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ELECTROSTATIC LENS FOR CATHODE-RAY TUBES

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2 Sheets-Sheet 1

Fig. 1

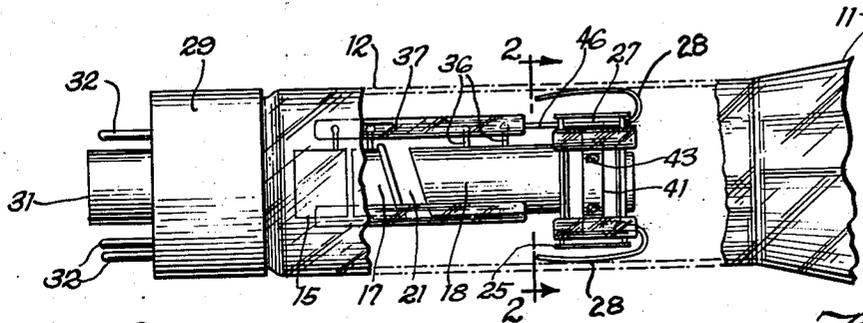


Fig. 2

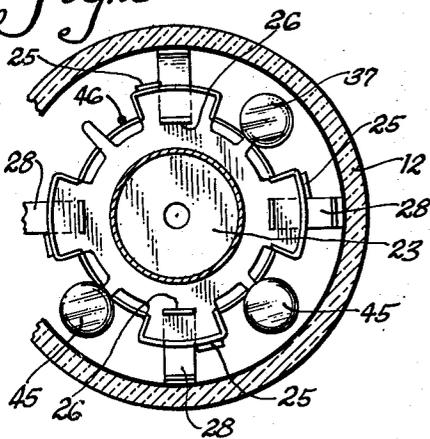


Fig. 4

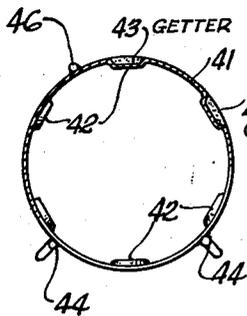
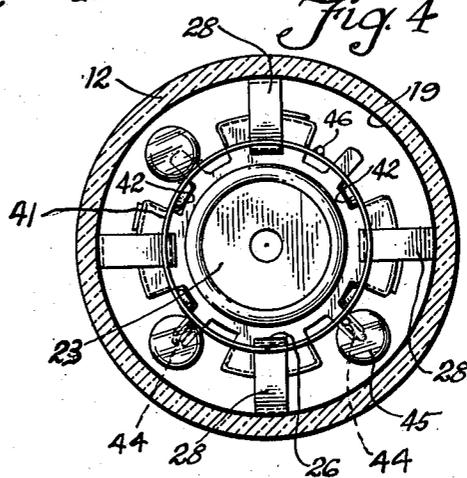


