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W. H. PAINTER

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CATHODE RAY TUBE

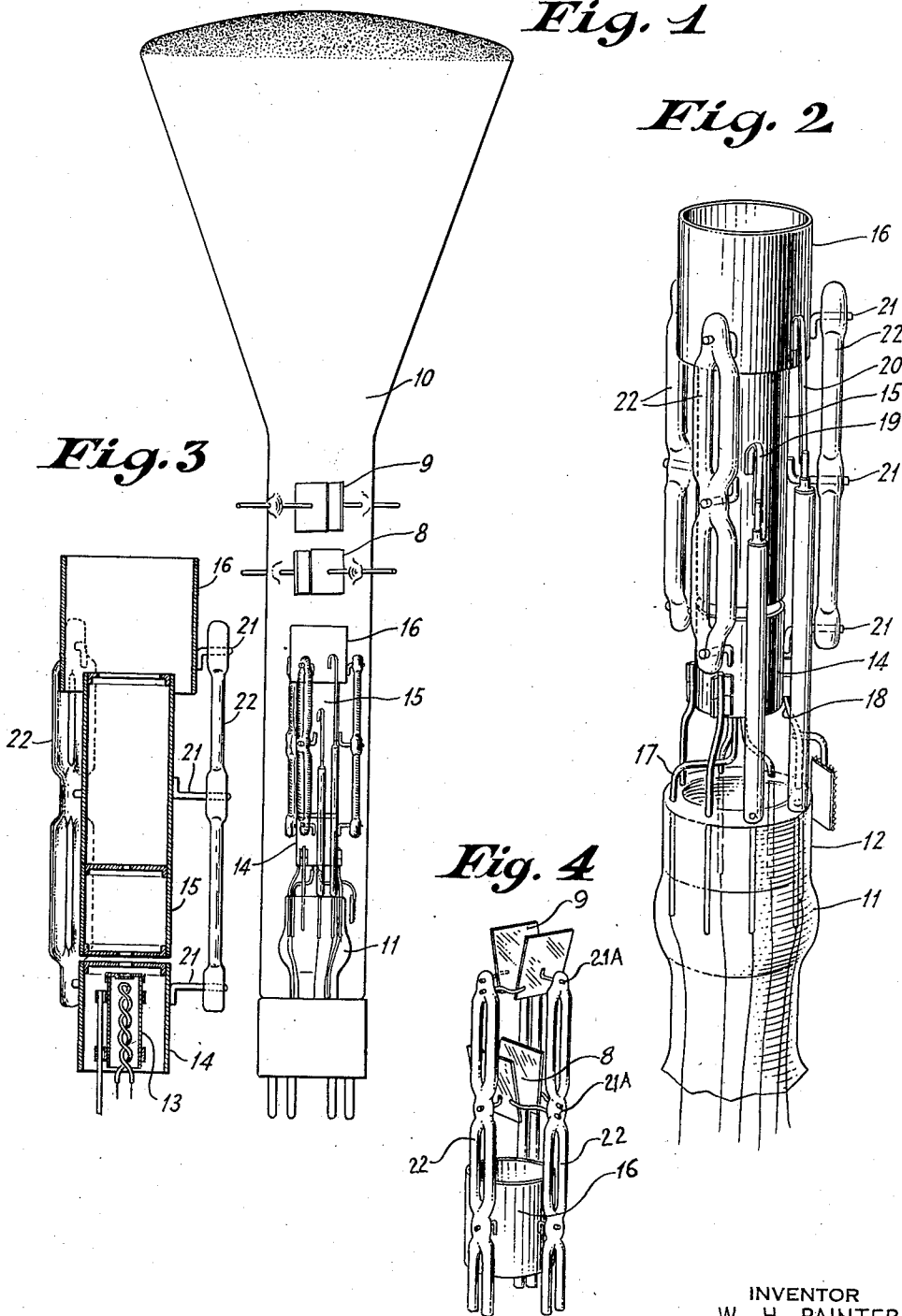
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Fig. 1

Fig. 2

Fig. 3

Fig. 4



INVENTOR
W. H. PAINTER

BY
Charles McClain
ATTORNEY

UNITED STATES PATENT OFFICE

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CATHODE RAY TUBE

William H. Painter, East Orange, N. J., assignor,
by mesne assignments, to Radio Corporation of
America, a corporation of Delaware

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My invention relates to electron discharge tubes and more particularly to the mounting of electron beam generating, focusing and accelerating electrodes to form a cathode ray gun for electron discharge devices of the cathode ray type.

