

Sept. 9, 1958

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2,851,610

VARIABLE APERTURE FOR ELECTRON MICROSCOPE

Filed Sept. 8, 1954

2 Sheets-Sheet 1

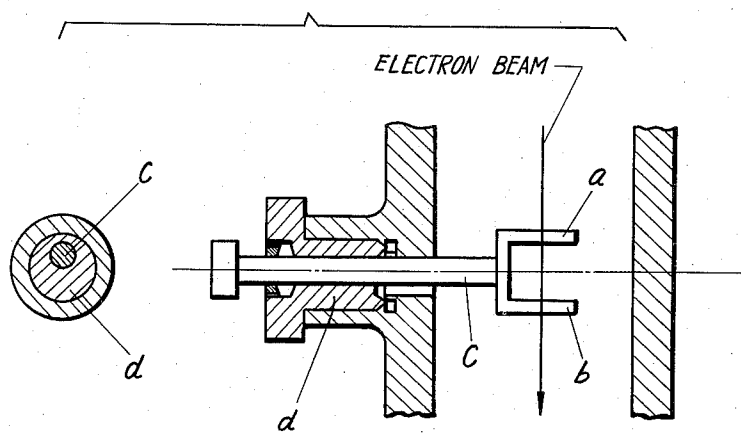
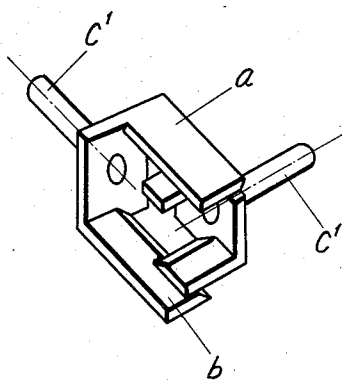
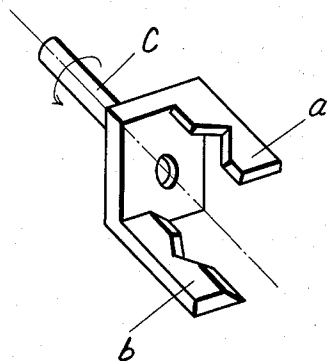


FIG 1

FIG 3

FIG 4



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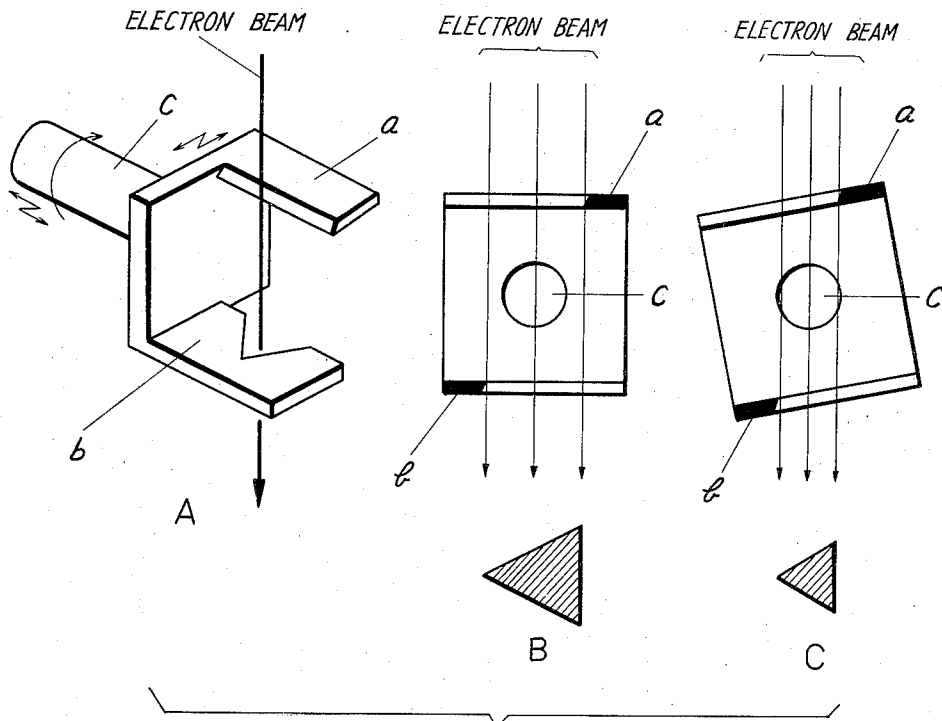