Fig. 5

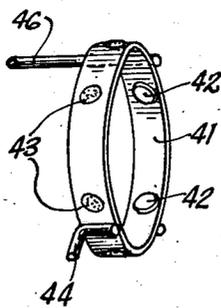


Fig. 6

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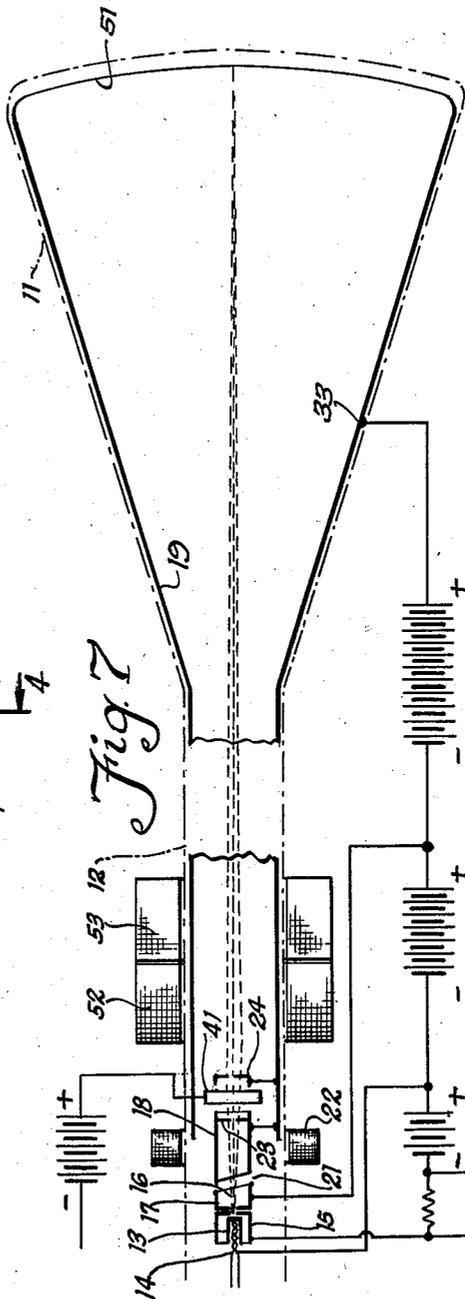
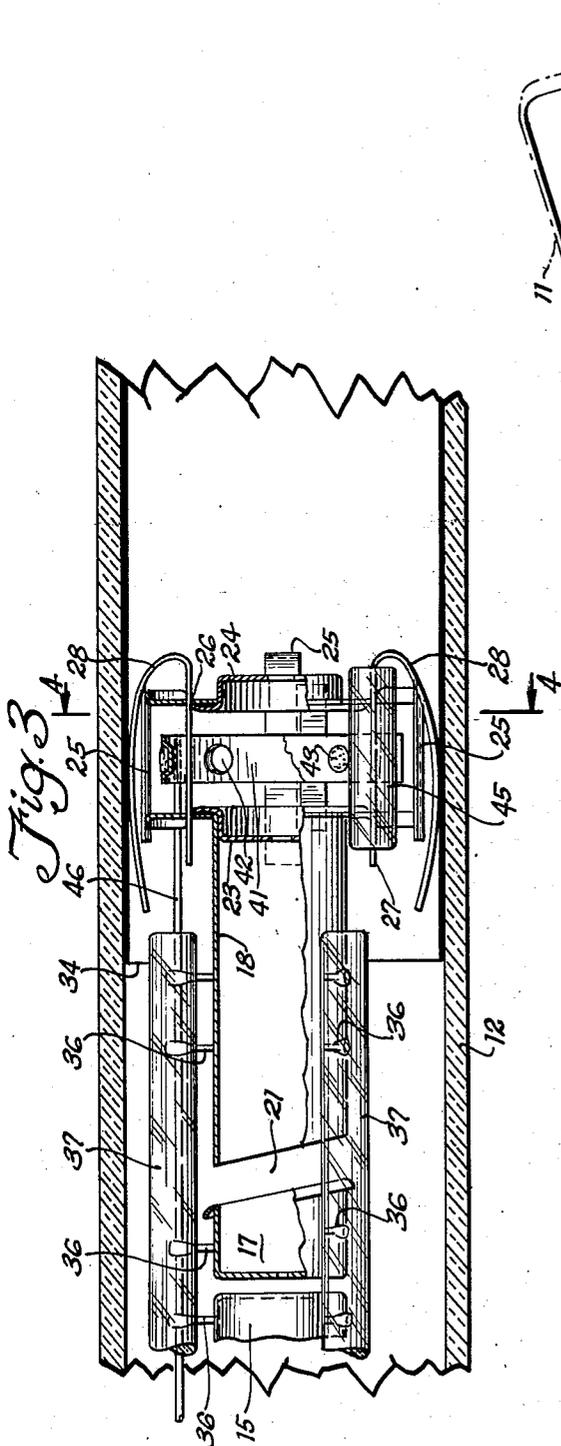
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ELECTROSTATIC LENS FOR CATHODE-RAY TUBES

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5 Claims. (Cl. 313--82)

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The present invention relates to electron lens systems for cathode ray picture tubes, and concerns itself more particularly with improvements in electrostatic focusing apparatus which functions in a dual purpose capacity as a getter

mount. In the construction of conventionally designed electron gun assemblies it has become customary to provide a successive series of paraxial metallic cylinders or thimbles which perform primary and intermediate anodal acceleration effects upon the scanning beam. Lens discs carried by one of these thimbles induce a focusing action upon the beam before the latter passes into the region of scanning deflection. In connection with electron gun systems, the use of multi-potential lens elements in different sequences of arrangement have been understood to exert convergent effects upon the scanning beam, whereby to achieve the cardinal purpose of concentrating and diminishing the cross-sectional beam area to a virtual point cross-section at its destination, the screen surface.

When the gun system includes a device for producing deflection of the generated beam as for example, to serve the purpose of ion trapping, the axial realignment of the beam is frequently achieved by electromagnetic rather than by electrostatic regulation. Following the ion trapping apparatus in a sequence of lens-anode elements, it is most often requisite that the beam be subjected to a multiple lens system for the reestablishment of paraxial and convergent action in order to achieve the proper physical dimensions and intensity of the beam. In such systems there have heretofore been utilized a pair of equipotential lens elements between which was disposed a thick lens which gave to the assembly a performance resembling a direct and inverted lens system in sequence.

