May 11, 1943. J. HILLIER 2,319,061

DEMOUNTABLE ELECTRON GUN

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Fig. 1

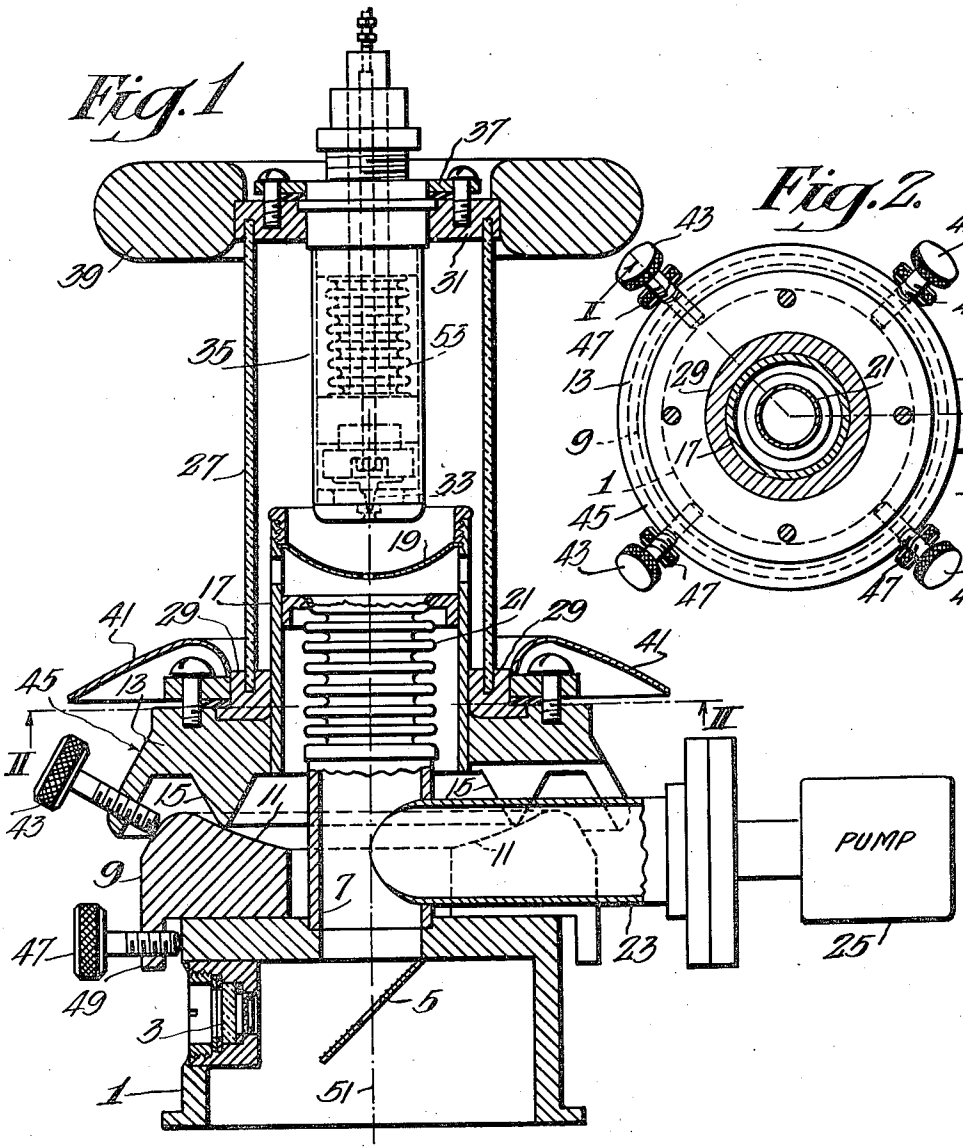
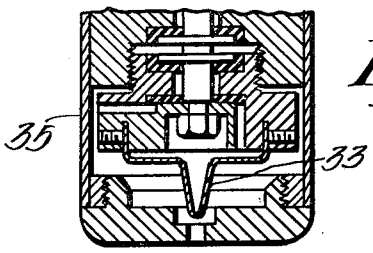


Fig. 2.

