Nov. 24, 1964 J. F. FLEMING ETAL 3,158,774

IMAGE ORTHICON FOCUSING COIL AND FIELD FLARING RING

Filed June 8, 1962

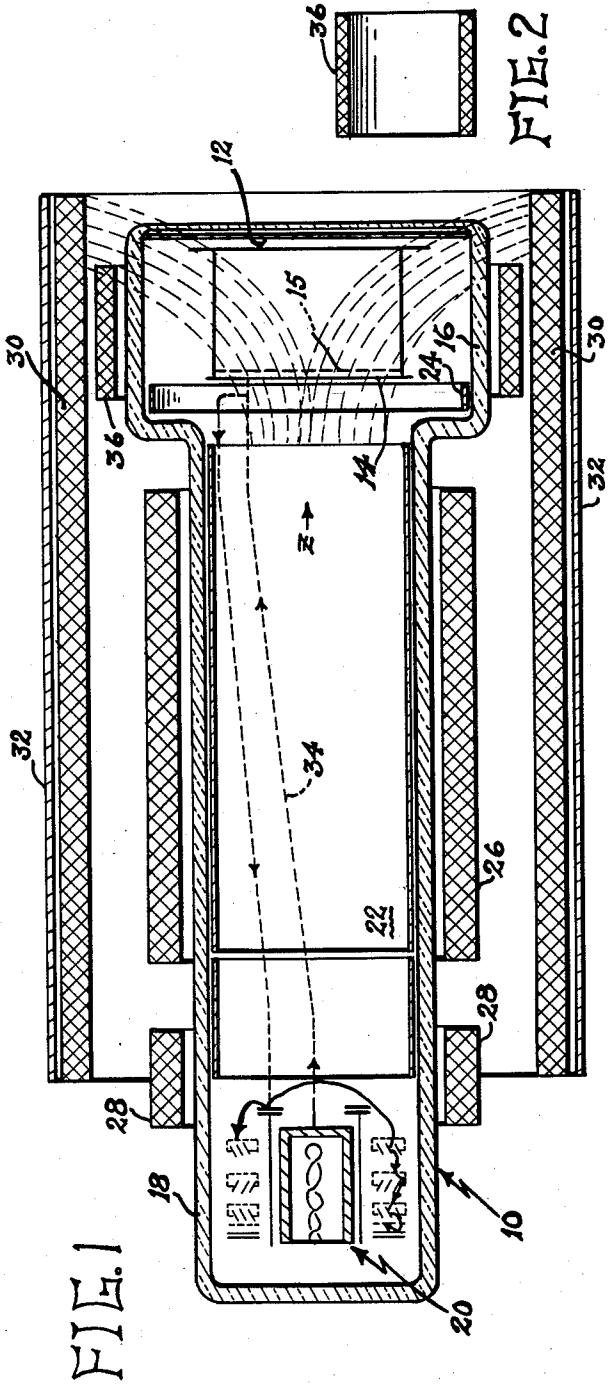

FIG. 1

FIG. 2

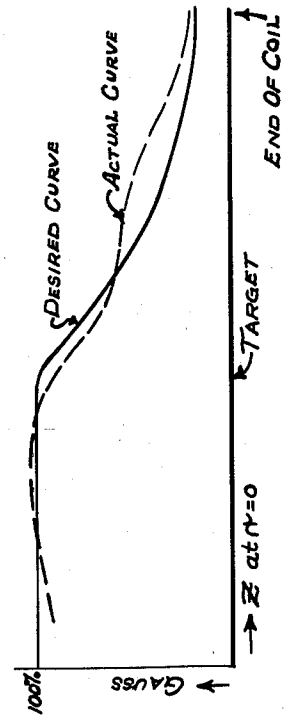

FIG. 6

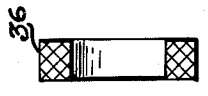

FIG. 5

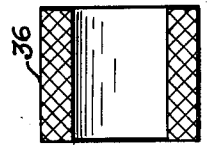

FIG. 4

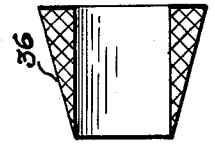

FIG. 3

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IMAGE ORTHICON FOCUSING COIL AND FIELD FLARING RING

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1 Claim. (Cl. 313—84)

The invention relates generally to focusing of image orthicon tubes, and more particularly to an improvement in the method of focusing in order to increase its sensitivity and resolution of the picture on the photosensitive face plate.

In order to improve the focusing and sensitivity of the image orthicon, the field from the focus coil should be flared out from the target in the direction toward the photosensitive surface. One proposed method for providing a solution has been to design focusing coils with variable ampere turns per inch along the coil in its axial or Z direction. The field obtained is the resultant of the superposition of the fields of the various sections of the focus coil having different ampere turns per inch.

The foregoing solution has a number of disadvantages. Firstly, a number of power supplies of different current, voltage and polarity ratings are required in order to supply a coil; and secondly, the magnetic shield normally provided on the outer periphery of the coil tends to average out or smooth out the fields generated by the separate coil sections, thereby leaving a relatively uniform field without the desired flaring at a target-photosensitive surface section of the tube.

In order to overcome the above enumerated disadvantages, it is necessary to leave off the outer shield, thereby subjecting the focusing field to the effects of the earth's magnetic field, or increase the magnetic shield by at least twice its diameter, which, not only wastes space, but requires major design changes in existing equipment.