Under other systems of focusing beam realignment, an external magnetic coil has been used for accomplishing this purpose, but because of the distance through which its field was required to exert an influence, the size and copper content of such a coil constituted an element of substantial cost consideration.

It has been found that by locating a relatively wide aperture lens right between the lens rings of a uni-potential lens system, a convergent influence of remarkable effectiveness is accomplished with the potential of the added electrode ring preferably higher but having creditable performance under a variety of contrasting potentials including zero. By locating this ring in this

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manner, and by making it of thin metal which may be pocked or depressed with shallow indentations, this same element may be made to perform also as an improved mount for a plurality of getter cartridges. In this respect the lens ring serves a dual function. By reason of the fact that the thin metal structure in accordance with this arrangement responds more instantly as an inductive loop the firing of its pellets is achieved with simultaneous efficiency under conditions which require a lower high frequency voltage and utilizing a firing coil that may be operated by automatic assembly line apparatus since placement of the coil over the neck of the tube may be accomplished without the otherwise necessarily precise direction.

Accordingly a principal object of the present invention is to achieve an improved type of picture tube gun assembly in which a highly efficient convergent lens is mounted between the lens rings of the conventional terminal lens systems and in which the ring which forms said lens may be preformed to receive oxidation pellets or getters which are more instantaneously responsive to induction heating.

Another object of the present invention is to accomplish an improved picture tube gun assembly in which a single annular element supported on post extensions which surround an ion trap structure is made to serve the dual purpose of mounting a series of getter pellets to be fired during the formative assembling of the tube and thereafter to exert a scanning beam regulation electrostatically as a lens factor.

Other objects and purposes of the present invention are such as will become apparent during the course of the following detailed description, and such as will be revealed from a reading of the hereunto appended claims.

For a better understanding, reference will now be had to the accompanying drawings wherein similar reference numerals designate corresponding parts throughout and wherein:

Fig. 1 is a side elevational view of a portion of a television cathode ray tube with parts broken away to reveal the elements of the gun structure, including the present improvements,

Fig. 2 is a transverse sectional view taken approximately on line 2--2 of Fig. 1,

Fig. 3 is a longitudinal sectional view resembling Fig. 1 but on a substantially enlarged scale,

Fig. 4 is a transverse sectional view taken approximately on line 4--4 of Fig. 3,

Fig. 5 is an end elevational view of the me-

tallic ring which serves the dual purpose of getter mount and electrostatic lens,

Fig. 6 is a perspective view of the dual purpose ring featured in Fig. 5, and

Fig. 7 is a schematic view illustrating diagrammatically the various elements with which the present improvement concerns itself as well as a representative arrangement of control potentials respecting the anode and lens systems of a tube.

In the accompanying drawings, the reference numeral 11 designates generally an outer glass envelope which encloses the chamber in which are contained the various functioning elements of a picture tube. In the neck portion 12 of this envelope there is contained a preformed sub-assembly of apparatus generally referred to as the gun.

This sub-assembly consists of a cathode emitter 13, Fig. 7, heated by an incandescent heater 14 and contained in an apertured control grid 15. By regulating the negative bias which is induced on grid 15 there is controlled the emission intensity of the beam 16 which emerges from the grid aperture and thereby is determined the fluctuating light and dark characteristics of the scanning beam.

The electrons which emanate from the cathode are as usual negative and hence become accelerated through the positive influence of a succession of anodes indicated 17, 18 and 19, the latter constituted predominantly of an inner surface coating of the tube envelope of carbonaceous electrically conductive material, commercially identified as Aquedag.

As the beam traverses the biased slash 21, which intervenes between the primary anode 17 and the intermediate anode 18, it undergoes the so-called ion trap phenomenon as a result of which it is first deflected to one side by the unevenness of the metallic distribution and is then realigned by the magnetic coil 22. Emerging from the intermediate anode 18, it is subjected to the action of a pair of anodic lens rings 23 and 24, usually but not necessarily of identical potential.

As shown in Fig. 3, the discs which constitute lens rings 23 and 24 in a uni-potential lens system are held apart by peripheral spacers 25 to which they are spot welded and for convenience in centering and assembling these discs are apertured as at 26 for receiving the innermost legs 27, see Fig. 3, of a series of equally spaced radial tension elements 28, which also constitute contacts communicating with the Aquedag in the neck of the tube.

