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CATHODE RAY TUBE STRUCTURE

Filed June 4, 1959 2 Sheets-Sheet 1

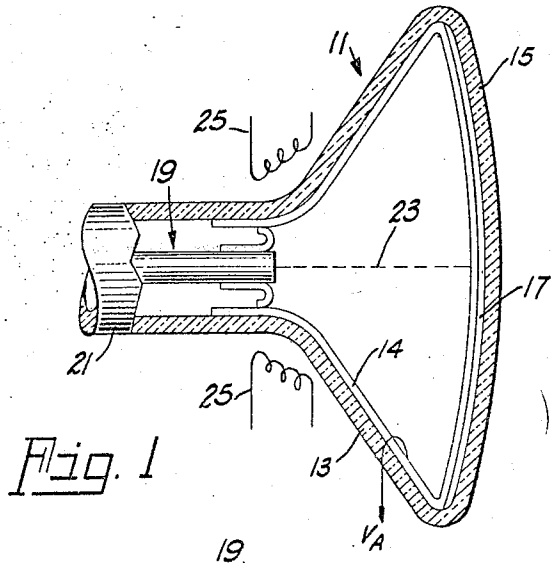


Fig. 1

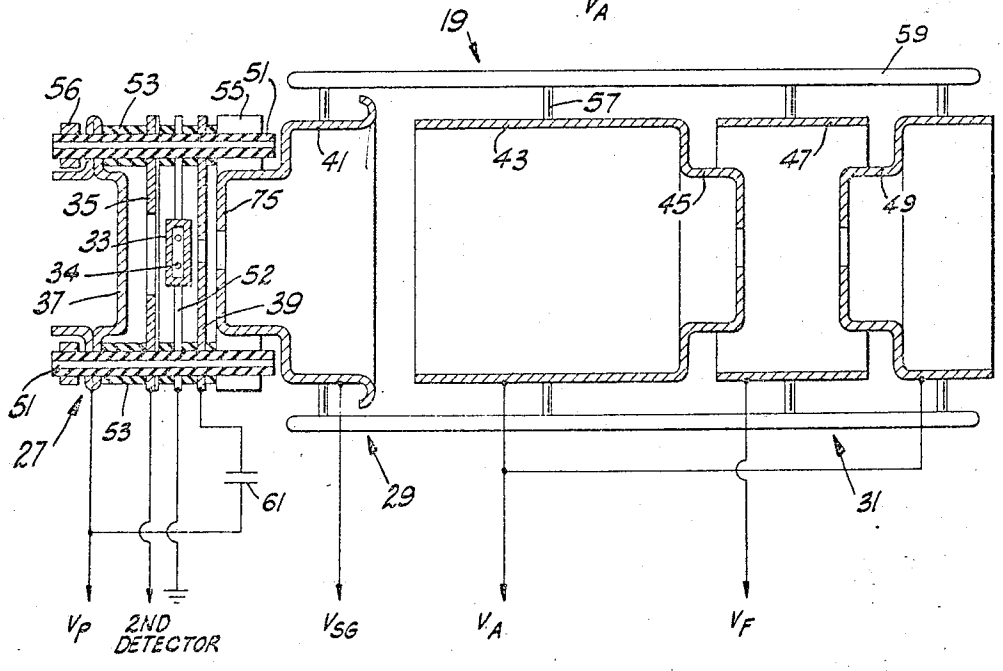


Fig. 2

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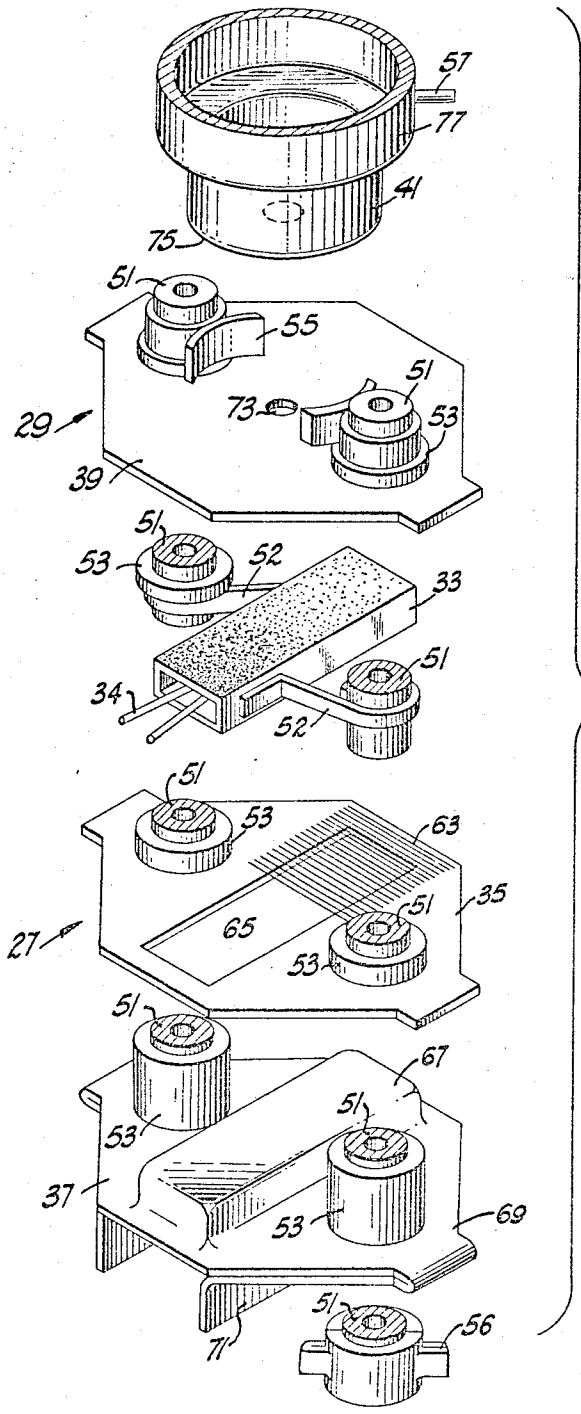


Fig. 3

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CATHODE RAY TUBE STRUCTURE

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4 Claims. (Cl. 313—82)

This invention relates to electron discharge devices and more particularly to high transconductance cathode ray tubes of the type having a video amplifier formed as part of the cathode ray gun structure.

Efforts have been made to incorporate the video amplifier of a television receiver in the cathode ray or picture tube in order to produce a packaged high transconductance unit. From a manufacturing viewpoint, such devices have not been satisfactory primarily because of the mounting incompatibility of the flimsy and awkwardly shaped wire and sheet metal amplifier parts relative to the rugged cylindrical electron gun parts. Due to the high cost of picture tubes relative to that of conventional amplifier tubes, it is essential for economic feasibility that all electrode structures sealed within the picture tube envelope be rugged and well adapted for easy assembly, and that individually the structures should have comparable life characteristics. In these respects, the video amplifier portion of the prior art assembly was not satisfactory.

Accordingly, an object of the invention is to ruggedize and increase the reliability of a cathode ray tube having an amplifier formed as part of the electron gun structure.

A further object is to provide an efficient and economical construction for a cathode ray tube electrode assembly which is uniquely adapted to facilitate use of close electrode tolerances and spacings.

The foregoing objects are achieved in one aspect of the invention by the provision of an electrode structure for a cathode ray tube employing stacked amplifier electrodes positioned on one side of a cathode and stacked electron beam immersion lens electrodes disposed on the opposite side of the cathode. These electrodes are supported upon common insulating rods and separated from one another by insulating spacers.

For a better understanding of the invention, reference is made to the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a sectional view of a typical cathode ray tube;

FIG. 2 illustrates the structural features of an electrode assembly employing a video amplifier formed as an integral part of the cathode ray gun; and

FIG. 3 is an exploded perspective view of the amplifier and immersion lens electrodes employed in the structures of FIG. 2.