FIG. 2

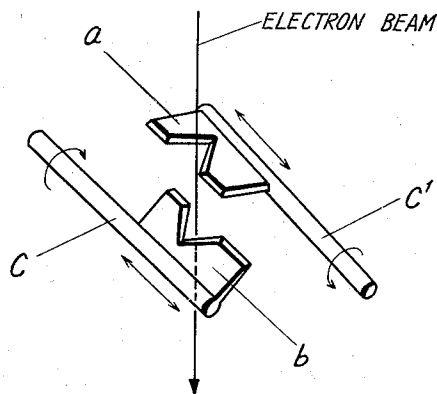


FIG. 5

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2,851,610

VARIABLE APERTURE FOR ELECTRON MICROSCOPE

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Application September 8, 1954, Serial No. 454,734

8 Claims. (Cl. 250—49.5)

This invention relates to an improvement in electron microscope structures and more particularly to the construction of the variable aperture thereof.

An object of this invention is to provide means conducive to an efficacious electron microscope structure which makes it possible that the magnitude of the aperture thereof be varied simply and continuously.

Generally the construction of the variable aperture to be used for an electron microscope has hitherto been complicated and moreover unhandy. According to one aspect of this invention, however, the variable aperture comprises a lateral shaft rotatably and slidably mounted in an eccentric sheave, which is in turn rotatably supported by the microscope tube. Two diaphragms are arranged in a spaced relation from each other about the axis of said shaft and fixed to the end of said shaft, said diaphragms projecting into the bore of said tube. One of said diaphragms may be made in a rectangular form having a beveled inner edge, while the other diaphragms may be provided with a triangular recess, the edges of which are also beveled. Sealing means are arranged between said shaft and sheave as well as between said sheave and tube.

Various further and more specific objects, features and advantages of the invention will appear from the description given below taken in connection with the accompanying drawings illustrating by way of example certain preferred forms of the invention.

In the drawings:

Fig. 1 shows a sectional elevation representing a constructional example of this invention.

Fig. 2 shows a locating device.

Fig. 3 shows a perspective view of diaphragms with one shaft.

Fig. 4 shows a perspective view of diaphragms with two shafts.

Fig. 5 shows a perspective view of diaphragms of another form.

Referring now to Figs. 1 and 2 further in detail, a lateral shaft *c* is rotatably and axially slidably mounted through an eccentric sheave *d*, which is in turn rotatably supported by the microscope tube. Two diaphragms *a* and *b* are fixed to the end of said shaft *c* projecting into the bore of said microscope tube in such a way that these diaphragms are disposed in spaced relation with respect to each other about the axis of said shaft *c*.

One of said diaphragms, for instance the upper one denoted by *a* in Fig. 1, is made in a rectangular form having a beveled inner straight edge, while the other diaphragm, for instance lower one denoted by *b* in Fig. 1, is provided with a triangular recess, the edges of which are also beveled. Although, in these figures, each of the diaphragms is shown diagrammatically as a plate, the diaphragm *b*, which is provided with the triangular recess, is preferably made of two pieces, so joined as to define the sides of said recess therebetween. This arrangement ensures an easy access to the apex of said

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recess and thus enables thorough cleaning of the side edges of said pieces to be effected.

Upon rotation of the shaft *c*, the two diaphragms *a* and *b* approach or move away from each other, as the case may be, when viewed from above. The area through which the electron beams pass can thus be varied from maximum to nil without abrupt change, as will be clear from B and C of Fig. 2. The position of the aperture can be controlled by shifting the shaft *c* axially. When the eccentric sheave *d* is turned, the aperture will move to the left or right in a direction transverse to the axis of said shaft *c* when viewed from above. As shown in Fig. 1, sealing means are provided between said lateral shaft *c* and eccentric sheave *d* as well as between said sheave and microscope tube, whereby the ambient air is effectively prevented from entering into the evacuated bore of the microscope.

A modified embodiment of diaphragms fixed to one lateral shaft is shown in Fig. 3. In this embodiment, both diaphragms are provided with triangular recesses. The form of the aperture is thus rectangular instead of triangular as in the preceding example.