The base end of the neck portion 12 is cemented within a plug base 29 which is provided with a locating core 31 and a series of terminal prods 32. Each one of the prods 32 is in electrical communication through a lead wire with a predetermined one of the gun assembly elements and by fitting into a socket in which are provided contacting tubes that have wiping engagement with the prods 32 the proper electrical potentials are communicated from the main circuit to the various elements of the tube.

The Aquedag coating is usually in electrical communication with its potential through a surface penetrating connection 33, Fig. 7, and by extending into the neck of the tube to a position 34 well below the resilient hairpin elements 28 this same potential prevails throughout the intermediate anode elements of the gun assembly.

In accordance with the usual practice, the

control grid is supported on a plurality of metallic posts which are bedded in the glass that forms the base end of the neck. The spacing between the grid, first anode, and intermediate anode is maintained stable by having a plurality of radially jutting anchor pins 36, Fig. 3, whose flattened ends are imbedded within a series of longitudinal glass support posts 37.

The dual purpose lens ring 41 which constitutes an essential feature of the present invention is an annular ring of sheet metal preferably having a diameter significantly larger than the apertures of the lens rings 23 and 24 and preformed by stamping with a plurality of shallow depressions as at 42, Fig. 3. Into each of these depressions is secured a getter pellet 43 which may be composed of any suitable oxidizing compound customarily utilized for this purpose. The lens ring 41 is disposed substantially intermediate the lens rings 23 and 24 and is supported on mount posts, two of which 44 are shown to be of short length, having their laterally extending ends imbedded in the glass mount posts 45, while the third 46 is of considerably greater length, communicating with one of the terminal prods 32 through which its electrical potential is supplied.

In operation the lens ring 41, being made of thin sheet stock, serves primarily as an instantly responsive inductive element for firing its contained getter pellets during the manufacture and assembling of the tube when a high frequency induction coil is placed around the neck 12 of the tube, causing the temperature of the ring 41 to be raised to the level required for firing the getters.

During the utilization of the ring in television operation it has been found to exert a convergence effect upon the beam 16 as it emerges from the central aperture of lens ring 23. A relatively low potential charge impressed upon ring 41 has been found to be adequate to produce a desired convergence so that the beam on reaching the screen 51 achieves an ideal point concentration. When the scanning coils 52 and 53 which are impressed with the synchronized sweep circuit currents cause the beam to describe the line for line picture surface area, the converged beam satisfactorily maintains its physical dimensions and its concentration intensity throughout its full field of displacement.

While the present invention has been explained and described with reference to a particular embodiment of structure, it will be understood nevertheless that it is susceptible to various modifications and variations. Accordingly, it is not intended that this invention be limited in scope by the particular features illustrated in the accompanying drawings, nor by the language employed in the foregoing detailed description, except as indicated in the hereunto appended claims.

The invention claimed is:

1. In a television picture tube apparatus, a dual purpose element comprising in combination with a gun assembly structure having at its forward end a pair of electrostatic lens discs and an annular lens ring formed of thin metal peripherally studded with getter pellets, a support rod for said lens ring communicating with an external source of electric potential, and additional support means for stabilizing said ring in predetermined spacing from and in concentricity with an endmost one of said lens discs.

2. In a television picture tube apparatus, a

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ray-emitting gun assembly comprising, a cathode, a control grid for regulating the intensity of emission from said cathode, a primary anode in axial alignment with said control grid, an intermediate anode spaced from said primary anode, an endmost electrostatic lens disc terminating said intermediate anode, and a dual purpose lens ring spaced from said lens disc and having a plurality of peripheral depressions for containing getter deposits to be fired during the manufacturing completion of said tube.

3. In a television picture tube apparatus the combination of a cathode ray tube gun assembly having at its forward end a high potential lens disc, a lens cylinder cooperating with said disc peripherally studded with getter pellets, a support rod for said cylinder constituting an electrical connection therefor, and additional support means for stabilizing said cylinder in predetermined spacing from and concentricity with said lens disc.

4. In a television picture tube apparatus, a cathode ray gun assembly comprising a cathode, a control grid for regulating the intensity of emission from said cathode, a primary anode cylinder in axial alignment with said control grid,

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an intermediate anode cylinder spaced from said primary anode cylinder and a dual purpose ring spaced from said intermediate anode cylinder mounting a plurality of getter deposits to be fired during the manufacturing completion of said tube.

5. In a television picture tube, a gun assembly including in combination with a cathode, a grid, and a cylindrical anode terminated by a high potential lens disc, a low voltage lens cylinder spaced from said disc to induce a divergent effect upon the scanning beam emanating from said cathode and mounting a plurality of getter pellets on its periphery whereby to be simultaneously fired when said cylinder is inductively heated following the sealing of said tube.

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