Fig. 3.



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DEMOUNTABLE ELECTRON GUN

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11 Claims. (Cl. 250—160)

This invention relates to demountable electron guns and especially to a demountable and adjustable electron gun for electron microscopes and similar devices.

Many electron guns, especially those of electron microscopes, are preferably demountable. The demountable feature makes it easy to replace a defective cathode. The original gun, as well as the gun with a replaced cathode, must be carefully aligned to avoid undesired distortion in the miscroscope, diffraction camera, or the like. The prior art demountable gun were difficult to align with respect to the axial line of the device in which the gun was used.

The instant invention has for one of its objects the provision of means for aligning a demountable electron gun. Another object is the provision of an electron gun with independent means for aligning and positioning the beam of electrons from the gun with respect to a desired line. Another object is to provide means in a demountable electron gun for aligning the gun and positioning the gun respectively and independently with respect to given axial line.

The invention will be described by referring to the accompanying drawing in which Figure 1 is a sectional view, taken along the line I—I of Fig. 2; Figure 8 is a sectional view taken along the line II—II of Fig. 1; and Figure 3 is a detailed sectional view of the cathode. Similar reference characters will be applied to similar elements in the drawing.

Referring to the drawing on a flanged base 1 are mounted a vacuum tight window 3, an apertured fluorescent screen 5, and a connecting tube 7. An adjustable member 9 is mounted on top of the flanged base 1. The upper portion of the adjustable member 9 is made to correspond to a hollow spherical portion 11, whose function is hereinafter described. A second adjustable member 13, having a V-shape projected portion 15 which engages the spherical portion 11, is mounted on the first member 9. A hollow cylindrical piece 17 is tightly connected to the upper bearing plate. An apertured anode electrode 19 is suitably clamped to the upper portion of the cylindrical piece. A flexible member or bellows 21 is suitably connected between the cylindrical piece and the connecting tube 7 to form a flexible and, at the same time, vacuum tight connection between the base and second adjustable member 13. A flanged pump connection 23 joins the connecting tube 7 and a vacuum pump 25.

An insulated tube 27 is mounted, vacuum tight, on an annular member 29. The annular member 29 is suitably clamped to the upper surface of the second adjustable member 13. An apertured disc 31 is fastened, vacuum tight, to the upper end of the insulated tube. The cathode electrode 33 of the gun is mounted within a tube 35, or the like. The tube 35 is inserted through the aperture of the disc 31 and secured thereto by an annular member 37. Shields 39, 41 are preferably secured at the upper and lower ends, respectively, of the insulated tube 27 and are connected to cathode and anode, respectively, to prevent corona discharge of the high voltage source between the cathode and anode.

Four adjusting screws 43, are arranged, preferably at 90° intervals, in a flanged portion 45 of the second adjustable member 13. Another set of adjusting screws 47 is similarly arranged on a flanged portion 49 of the first adjustable member 9. The adjusting screws 43, attached to the second member 13, are for moving the second member with respect to the spherical surface 11. Since the emissive portion of the cathode 33 is located at the center of curvature of the spherical portion, the direction of the beam of electrons may be readily adjusted with respect to the axial line 51 of the base 1. While the electron beam is somewhat diffused at the fluorescent screen 5, electrons impinging on the screen provide some indication of the nature of the beam and its direction. The optimum adjustment is obtained by means of the second member 13 which is oriented to make the electron beam parallel the axial line. The parallel adjustment having been secured, the center of the beam may be made to coincide with the axial line 51 by adjusting the screws 47.

The independence of the two adjustments permits the user to readily align the beam without having the successive adjustments upset each other. That is, the adjustment of the upper or second member 13 on the spherical surface is to obtain the desired direction of the beam without regard to its location. The adjustment of the lower member 9 is to locate the beam with respect to the axial line or any desired reference position. These adjustments are independent of each other.

