

ion-trap should be such that the north pole is adjacent to vacant pin position No.8 and the south pole to pin No.2. The field strength required of the ion-trap magnet will vary directly with the square root of the anode voltage. The type of focusing device used, however, will have only a slight effect on the required ion-trap-magnet field strength.

An ion-trap magnet with a maximum field strength of 45 gausses will provide satisfactory operation when the anode of the kinescope is operated in the range of 10 to 14 kilovolts. An ion-trap magnet with a uniform field strength throughout the region where the beam passes should be used. A uniform field permits all portions of the electron beam to pass through points of the same field strength and results in improved focus. Fig. 2 shows a curve of uniform field strength and a measured curve of field strength for a typical commercially available ion-trap magnet. Measurements were made with a General Electric Gauss Meter (Cat. No. 409X51). If an ion-trap magnet with a non-uniform field is used, more beam deflection can be obtained when the side of the magnet having the greater field strength is placed on the side of the neck closest to the electron gun. This side corresponds to pin 11 in the base.

Centering Adjustments

In order to obtain maximum center resolution, the focusing device should be placed on the kinescope neck with the air gap near the deflecting yoke windings, preferably with the center of the air gap approximately a half-inch from the deflecting yoke windings. In most cases where the yoke has a back insulating cover, which is approximately

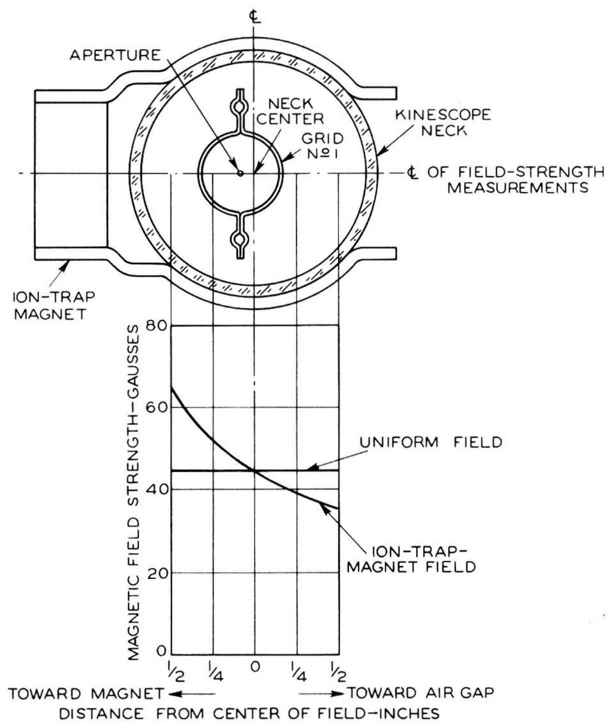

Fig. 2 - Curve of Uniform Field Strength and Field-Strength Curve of Typical Ion-Trap Magnet.

one-half inch back of the yoke windings, the focusing device may be placed flush with this cover. Centering of the raster is preferably obtained by adjusting the direct current through the deflecting yoke, in which case the focusing device should be placed symmetrically about the axis of the kinescope neck. If this method of centering is not feasible, centering may be obtained by moving the focusing device. When the focusing device is moved for centering, it is recommended that the movement be restricted to the plane perpendicular to the axis of the kinescope. Tilting the focusing device to obtain centering is generally less satisfactory because it produces more distortion. To provide for sufficient raster centering by movement of the focusing device, it is recommended that the device have a minimum inside diameter of 1-5/8 inches. A narrow air gap of about one-quarter inch in length gives maximum focus control and makes possible maximum resolution.

If difficulty is encountered in obtaining centering, reversing the field of the focusing device may possibly provide easier centering. When an electromagnetic type of focusing device is used, reversal can easily be accomplished by changing the direction of current flow. For a permanent-magnet type of focusing device, the field can be reversed only by turning the focusing device end for end. This expedient, however, is not recommended if the air gap is not physically symmetrical with the two ends of the focusing device. If centering of the raster still remains difficult, the desired centering range may be provided by rotating the kinescope or by turning the ion-trap magnet end for end but keeping the poles on the same side of the gun. When an ion-trap magnet having a non-uniform field in the region where the beam passes is used, turning the magnet end for end will place a different field strength in the region where the beam passes.