Referring to FIG. 1, a cathode ray tube 11 is shown for purposes of illustration as comprising an envelope 13 with a face plate 15 having a phosphor screen 17 formed on and the beam forming portions of the gun structure 19 is positioned in the neck portion 21 of the cathode ray tube and is formed to provide amplification of the detected video signal in addition to providing the source, modulation, focusing and acceleration of the electron beam 23. A coating 14 of a conductive material such as aluminum is formed internally on the wall of envelope 13 and screen 17 to provide the high potential V_A used to accelerate beam 23 toward the screen. The image display raster is formed by the magnetic fields produced by deflection coils 25.

An assembly of electrodes which may be used as structure 19 is illustrated in FIG. 2. This assembly comprises an amplifier 27, immersion lens electrodes 29 and beam focusing assembly 31. A common cathode 33 is used

to provide the source of electrons for both amplifier 27 and the beam forming portions of the gun structure 19 consisting of immersion lens electrodes 29 and focusing assembly 31. Disposed on one side of cathode 33, which is heated by filament 34, is the amplifier control grid 35 and amplifier plate 37. Longitudinally arrayed on the opposite side of cathode 33 is the electron beam control grid 39, screen grid 41 and anode 43. The immersion lens is primarily formed by the cathode and grids 39 and 41. The uni-potential electrostatic electron beam focusing assembly 31 employs a first lens cup 45 formed as part of anode 43, a lens ring 47 and the second lens cup 49.

The electrodes of amplifier 27 and immersion lens electrodes 29 are supported relative to one another by common insulating rods 51 and separated from one another by insulating spacers 53. Support straps 55 are connected to screen grid 41 and mounting straps 56 are affixed to rods 51 at the amplifier plate end of the assembly. In order to insure a compact assembly, the screen grid, anode 43 and the electrodes of focusing assembly 31 are provided with pins 57 which are attached to insulating supports 59. Therefore, the amplifier and immersion lens electrodes 29 are provided with common rods 51 while grid 41 of the immersion lens electrodes is also coupled to the anode 43 and focusing assembly 31 electrodes by common supports 59. This arrangement provides a rigid structure which is easy to assemble.

In operation, cathode ray tube electrode structure 19 has the video signal derived from the second detector of the television receiver imposed upon the grid 35 as a "negative white" signal. The amplified signal on plate 37 is coupled to beam control grid 39 through capacitance 61 to afford video modulation for the electron beam 23 emitted from cathode 33. The plate V_P and screen grid voltage V_{SG} are selected in accordance with the desired drive, cutoff and transconductance characteristics for a given bias on grid 39. The anode accelerating voltage V_A is generally high, e.g., 17 kv., while focusing potential V_F is substantially lower and in the vicinity of V_{SG}. In the electron beam portion of structure 19, the electrons emitted from cathode 33 are modulated by grid 39 and tend to form a cross-over point intermediate grids 39 and 41. This point is formed in part by the potentials on immersion lens electrodes 39 and 41. The beam expands from the cross-over as it passes through anode 43 and is focused primarily by assembly 31 to a minimum spot on the screen. Therefore, the immersion lens electrodes 29 primarily form the initial cross-over point of the electron beam which is in turn imaged on screen 17 by focusing assembly 31.

Referring to FIG. 3, the amplifier 27 and immersion lens electrodes 29 are shown generally as having planar operating surfaces disposed laterally on the longitudinal axis of structure 19. These electrodes are accurately mounted relative to one another by common rods 51 passing through the apertures on the outside edges thereof and spaced within very close tolerances by apertured spacers 53. During assembly, the electrodes are stacked alternately with the spacers upon one another in a telescoping fashion over rods 51. Welding opposed sides of straps 55 and 56 close to the rods creates a tight fit for the stacked assembly upon the rods.

Disposed on one side of the indirectly heated cathode 33, which is held to rods 51 by tabs 52, is the planar amplifier control grid 35. Lateral wires 63 are brazed, welded or otherwise attached across the window 65 of the grid. The amplifier plate 37 has a planar operating portion 67 aligned with the grid window, support wings 69 and radiators 71. It is to be understood that plate 37 may assume various configurations other than that shown which are capable of satisfying the requirements of spacing, power dissipation and inter-electrode capacitance.