In a further modified embodiment of the invention, as shown in Fig. 4, two sets of aperture control devices substantially like those described in connection with Figs. 1 and 2 are employed. These devices include diaphragms *a* and *b* arranged on separate shafts *c*¹ oriented at right angles to each other. None of the diaphragms is, however, in this case provided with a triangular recess. The form of the aperture is, therefore, rectangular.

Still a further modification of the aperture control device is shown in Fig. 5. The lateral shafts *c* and *c*¹ are arranged in a parallel and staggered relation with respect to each other and at different levels. Although not shown, each of these shafts is rotatably and slidably mounted in an eccentric sheave, which is in turn rotatably supported by the microscope tube, as in the case of the first described embodiment of the invention. Diaphragms *a* and *b* are fixed to the end portions of said lateral shafts projecting into the bore of said tube. Each diaphragm is provided with a triangular recess with beveled side edges. The size of the aperture can be varied by the rotation of the lateral shafts, and the location of the aperture can be adjusted by the axial movement of these shafts and/or by the rotational movement of the eccentric sheaves (not shown).

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In an electron microscope having a hollow microscope tube defining a path of movement for electron beams; a control arrangement for regulating the cross-section of said path and comprising shaft means extending into the interior of said tube substantially transversely to said path and arranged for rotation and for reciprocal axial displacement relative to said tube and substantially transversely of said path, diaphragm means carried by said shaft means within said tube and rotatable and displaceable with said shaft means, said diaphragm means being shaped and constructed to define an aperture through which said electron beams pass during their movement along said path, and operable means connected to said shaft means for displacing the latter in a direction substantially transverse to the direction of said axial displacement, whereby the position of said aperture relative to said path is determined through said substantially transverse displacements of said shaft means together with said diaphragm means, respectively, while the effective cross-sectional shape and area of said aperture are determined through the extent of rotation of said shaft means together with said diaphragm means.

2. In a microscope according to claim 1, said shaft

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means comprising a single shaft having a longitudinal axis, said diaphragm means comprising first and second diaphragms connected to said shaft at one end thereof and disposed in respective planes on opposite sides of said axis, said diaphragms being provided with respective inner edges facing each other, said inner edge of said first diaphragm being straight, and said inner edge of said second diaphragm being provided with an angular recess, whereby a triangular aperture is defined by said diaphragms.

3. In a microscope according to claim 2, said planes in which said diaphragms are disposed being parallel to one another and to said axis, said inner edge of said first diaphragm being parallel to said axis.

4. In a microscope according to claim 3, said inner edges of said diaphragms being beveled.

5. In a microscope according to claim 1, said shaft means comprising a single shaft having a longitudinal axis, said diaphragm means comprising first and second diaphragms connected to said shaft at one end thereof and disposed in respective planes on opposite sides of said axis, said diaphragms being provided with respective inner edges facing each other, said inner edge of said first diaphragm being provided with a first angular recess, said inner edge of said second diaphragm being provided with a second angular recess, said recesses being aligned with one another, whereby a quadrangular aperture is defined by said diaphragms.

6. In a microscope according to claim 1, said shaft means comprising two shafts each having a longitudinal axis, said diaphragm means comprising at least two diaphragms connected, respectively, to said shafts at corresponding adjacent portions of the latter, said operable means comprising a pair of eccentric sheaves rotatably arranged on said tube and supporting said shafts, respec-

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tively, whereby said shafts may be displaced independently of one another and transversely of their respective axes through rotation of said sheaves.

7. In a microscope according to claim 6, said axes of said shafts being parallel to one another and spaced from one another in the direction of said path, said diaphragms having respective outer edges connected, respectively, to said shafts, and further having respective inner edges facing one another and provided, respectively, with angular aligned recesses, whereby said diaphragms define a quadrangular aperture.

8. In a microscope according to claim 6, said axes of said shafts being substantially perpendicular to one another, said diaphragm means comprising two first diaphragms connected to one of said shafts and disposed a predetermined distance from one another in respective first planes on opposite sides of said axis of said one shaft, said first diaphragms being provided with respective straight inner edges facing one another, and two second diaphragms connected to the other shaft and disposed in respective second planes on opposite sides of said axis of said other shaft, said second diaphragms being provided with respective straight inner edges facing one another and being oriented substantially at right angles to said inner edges of said first diaphragms, the distance between said second diaphragms being less than the distance between said first diaphragms, and said second diaphragms being located between said first diaphragms, whereby a quadrangular aperture is defined by said first and second diaphragms.

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