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DIAPHRAGM FOR LIMITING THE FIELD OF VIEW OF THREE-STAGE ELECTRON MICROSCOPES

Filed June 17, 1959

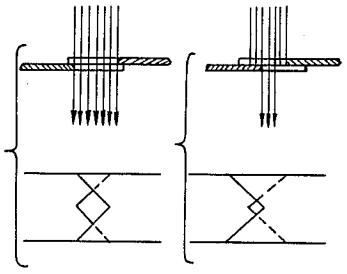

Fig.1 Fig.2

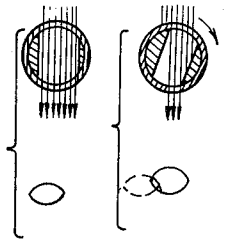

Fig.3 Fig.4

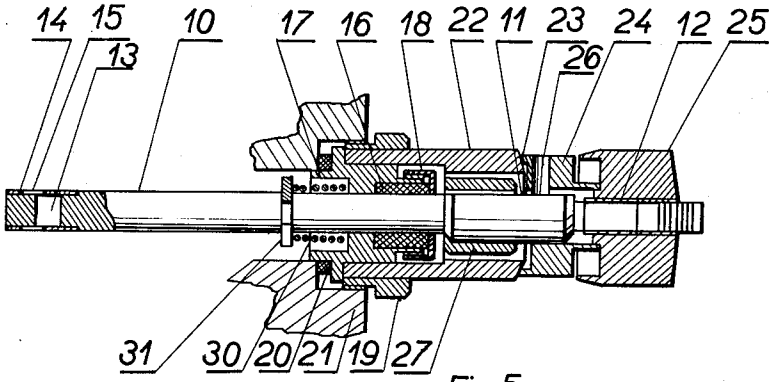

Fig.5

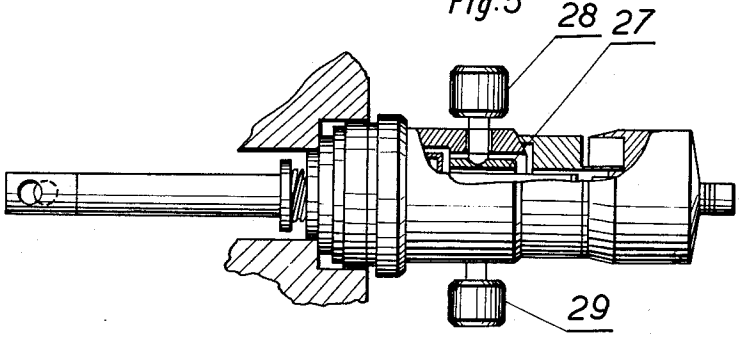

Fig.6

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DIAPHRAGM FOR LIMITING THE FIELD OF VIEW OF THREE-STAGE ELECTRON MICROSCOPES

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The present invention relates to a diaphragm for limiting the field of view of three-stage electron microscopes with the aid of a selective diaphragm.

For identifying materials in electron-diffractography it is often desirable to limit the region from which a diffraction image is taken. The region can be limited in three-stage electron microscopes by placing a diaphragm in the object-plane of the auxiliary lens in such a manner that the beams outside the selected region do not participate in engendering the diffraction image. In this way it is possible to ascertain what part of the observed object participates in forming the diffraction image after switching the apparatus over to diffraction work. In accordance with the character of the examined objects it is sometimes necessary to limit the observed region up to the dimensions of a single microcrystal so that different apertures of the diaphragm are necessary.

There are known various diffraction diaphragms in the form of slidable tongues which are provided with several openings of various sizes with exactly predetermined diameters and which are optionally insertable into the field of view. The openings of the diaphragms are usually circular in shape. A disadvantage of these diaphragms consists in that the choice of the apertures is limited to a comparatively small number of openings provided in the slidable tongue. More useful are continuously adjustable diaphragms, the openings of which, for instance in the shape of a lozenge, are adjustable by relative movements of two overlapping blades having triangular indentures at their ends. By changing the extent of the mutual overlapping of the blades in moving them towards the optical axis or away from it the aperture of the diaphragm may be adjusted as desired. The adjustable diaphragms have a complicated mechanism and high costs of production with respect to the small dimensions of the aperture of the diaphragm which is to be continuously adjustable. A common disadvantage of all the known diaphragms of the said kind is their uneasy handling because they require a tiresome centering.

The present invention removes the inconveniences of the known diaphragm systems and considerably reduces the time necessary to adjust the diaphragm.

The invention relates to a diaphragm for screening off electron beams in three-stage electron microscopes, the diaphragm having a lenticular opening and being rotatable round an axis perpendicular to the optical axis of the apparatus. The diaphragm consists of two members with circular openings, the openings being adapted to coincide partly with each other thereby forming the lenticular opening of the diaphragm.