Positioned on the opposite side of common cathode 33 from amplifier 27 are the immersion lens electrodes 29 including the beam control grid 39 which is formed with beam aperture 73. The sides of screen grid support straps 55 are welded about rods 51 at a position above grid 39 as determined by spacer 53. Screen grid 41 is formed with a planar apertured end plate 75 and a side wall 77 stepped laterally outward to provide a maximum lateral dimension substantially equal to the diameter of anode 43. It is desirable, although not essential, to bend the ends of the screen grid away from the anode to prevent arcing. The straps 55 are welded to the reduced diameter portion of side wall 77 to affix the screen grid to the electrodes of assemblies 27 and 29. As stated above, grid 41 is also connected to anode 43 and focusing assembly 31 by means of pins 57 and supports 59.

The diameter of neck 21 is important in the construction of cathode ray tubes since it determines the advantageous close proximity to and thereby the influence of the coils 25 on beam 23. Therefore, amplifier assembly 27 and grid 39 are so fabricated that their maximum lateral dimensions are not larger than grid 41, anode 43 or the focusing assembly 31. It is to be noted that the step in side wall 77 of the screen grid allows mounting at the reduced diameter side wall portion. Accordingly, the entire structure 19 is mounted within the outermost supports 59.

A cathode ray tube gun construction of the type described herein is rugged and the individual components have comparable life characteristics. The stacked array of electrodes and the insulating spacers assures efficient assembly and enhances the ability to maintain close tolerances and spacings.

Although several embodiments of the invention have been shown and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention as defined by the appended claims.

What is claimed is:

1. In a cathode ray tube employing a display screen, a longitudinally arrayed electrode structure spaced from said screen comprising a cathode, stacked amplifier electrodes disposed on one side of said cathode, stacked electron beam immersion lens electrodes including a grid disposed on the opposite side of said cathode, common insulating rods for mounting said amplifier and immersion lens electrodes relative to one another, insulating spacers for separating said electrodes telescoped over said rods, an electron beam focusing lens assembly positioned between said immersion lens electrodes and said screen, and common insulating supports for mounting said immersion lens grid and focusing lens electrodes relative to one another.

2. In a cathode ray tube employing a display screen, a longitudinally arrayed electrode structure spaced from said screen comprising a cathode, stacked amplifier electrodes disposed on one side of said cathode including a planar wire grid and an anode lying substantially normal to the longitudinal axis of said electrode structure, stacked electron beam immersion lens electrodes disposed on the opposite side of said cathode including a planar control grid formed with an aperture therein and a screen grid having an apertured planar end plate, and common insulating rods for mounting said amplifier and immersion lens electrodes relative to one another.

3. In a cathode ray tube employing a display screen, a longitudinally arrayed electrode structure spaced from said screen comprising a cathode, stacked amplifier electrodes disposed on one side of said cathode including a planar wire grid and an anode lying substantially normal to the longitudinal axis of said electrode structure, stacked electron beam immersion lens electrodes disposed on the opposite side of said cathode including a planar control grid formed with an aperture therein and an apertured screen grid, common insulating rods for mounting said amplifier and immersion lens electrodes relative to one another, insulating spacers for separating said electrodes telescoped over said rods, and support straps connected to said rods welded to said cylindrical screen grid.

4. In a cathode ray tube employing a display screen, a longitudinally arrayed electrode structure spaced from said screen comprising a cathode, stacked amplifier electrodes disposed on one side of said cathode, stacked electron beam immersion lens electrodes including a grid disposed on the opposite side of said cathode, said grid being formed with an apertured end plate and a side wall stepped laterally outward to provide a given side wall maximum lateral dimension, and common insulating rods for mounting said amplifier and immersion lens electrodes relative to one another, said amplifier electrodes having a lateral dimension not larger than said given side wall maximum dimension.

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CERTIFICATE OF CORRECTION

Patent No. 3,016,471

January 9, 1962

Oscar A. Drake et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 57, strike out "and the beam forming portions of the gun" and insert instead -- the internal surface thereof. An electrode --; column 2, line 34, after "plate" insert -- supply --.

Signed and sealed this 5th day of June 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents