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[54] IMAGE TRANSFORMER TUBE WITH
MOVABLE PHOSPHOR SCREEN

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[58] Field of Search 313/148, 94, 146

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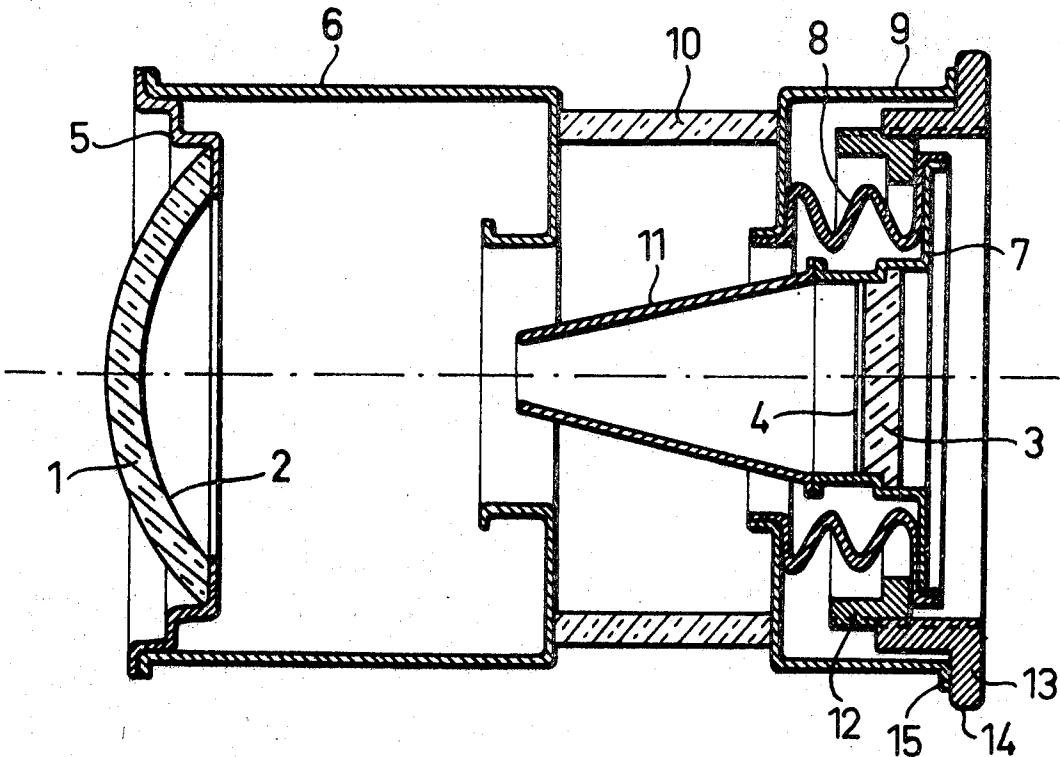
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[57]

ABSTRACT

In an diode image amplifier or image transformer tube a part of the wall of the tube between the anode and cathode window is composed of one or more interconnected metal rings which can elastically be deformed to vary the distance between anode and cathode to avoid the use of a third focusing electrode.

1 Claim, 2 Drawing Figures



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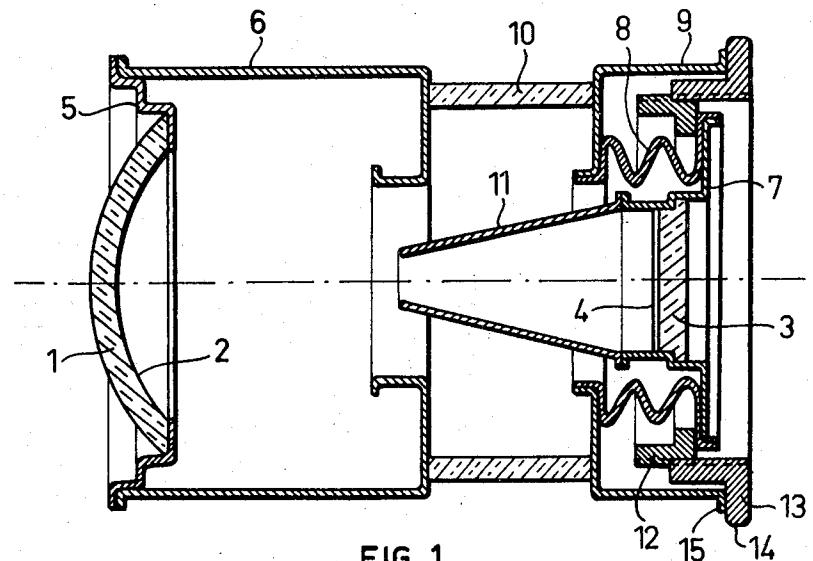


FIG. 1

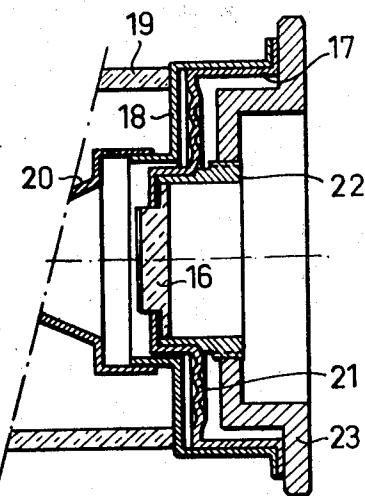


FIG. 2

IMAGE TRANSFORMER TUBE WITH MOVABLE PHOSPHOR SCREEN

The invention has reference to a diode image intensifier or image transformer tube. Image tubes of this kind have only two electrodes, the one of which has a photo cathode potential and the other an anode potential. Their advantage lies in that they can both be supplied by a simple high tension apparatus. This apparatus need only supply one tension and need not be stabilized, as variations in tension do not influence its focusing.