The portion of the gun including the cathode is made with a vacuum tight bellows 53 connection between the cathode and the upper portion of the gun. This connection permits the cathode to be raised or lowered. If a cathode is replaced, the replacement cathode may be readily

adjusted so that the emissive portion coincides with the center of curvature of the spherical portion of the second member 13. The cathode is connected to the insulated terminal at the center of the gun and to the shell of the gun. The details of one suitable cathode are shown in Fig. 3.

Thus, the invention has been described as a demountable gun. The gun is mounted on a base which may be a portion of the device employing the gun. Flexible vacuum tight connections are provided between the base and the adjustable parts of the gun. One of the adjustable members is arranged to locate the electron beam with respect to a reference line or position; another adjustable member is arranged to provide a directional alignment independent of the location alignment; and finally an adjustable cathode is provided.

What is claimed is:

1. A demountable electron gun including in combination a base, a member adjustably mounted on said base and including a hollow spherical portion, a second member adjustably mounted on said spherical portion, an electron gun including a cathode and an anode mounted on said second member, and a flexible member connected between said base and said second member and forming a vacuum tight connection therebetween.

2. A demountable electron gun including in combination a base, a member adjustably mounted on said base and including a hollow spherical portion, means for adjusting said adjustable member with respect to said base, a second member adjustably mounted on said spherical portion, an electron gun including a cathode and an anode mounted on said second member, and a flexible member connected between said base and said second member and forming a vacuum tight connection therebetween.

3. A demountable electron gun including in combination a base, a member adjustably mounted on said base and including a hollow spherical portion, means for adjusting said adjustable member with respect to said base, a second member adjustably mounted on said spherical portion, means for adjusting said second member with respect to said spherical portion, an electron gun including a cathode and an anode mounted on said second member, and a flexible member connected between said base and said second member and forming a vacuum tight connection therebetween.

4. A demountable electron gun including in combination a base, a member adjustably mounted on said base and including a hollow spherical portion, a second member adjustably mounted on said spherical portion, an electron gun mounted on said second member and including a demountable cathode, and a flexible member connected between said base and said second member and forming a vacuum tight connection therebetween.

5. A demountable electron gun including in combination a base, a member adjustably mounted on said base and including a hollow spherical portion, a second member adjustably mounted on said spherical portion, a cathode mounted on said second member, an anode electrode mounted on said second member and interposed between said cathode and said base, and a flexible member connected between said base and said second member and forming a vacuum tight connection therebetween.

6. In a demountable electron gun the combination of a base, a member mounted on said base and including a hollow spherical portion and means for adjusting said member in a plane normal to the axial line of said base, a second member mounted on said spherical portion and including means for adjusting said second member with respect to said spherical portion, an electron gun mounted on said second member, and a flexible member connected between said base and said second member and forming a vacuum tight connection therebetween.

7. In a demountable electron gun the combination of a base, a member mounted on said base and including a hollow spherical portion and means for adjusting said member in a plane normal to the axial line of said base, a second member mounted on said spherical portion and including means for adjusting said second member with respect to said spherical portion, an electron gun mounted on said second member and including a cathode located substantially at the center of curvature of said spherical portion, and a flexible member connected between said base and said second member and forming a vacuum tight connection therebetween.

8. In a demountable electron gun the combination of a base, a member mounted on said base and including a hollow spherical portion and means for adjusting said member in a plane normal to the axial line of said base, a second member mounted on said spherical portion and including means for adjusting said second member with respect to said spherical portion, an electron gun mounted on said second member and including a cathode located substantially at the center of curvature of said spherical portion, an anode mounted on said second member and including an aperture substantially in alignment with said cathode, and a flexible member connected between said base and adapted for aligning an electron beam from said gun with said axial base line and said second member and forming a vacuum tight connection therebetween.

9. A device of the character of claim 1 including an adjustable cathode electrode located within said electron gun.

10. A device of the character of claim 6 including an adjustable cathode electrode located within said electron gun.

11. A device of the character of claim 7 including means for adjusting the position of said cathode with respect to said center of curvature.

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