In conventional cathode ray tubes the cathode ray gun for producing the cathode ray or beam of electrons comprises a thermionic cathode and various apertured cold electrodes mounted on a glass press or pinch by metal support wires or rods. Accurate and permanent alignment of the electrodes which is necessary for efficient and stable operation, has been obtainable in the conventional cathode ray gun only with difficulty and by assembly methods which are slow and require a considerable amount of skilled hand work.

One object of my invention is to provide an improved cathode ray gun of greater rigidity and better alignment of the electrodes than is found in the conventional devices of the kind.

Another object is to provide a simplified and improved method of assembling the electrodes into a rigid and accurately aligned cathode ray gun.

Other objects and advantages of my invention will appear from the following description of the invention.

The novel features that I consider characteristic of my invention together with the invention itself will best be understood from the following description of certain preferred embodiments thereof when read in connection with the accompanying drawing in which:

Figure 1 is a view in side elevation of a cathode ray tube with a cathode ray gun embodying one form of my invention;

Figure 2 is a perspective view of the mount;

Figure 3 is a longitudinal sectional view of the cathode ray electron gun of the tube shown in Figure 1; and

Figure 4 is a perspective view of a portion of the cathode ray gun and deflection structure.

The cathode ray tube shown in the accompanying drawing is in general of the conventional type. The evacuated bulb 10 has a fluorescent screen at the large end and at the other end a tubular neck which contains a mount comprising a tubular glass stem 11 with an annular press 12, and a cathode ray gun, in general of the conventional type, carried by the stem. Suitable cathode ray deflection elements may be provided such as the deflection plates 8 and 9, or electro-magnetic means or a combination of

both, may be utilized to deflect the electron beam as it passes from the cathode ray gun to the fluorescent screen. The cathode ray gun comprises the usual indirectly heated cathode 13, with cooperating cold electrodes such as the control grid 14, and first and second tubular anodes 15 and 16, axially aligned with the cathode and with one another. These electrodes may be conductively connected to lead wires sealed in the press by suitable conductors 17, 18, 19 and 20 respectively. Certain of these conductor leads may also serve as mechanical support members as hereinafter stated.

Accurate alignment of the first and second anodes with the control grid is essential for the proper operation of the tube, and this alignment should be maintained in use in spite of temperature variations in the electrodes of the cathode ray gun. A common way of holding the electrodes in alignment is to provide glass rods or pedestals extending from the stem with projecting support wires and to weld the projecting ends of these wires to the electrodes while the electrodes are held in alignment on a mandrel or in a jig. This method of assembly is relatively slow, requires considerable hand work and skill, and experience has shown that in such a cathode ray gun the electrodes are apt to move out of alignment slightly either just subsequent to assembly due to inherent strains in the parts or during use of the tube.

In accordance with my invention I maintain the cold electrodes, such as the control grid, the first anode, and the second anode, in rigid and permanent alignment by providing each of these electrodes with rigid radial projections, which is conveniently done by attaching, preferably by welding to each of the three electrodes several support brackets 21 which project radially outward beyond the periphery of the electrode. When the electrodes are in place the projections or brackets on each electrode are aligned with the corresponding projections on the other electrodes to form as many rows of projections as there are projections on each electrode. In the tube shown in the drawing there are three projections on each electrode, and therefore three rows, each row containing three projections, one on each of the three electrodes. The projections or brackets in each row are firmly secured to a pair of parallel support rods which extend lengthwise of the electrodes and may be of any rigid insulating material, preferably of glass or similar vitreous material which may be

deformed and sealed to the brackets by heating the material until it is plastic.

The two rods 22 of each pair are placed alongside a row of axially aligned support brackets 21, one on each side of the row of brackets, while the electrodes are held for purpose of assembly by a jig fixture not shown. The rods are heated locally until those portions of the rods adjacent the brackets become plastic, whereupon the heated plastic portions are brought together by pinching on both sides of the bracket and are thus sealed to each other and to the support bracket between them. Preferably, as shown in the drawing, three pairs of glass rods are used to rigidly tie together in proper alignment the control grid to the first and second anodes. This mounting is inherently strong, as any tendency of a rod to bend in a plane tangent to the anodes is opposed by the companion rod of the pair, while bending or tilting movement of the anodes is opposed by the pair of rods on the other side of the mount.

