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INDEPENDENT ELECTROSTATIC LENS

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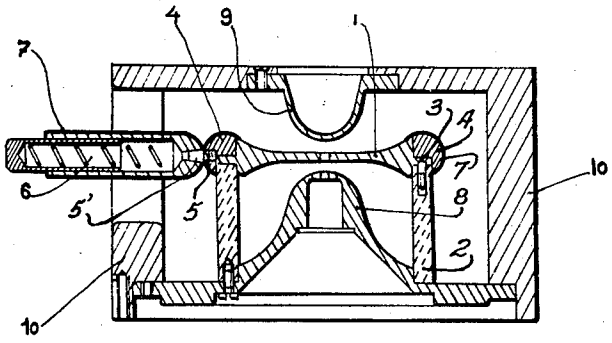

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INDEPENDENT ELECTROSTATIC LENS

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1 Claim. (Cl. 250—49.5)

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The present invention relates to improvements in electrostatic lenses; it involves the shape and the mounting of such lenses, and also the materials to be used in their manufacture. The object of the said improvements is to reduce the bulk of these members and ensure the mechanical accuracy thereof, while enabling disruptive electric discharges to be prevented.

The accompanying drawing shows, in sectional elevation, and in a non-limitative manner, one example of an electrostatic lens provided with all the improvements according to the invention.

This lens comprises essentially three electrodes having shapes of bodies of revolution around common optical axis XX'. Extreme electrodes 8 and 9 are raised to a relatively high direct potential with respect to central negative electrode 1. All three are apertured along axis XX' to allow passage of the electron beam. The shape of the three electrodes is so arranged that the force lines are distributed as evenly as possible in the vacuum spaces which separate them. Since the fields are greatest at the center and at the edges of both faces of negative electrode 1, the other two electrodes are made as pointed as possible. In this manner the equi-potential surfaces of these two faces attain maximum spacing from the center outwards seen from axis XX', as shown in Fig. 2.

In this figure it is assumed that the central electrode is not connected by any supporting means to electrode 8. The meridians of the equi-potential surfaces of revolution surrounding the extremities 4 of the central electrode have only smooth contours. Since a sharp bend in these contours would mean an abrupt increase of the field, insulating supports 2 must be so arranged that they do not substantially modify the shape of the equi-potential surfaces. To these surfaces there correspond, on the left side of axis XX', force lines 11—12 and 13—14, and on the right 13'—14' and 11'—12'.

The invention consists in giving to the support the shape of an induction tube which is a body of revolution about axis XX'. The intersection of this support with the plane of the drawing provides a left side limited by the force lines 11—12 and 13—14 and a right side limited by the force lines 11'—12' and 13'—14'. The central electrode is preferably chosen with such dimen-

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sions that the interior and exterior surfaces constituting the support form cylinders of revolution about axis X'X.

The central electrode 1 of circular shape rests upon the insulating support 2, to which it is secured by means of a screw 3, which screw enables electrode 1 to be held strictly perpendicular to axis XX'.

The bearing zone of the central electrode is electrostatically screened by a separate rim 4.

The rim aforesaid is locked by means of a screw 5 terminating in a head 5' which has a slight conical taper in the outward direction and to which the spring-pin 6, serving for applying the requisite potential, is adapted to be fixed.

The rim 4 and the pin 6 are both covered with a layer 7 of insulating material.

It is known that this relatively thin insulating layer has the effect of decreasing the field in the immediate vicinity of the outer surface of the electrode, where there is a maximum field in the vacuum. This will be readily understood from the fact that the tubes of force emanating from this outer surface, for example the tube bounded by lines 17—18 and 19—20, flare outwardly toward casing 10. The decrease of field thus obtained results from the fact that in any cross-section of a force tube the flux of the induction vector is constant.

The lens is enclosed in a case 10 of solid Mu-metal instead of a case made of any other metal surrounded with Mu-metal. This magnetic metal is known to comprise about 75% nickel and 25% iron.

The case aforesaid is so shaped and secured that it can be removed alone, without touching the lens mounting, thereby exposing the central electrode 1.

We claim:

In an electrostatic lens for electronic microscopes, a negative electrode having the shape of a horizontal disc with an enlarged periphery, said disc being centrally apertured and centered on a vertical axis, two positive electrodes located respectively on either side of said lens, centered on said axis and each having the shape of a finger-stall pointing toward said disc, a cylindrical insulating support co-axial with said axis connecting said disc to the lower of said positive electrodes and having lateral surfaces coinciding with

the force lines passing through the space between said disc and lower electrode, a screw connecting said electrode to said support, a further screw connecting said support to said disc, a thin insulating sleeve surrounding said disc, a screw connecting said sleeve to said disc, a metal rod connecting said last-mentioned screw to a source of direct current, said screw having a projecting conical head, a thin insulating coating on said rod in contact with said insulating sleeve, a casing made at least in part of magnetic metal wherein said positive electrodes are located and which surrounds said disc, and means for removing said casing without disconnecting said disc from the lower electrode.

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