Whether the image produced by a diode tube will be clear, depends exclusively on the geometry of the two electrodes on the tube's completion. The tolerances to be applied in this case will be narrower in so far as a stronger electronic optical minification is applied. As image tubes are normally constructed from various glass and metal parts, which may easily get slightly distorted when assembled, it may be very hard to hold on to these narrow tolerances.

In practice, therefore, at least one spare electrode is inserted in the case of minifications of more than two times, this being the focusing electrode, the potential of which can be adjusted separately, if so desired.

The invention now seeks to provide a diode image tube wherein the harmful influence of deviations in the geometry of the electrodes may be compensated for on the tube's completion. In a diode image intensifier or image transformer, according to the invention, part of the tube's wall between the photo cathode window and the anode window being composed of one or more metal rings vacuum tight interconnected, at least one of said metal rings has to this end a profiled in axial direction elastically deformable zone by means of which the distance between the cathode window and the anode window may be varied.

The invention may be realized in various ways; a few will here be further described with reference to the accompanying drawing:

FIG. 1 shows a longitudinal section of the first embodiment of the tube; and

FIG. 2 shows a partial longitudinal section of a second embodiment.

In FIG. 1 number 1 is the input window of the diode. The latter supports the photo cathode 2. The output window 3 supports the anode screen 4. The wall of the tube is formed by the metal rings 5, 6 which have the photo cathode potential, by the metal rings 7, 8, 9 having the anode potential, and by the tube shaped insulator interconnecting rings 6 and 8. The metal rings may, for example, be composed of a suitable iron nickel cobalt alloy, and vacuum tight welded together. The glass windows 1 and 3 and the glass insulator 10 are furthermore vacuum tight fused with the metal parts.

Ring 7 supporting the anode window also supports a truncated conical electrode 11. This electrode tube having the same potential as anode screen 4 constitutes together with the electrode 6 (on photo cathode potential) and photo cathode 2 itself, the electronic optical system.

The metal ring 8 is made in the shape of a pair of bellows, and therefore easily elastically deformable in axial direction. When the tube is evacuated the anode window 3 is sucked inwards part of the way. The geometry is selected such that the anode screen will with some certainty come to lie to the left of the plane of best definition. A ring 12 with a fine external screw

thread is soldered to one end of the bellows 8. A ring shaped adjusting nut 13 fits onto the latter which is provided with a milling 14. When screwed on the nut will touch the raised collar 15 of ring 9. If nut 13 is thereupon tightened, window 3 together with anode 11 will move outwards. This must be continued until the best in-focus position is found. Normally this will only require small adjustments from 0.1 to 0.5 millimeter, especially where the reducing diodes are concerned 10 which have a most critical position of the focusing plane.

FIG. 2 shows a variation, only the anode section of it being given for simplicity's sake. In this case the anode window 16 is fused with a stepped ring 17. The latter is welded to a second ring 18 the conical anode 20 on the one side, and having a connection with the insulator 19 on the other side. Zone 21 of ring 17 is positioned in a plane perpendicular to the tube's axis and is provided with a rotational symmetric corrugated profile causing this part to act like a membrane in the direction of the axis fairly easily deformable. A ring 22 is welded to the centre part of ring 17, ring 22 having a fine external screw thread running part of its length. The ring 22 cooperates with a saucer shaped nut 23, its rim bearing on a rim fitted around ring 17 in order to move window 16 outwards. Anode 20 does not travel along in this case, so the electronic optical system does not vary, only the screen's surface is moved.

It is evident that similar provisions as described 30 above may also be fitted to the side of the photo cathode. The examples given, however, have the advantages that they can easily be accommodated into the available space which will originate at the side of the anode in the case of minifying intensifier tubes and will be simple to construct.

What we claim is:

1. A diode intensifier or image transformer tube comprising an evacuated, air-tight, axially elongated housing comprising a cylindrical metallic cathode support ring having a window seat at one end thereof, a window mounted in air-tight relationship in said seat, a photo-cathode supported on the inner face of said window within said housing, a cylindrical insulating ring having one end secured in air-tight connection to the end of said cathode support ring remote from said window, a metallic cylindrical anode support ring having one end secured in air-tight relation to the other end of said insulator ring, said cathode and anode support rings being conductive and connected to sources of cathode and anode potential, respectively, a third metal ring in said housing within said anode support ring, all of said rings having their axes coaxially disposed, a bellows assembly flexible in the direction of the axis of said rings interposed between said anode ring and said third ring, said bellows forming an air-tight connection with each of said anode and third rings, a single anode carried by said third ring, said anode being electrically connected to said anode support ring, a window seat on said third ring, an anode window mounted in air-tight relation in said window seat of said third ring, a phosphor screen mounted on an interior face of said anode window, said screen being disposed perpendicular to the axis of said rings, a thread portion formed on said third ring and extending in the direction of the axis of said rings, a cylindrical nut means having a threaded portion engaged with said threaded portion of said third ring, said nut means including a radially extending shoulder slidingly

engaged against the end portion of said anode support ring remote from said insulator ring, said nut means shifting said third ring and, hence, said phosphor screen, in the direction of the axis of said rings responsive to rotation of said nut means relative to said third

ring, whereby the spacing of said phosphor screen and cathode may be varied for purposes of improving focus, said rings and windows together defining an air-tight evacuated structure.

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