I have obtained good results and secured strong and rigid mounts in which the electrodes remain accurately aligned during use by using for the brackets nickel which has been fired in hydrogen at about 1200° C. for about 15 minutes and using rods of lime glass which will make a strong seal with such nickel brackets. In these mounts glass rods about 0.1 inch in diameter were used and the electrodes as well as the rods were held in a jig during the assembly of the mount. If desired, the glass tie rods can be extended and joined to the press of the stem, but ordinarily it is sufficient to rigidly tie together by the structure such as I have described the control grid and the first and second anode. Such a mount is considerably stronger mechanically than the mounts heretofore made and will withstand considerable pressure without either breaking or causing mis-alignment of the electrodes. Two pairs of mounting rods will ordinarily give satisfactory results, but in general I prefer to use, as shown in the drawing, three or more pairs to give ample strength.

I have at times found it desirable to support the cathode ray deflection electrodes directly on the electron gun structure which procedure insures perfect alignment of these electrodes with the focusing members of the electron gun. Figure 4 shows such a structure in which the glass rods 22 are sufficiently extended to provide support for the electrodes 8 and 9 through additional brackets 21A.

The method of assembling the parts of the electron gun and deflection structure in accordance with my invention is not only much simpler and quicker than the conventional methods heretofore used, but offers advantages in production because it is adaptable to machine operation. The parts mounted in a jig can easily be carried while in the jig through a machine in which the heating of the glass rods adjacent the brackets and the pinching of the glass rods down on the brackets to seal the pinched portions to each other and to the bracket can be carried out with great expediency.

What I claim as new and desire to secure by Letters Patent is:

1. A cathode ray gun assembly including a plurality of axially aligned cylindrical electrodes, a bracket on each of said electrodes extending radially beyond the periphery of the electrode, the brackets on said electrodes being aligned in a row, and a pair of glass support rods positioned

side by side along and on opposite sides of the row of brackets, with the portions adjacent each bracket sealed to each other and to the bracket and the portions intermediate the brackets spaced apart in a plane perpendicular to the bracket.

2. A cathode ray gun assembly including a plurality of axially aligned tubular electrodes each having a plurality of outwardly extending radial projections uniformly spaced on the periphery of each electrode, the projections on each electrode being aligned with the corresponding projections on each adjacent electrode to form a plurality of rows of projections parallel to the longitudinal axis of said electrodes, and a pair of glass support rods extending along each row of projections on opposite sides of said projections, the portions of said rods of each pair adjacent each projection being sealed to each other and to the projection and the remaining portions being spaced apart and parallel to a plane tangential to said electrode at the projection.

3. A cathode ray focusing and deflection assembly including a plurality of axially aligned cylindrical electrodes and a plurality of substantially plane electrodes, a bracket on each of said electrodes extending radially beyond the periphery of the electrode, the brackets on said electrodes being aligned in a row, and a pair of glass support rods positioned side by side along and on opposite sides of the row of brackets, with the portions adjacent each bracket sealed to each other and to the bracket and the portions intermediate the bracket spaced apart in a plane perpendicular to the bracket.

4. A cathode ray tube including an evacuated envelope having a stem at one end and a fluorescent screen at the other end, and a cathode ray gun directed toward said screen and mounted on said stem and comprising a cathode, a plurality of tubular electrodes axially aligned with said cathode and with one another, a plurality of projections extending radially beyond the periphery of each electrode with the projections on each electrode aligned in a row with the corresponding projections on the other electrodes, and two vitreous rods positioned side by side along each row of said projections and sealed at each projection in the row to each other and to the projections.

5. A cathode ray tube including an evacuated envelope having a stem at one end and a fluorescent screen at the other end, and a cathode ray gun directed toward said screen and comprising a cathode mounted on said stem, a tubular electrode adjacent said cathode rigidly supported by said stem, at least one additional tubular electrode in alignment with said first electrode, each of said tubular electrodes having projections extending radially beyond the periphery of the electrode with the projections on each electrode aligned in a row with the corresponding projections on the other electrodes and two vitreous rods positioned side by side along each row of said projections and sealed at each projection in the row to each other and to the projection.

6. A cathode ray tube including an evacuated envelope having a stem at one end, a fluorescent screen at the other, and a plurality of ray deflection plates therebetween, and a cathode ray gun directed toward said screen and comprising a cathode mounted on said stem, a tubular electrode adjacent said cathode rigidly supported by said stem, at least one additional tubular elec-

trode in alignment with said first electrode each
of said tubular electrodes and said deflection
plates having projections extending beyond the
periphery thereof with the projections on each
5 aligned in a row with the corresponding projec-
tions on the other electrodes and deflection plates

and two vitreous rods positioned side by side
along each row of said projections and sealed at
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the projection.

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