The features of the invention are elucidated in the accompanying drawing in which:

FIG. 1 illustrates schematically a diaphragm of a known kind, showing a lozenge-shaped aperture at its maximum size;

FIG. 2 illustrates the same diaphragm, showing the aperture at a reduced size;

FIG. 3 represents schematically an embodiment of the diaphragm according to the invention, in the position of its maximum aperture;

FIG. 4 shows the same diaphragm as FIG. 3 does, but with reduced aperture;

FIG. 5 shows in sectional elevation an embodiment of the diaphragm together with its holding and operating parts; and

FIG. 6 shows the same embodiment in plan view, partly in section.

Referring to the drawing in detail, one method used hitherto for changing the aperture of a diaphragm is shown in FIGS. 1 and 2. The maximum aperture of the diaphragm for the electron beams is shown in FIG. 1, whereas FIG. 2 shows how the aperture may be successively reduced.

FIGS. 3 and 4 represent the screening off of a pencil of electron beams by a lenticular opening of the diaphragm according to the present invention. FIG. 3 shows the diaphragm in a position allowing a maximum passage of the electron beams, and FIG. 4 shows how the electron beams may be successively screened off by turning the diaphragm round its axis.

An embodiment of the invention is represented in FIGS. 5 and 6 showing the diaphragm with its operating members. A rod **10** provided with a guide-surface **11** on one end has a screw spindle **12** on the same extremity. A transverse opening **13** is arranged in the other extremity of the rod **10**, the axis of said opening being perpendicular to the plane of the guide-surface **11**. A sleeve **14** is put slidably over this end of the rod **10**, the sleeve having two diametrically opposite openings **15** which partly coincide with the opening **13** in the rod, thus forming a lenticular opening of the diaphragm. The rod **10** is packed by an elastic packing ring **16** which is pressed towards a bearing member **17** by means of a cap-nut **18** in such a manner that the rod **10** is able to make sliding, rotating and slanting movements while maintaining a vacuum-tight connection. A cap-nut **19** presses the bearing member **17** over a packing ring **20** to a wall **21** of the evacuated chamber of the apparatus. A sleeve **22** is put slidably over the bearing member **17**, one end of the sleeve having a spherical surface **23**. A ring **24** provided with a scale for indicating its angle of rotation leans against the spherical surface **23** and an adjusting nut **25** bearing a micrometer gauge leans against the ring **24**, the adjusting nut being screwed on the screw spindle **12** of the rod **10**. A wedge **26** inserted in the ring **24** serves to transfer rotational movements of the ring **24** to the rod **10** and at the same time prevents the rod **10** from rotating during its axial movements caused by the adjusting nut **25**. A sleeve embracing slidably the rod **10** is engaged by two set-screws **28, 29** adapted to slant the rod **10**. The rod **10** with all the parts connected with it is pressed towards the inner space of the evacuated chamber by the overpressure of the outer air and by a spring **30** leaning against a washer **31**.

The above described device is located under the objective of an electron microscope. The centre of the lenticular opening of the diaphragm may be brought into coincidence with the center of the pencil of electron beams, firstly, by axial movement of the rod effected by rotation of the adjusting nut, these movements being controllable by the micrometric scale of the nut, and secondly, by slanting movements effected by the set-screws **28** and **29**.

The pencil of electron beams may be screened off by turning the ring **24** round the axis of the rod **10**. The angle of rotation is indicated by the scale arranged on the ring **24**.

The handling of the novel device for screening off electron beams is greatly simplified and brings about a novel method of continuous adjustment of the diaphragm whose opening can be reduced practically up to the least possible extent of the field of view.

What we claim is:

1. A diaphragm for variably screening the electron beam of an electron microscope comprising an elongated member having a circular bore extending diametrically therethrough, a sleeve member having diametrically opposed circular openings and being disposed on said elongated member with the axis of said openings extending parallel to the axis of said bore and with the axes of said openings and bore being spaced from each other in the direction of the longitudinal axis of the elongated member to provide a partial overlap of the areas of said bore and openings to define an aperture having a lenticular shape, and means supporting said elongated member for rotation about said longitudinal axis thereof and adapted to project said elongated member into the path of the electron beam with said longitudinal axis extending substantially at right angles to the direction of the electron beam and with said aperture variably screening the beam in accordance with rotational adjustment of said elongated member.

2. A diaphragm as in claim 1; wherein said bore and said openings have the same diameter, and said axes of the openings and bore are spaced apart in said direction of the longitudinal axis of the elongated member by a distance smaller than said diameter.

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