This invention provides a solution for the problem without the disadvantages of the previously mentioned solution. The desired result is achieved by placing either a ring or rings of a high permeable material within the standard, shielded, focusing coil of a conventional image orthicon tube arrangement.

Accordingly, it is an object of this invention to provide improved focus for image orthicon tubes.

It is another object of this invention to provide improved focus of image orthicon tubes without requiring redesign of existing equipment.

It is still another object of this invention to provide an improved focusing of image orthicon tubes without the attendant disadvantages of prior art solutions.

It is a further object of this invention to provide improved focusing in an image orthicon tube by providing for a novel arrangement to control the focusing flux lines.

It is a still further object of this invention to provide a focusing arrangement for a standard image orthicon tube wherein a ring or rings are inserted within the conventional focus coil to provide a predetermined pattern of the focus flux lines.

An additional object of this invention involves the provision of shunting rings which may be varied in shape, thickness, width, type of material, number of pieces and spacing in order to vary the shape of a magnetic field from a focus coil.

These and other advantages, features and objects of the invention will become more apparent from the following description taken in connection with the illustrative embodiment in the accompanying drawing wherein:

FIGURE 1 is a partially schematic representation of a

standard image orthicon tube having a shunting ring of this invention applied thereto;

FIGURES 2 through 5 illustrate in section various shapes and sizes of shunting rings which may be utilized with an image orthicon tube; and

FIGURE 6 is a plot of a magnetic field strength against the distance along the focus coil.

Referring to FIGURE 1, there is shown an image orthicon **10** which combines the principles of both image multiplication and signal multiplication while maintaining a relatively high sensitivity. The image orthicon utilizes a photocathode **12** which, when light is projected through the front end of a tube, causes electrons to be released toward the target **14**. An electron image is formed on target **14** while the secondary electrons therefrom are drawn away from the field by means of a target screen **15** located proximate to the target. Withdrawal of the secondary electrons causes corresponding picture elements of the target to become positive to a slight extent. The target structure is enclosed within enlarged portion **16** of envelope **18** which houses the entire target and electron gun structure of the image orthicon. The gun structure is located at the end of the envelope opposite to section **16** and is designated generally as **20**. Within the envelope is located a conventional accelerating electrode **22** which is coated on the inner wall of the envelope **18**. The purpose of the accelerating electrode **22** is to accelerate an electron beam toward the target **14**. A decelerating ring **24**, adjacent the gun side of target **14**, is used to decelerate the electron beam from the gun structure **20** as it approaches the target **14**. A deflection yoke **26** surrounds the neck-down portion of the envelope **18**, as shown, and contains the conventional horizontal and vertical deflecting coils which form part of a conventional scanning system. In addition, a conventional alignment coil **28** is provided adjacent the gun structure while the photoelectrons from the photocathode are focused by the magnetic field of the long focusing coil **30**. A magnetic shield **32** surrounds the coil structure.

The device described thus far operates in the same manner as a conventional image orthicon such as that described in "Television," second edition, by Zworykin and Morton, John Wiley and Sons, Inc., New York, publishers. The electron beam **34** approaches the target **14** at a low velocity due to the action of decelerating ring **24**. Zero potential at the target area reflects the beam back toward the electron gun **20** while positive portions of the target surface cause electrons from the beam **34** to neutralize the charge, and the beam is then repelled back toward the gun **20** of the image orthicon tube. The variation in the electrons provides a modulation of the beam which, upon its return from the target, enters a conventional secondary emission multiplier at the gun end of the tube.

This invention involves the addition of a high permeability material **36** inside the standard shielded focusing coil **30** of the conventional image orthicon of the foregoing description. The rings **36** shunt out part of the solenoid field of the focus coil **30** in order to produce a desired flare out as indicated by the dashed showing of the flux lines in FIGURE 1. The shunting rings may be varied in shape, thickness, width and type of material and also the number of pieces and their spacing in order to obtain a desired field shape. Examples of these variations are shown in FIGURES 2 through 5.

A single ring of "A" nickel of uniform cross-section was placed in a standard shielded coil. The desired curve of the axial flux density and the actual curve obtained with the single ring of "A" nickel are shown in FIGURE 6. The actual curve may be made to conform more exactly with the desired curve by raising the permeability of the ring material and lengthening it in the Z direction or by

varying ony of the parameters affecting the ultimate curve shape.

Although the invention has been described relative to a particular material and use with an image orthicon tube, it should be understood that other high permeability materials may be utilized. In addition, if other configurations of magnetic field are desired with vacuum tubes such as cathode ray tubes, pickup or camera tubes, the broad invention of placing magnetic shunting rings in a focusing coil would be equally applicable.

We intend to be limited only by the accompanying claim.

We claim:

A television camera tube having a means for producing a beam of electrons at one end of said tube, a photocathode remote from said first-mentioned means at the other end of said tube, a target structure at said other end of said tube and spaced from said photocathode for receiving a charge pattern from said photocathode, means for scanning said beam over said target, means for producing a magnetic field for focusing said beam, said means comprising a solenoid around said tube and extending from said photocathode to said means for producing a beam, and means adjacent the end of said tube containing said photocathode and said target for flaring the magnetic field from said focus solenoid from said target toward said photocathode, said last-mentioned means comprising a ring of high permeable magnetic material intermediate said solenoid and said picture tube, and extending from said photocathode portion of said tube to said target portion of said tube.

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