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ELECTRON-GUN USING COMBINED MAGNETIC  
AND ELECTROSTATIC FOCUSING  
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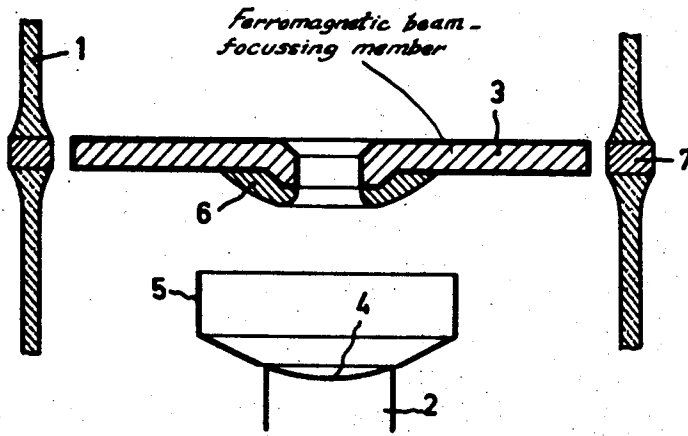


FIG. 1

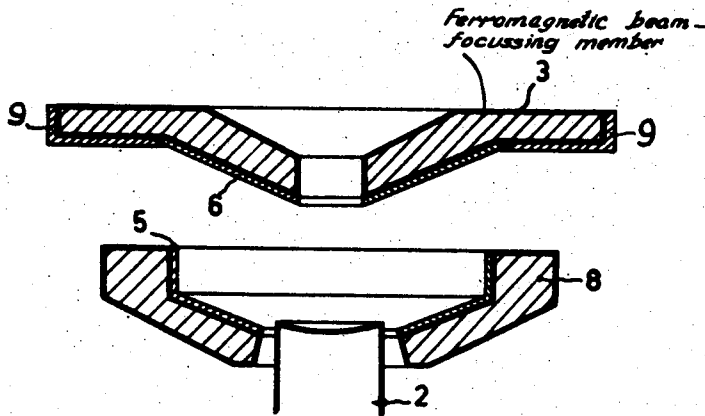


FIG. 2

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## ELECTRON-GUN USING COMBINED MAGNETIC AND ELECTROSTATIC FOCUSING

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6 Claims. (Cl. 313-84)

This invention relates to electron-guns such as are used in electron-beam tubes, e.g. travelling wave tubes for forming the electron-beam. The invention is particularly directed towards the arrangement of beam-forming electrodes and focusing members forming part of the electron-gun.

According to the invention an electron-gun comprises a ferromagnetic focusing member and a beam-forming electrode, the said electrode being formed by a metal surface on a portion of a face of the said focusing member adjacent the electron-beam. Preferably the focusing member is substantially circular and has a central aperture for the passage of the electron-beam.

In order that the invention may be readily understood and carried into effect embodiments thereof will now be described with reference to the accompanying diagrammatic drawings wherein

FIG. 1 is an elevational view in section of an embodiment of an electron-gun; and

FIG. 2 is an elevational view in section of another embodiment of an electron-gun according to the invention.

Referring to FIGURE 1 the electrode-assembly of an electron-gun is disposed within a glass envelope 1 only part of which is illustrated. The electron-gun comprises a cathode indicated generally at 2 and having an electron-emissive end face 4. A beam-forming electrode 5 is arranged forward of the cathode end face 4 and a ferromagnetic beam-focusing member 3 is arranged forward of the electrode 5, this member 3 having a central aperture through which the electron-beam passes. The member 3 serves to focus the electron-beam and forms part of a magnetic circuit which includes an annulus 7 sealed to the envelope 1 adjacent the member 3. The remainder of the magnetic circuit is not shown since it is conventional and is described, for example, in British Patents 833,687 and 845,000.

At the portion of the member 3 adjacent the central aperture thereof and on the rear face of the member, that is to say the face of the member nearest the cathode 2, there is provided an electrode 6 formed by metal deposited upon the ferromagnetic member 3. Where the ferromagnetic member is an alloy, which usually will be the case, this electrode 6 may comprise a copper-plated surface formed upon the member 3. Where the member 3 is a ferromagnetic ferrite the surface may be formed by copper-plating or, if desired, by a metal spraying process.

It will be seen that this deposition of the electrode 6 affords a simpler method of providing the electrode than the known arrangement of supporting the electrode separately from ceramic spaces such as will be provided for supporting the electrode 5. Where the desired profile of the electrode 6 differs from the profile of the member 3, as is the case with the arrangement shown in FIGURE 1, the electrode 6 may be built up to the desired profile by successive plating or metal-spraying operations and subsequent machining.

FIGURE 2 illustrates a second embodiment wherein the ferromagnetic member 3 is in the form of a disc hav-

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ing a dished central portion with an aperture through which the electron beam is arranged to pass. An electrode 6 is formed upon the face of the member 3 nearer to the cathode 2, the electrode 6 in this embodiment having a profile much the same as that of the said face of the member 3.

The electron-gun also includes a second ferromagnetic member 8 which is provided with an electrode 5 which is formed on the surface of the member 4 facing the electrode 6. In this case also the profile of the electrode 5 is substantially the same as that of the face of the member 4 upon which it is formed but it will be appreciated that, if these two profiles were required to be different, then the profile of the member 5 could be determined by plating or metal-spraying processes, followed by subsequent machining, in a manner similar to that outlined above in respect of the embodiment shown in FIGURE 1.

In both the embodiments described, connections to the electrodes formed upon the ferromagnetic members may be made at a location on these members remote from the electron-beam and for this purpose a metal connecting strip 9 may be plated or otherwise provided upon the same face of the ferromagnetic member as the electrode. If convenient, of course, the whole of the appropriate surface of the ferromagnetic member may be formed with a metal film so as to facilitate application to the electrode of the appropriate voltage.

The electron-gun according to the invention is particularly useful in travelling-wave tubes where it is used in a Pierce type immersed field, or as it is sometimes known, a "confined flow" gun, i.e. in this type of electron gun, the magnetic field extends from the electron-emissive surface of the cathode and the lines of magnetic force lie parallel to the direction of electron flow from the cathode to the first anode.

What I claim is:

1. An electron-gun assembly for an electron discharge tube comprising a source of electrons, a circular disc-shaped ferromagnetic member spaced from said source of electrons and provided with a central aperture through which passes a beam of electrons derived from said source, and a metal layer on a portion of a surface of said ferromagnetic member adjacent the electron beam surrounding said aperture and facing said electron source serving as a beam-focusing electrode.

2. An electron-gun as claimed in claim 1 wherein the metal layer on the focusing member is of substantially even thickness, the profile of the electrode being substantially the same as that of the base of the focusing member upon which it is formed.

3. An electron-gun as claimed in claim 1 wherein the profile of the electrode is different from that of the surface of the focusing member upon which it is formed.

4. An electron-gun as claimed in claim 1 wherein the ferromagnetic focusing member is composed of a ferromagnetic ferrite.

5. An electron-gun as claimed in claim 1 wherein the ferromagnetic focusing member is composed of a ferromagnetic alloy.

6. An electron-gun as claimed in claim 1 wherein a strip of metal is provided on the focusing member which extends from the electrode to a portion of the focusing member remote from the electron-beam.

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