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S. BÜSCH ET AL

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DEVICE FOR VARYING THE SPATIAL POSITION OF SPECIMENS IN ELECTRON MICROSCOPES

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FIG. 1

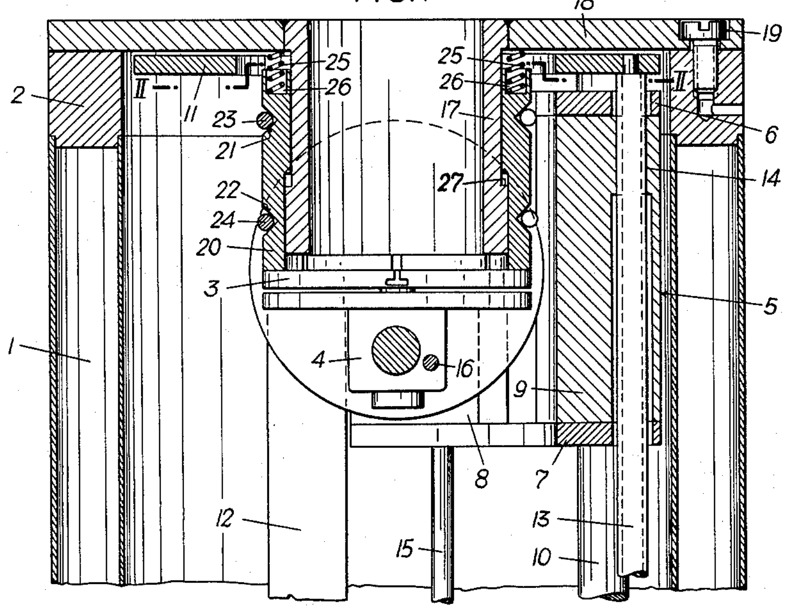
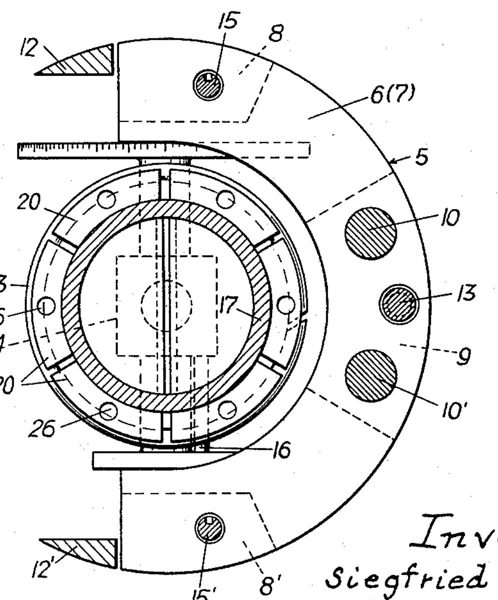


FIG. 2



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DEVICE FOR VARYING THE SPATIAL POSITION OF SPECIMENS IN ELECTRON MICROSCOPES

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The invention relates to a device for adjusting and altering the spatial position of articles, in particular of specimens in a treatment chamber for irradiation or vacuum-coating for electron microscopy, comprising a specimen carrier receiving the article to be treated and mounted in the treatment chamber in such a manner as to be displaceable and rotatable around at least two axes.

Devices of this type serve for the treatment of articles under certain conditions of pressure, temperature and radiation, said treatment requiring the spatial position of the articles to be continuously or intermittently altered while maintaining the prevailing critical conditions. For example, such devices can be used for the treatment of articles by corpuscular radiation or other types of radiation, such as X-rays or ultra-violet rays for a variety of technical and scientific purposes. Further applications are the high-vacuum-coating of articles for the preparation of objects for electron microscopy, the production of refining or other coatings on metalloids or metals, on rheostats etc. as well as deepfreeze drying.

For the above-mentioned treatments it is frequently an advantage or even a requirement to keep the article to be treated at a certain, generally very low, temperature or to cool it from time to time to an appropriately low temperature. As a rule, the temperature of the specimen carrier should be lower than the temperature of its immediate environment inside the treatment chamber, so that the provision of a cooling jacket or the like surrounding the specimen carrier is insufficient to meet specific requirements. In particular, it should be possible to cool the specimen carrier quickly down to any desired temperature, if and when necessary.

In order to solve this problem, the invention provides for a cooled body within the area of displacement of said specimen carrier. This offers the advantage that the specimen carrier can at any time be approached to the cooled body and cooled down by means of operating elements provided for the shifting and tilting of said specimen carrier. As a result of the heat-conductive contact thus established between the cooled body and the specimen carrier, the latter cools off rapidly and its temperature can be decreased until it comes close to the temperature of the cooled body.

According to a preferred embodiment of the invention, the cooled body can be maintained in an effectively heat-conductive connection with a cooling jacket surrounding the specimen carrier, the cooling device provided for the cooling of the treatment chamber serving simply also to cool the specimen carrier. This arrangement provides the possibility of cooling the specimen carrier quickly down to a lower temperature than its environment, since the heat-conductive connection thereby established by the cooled body between the cooling jacket and the specimen carrier, in particular also in a vacuum, ensures speedy and effective cooling of the specimen carrier.

According to a further feature of the invention, the cooled body can be displaceable in the direction in which it can be approached by the specimen carrier, in opposition to a restoring force, preferably of an elastic nature. On the one hand, this measure will preclude a

deadlock when the specimen carrier and/or its operating mechanism abuts against the cooled body and on the other hand, a positive contact ensuring an effective transfer of heat between the specimen carrier and the cooled body is achieved, a further advantage residing in the equality of the given contact pressure.

It is a well-known fact that in order to achieve a positive spring action, the elastic body must present a small cross-section somewhere. In the present instance, however, if the cooled body were designed so as to provide adequate elasticity, the resulting minor cross-section would impair the heat flow, so that under certain circumstances no adequate cooling of the specimen carrier could be achieved during the desired period of time. According to a further embodiment of the invention this difficulty is overcome by providing ring segments on the cooled body, said ring segments being mounted on a tube in such a manner as to be displaceable against the force of axial springs, spring rings, ring-shaped springs or the like being provided in order to maintain the ring segments in position on the tube. Since the springs loading the ring segments in an axial direction do not serve for the conduction of heat, there is no risk involved in designing them with a small cross-section, thus producing an effective spring action, the heat being transferred between the segments and the tube through the sliding surfaces with which the segments rest on the tube. If the ring segments are of appropriate height, sufficiently large heat transfer surfaces are provided to ensure effective cooling. Another advantage of this embodiment of the invention resides in the fact that the elastic ring segments are applied more accurately to the corresponding contact surface of the specimen carrier which makes for an even better heat transfer along these points of contact.

An embodiment of the invention is illustrated in the accompanying drawing wherein

FIG. 1 shows a sectional view through the longitudinal axis of the device according to the invention and

FIG. 2 is a section through a detail on line II—II of FIG. 1.

In the embodiment shown, a cylindrical cooling jacket **1** is provided, e.g. inside a treatment chamber (not shown), which can be designed, for example, as a container serving to produce a vacuum, said cooling jacket being closed on top by a ring **2** and enclosing the specimen carrier **3**. The specimen carrier **3** is mounted on a tilting platform **4** in such a manner as to be rotatable around an axis extending in perpendicular relation to its plane, the tilting platform **4** carrying the specimen carrier **3** being pivoted on a supporting frame **5** and rotatable around an axis extending in parallel relation to the plane of the specimen carrier **3**. The specimen carrier **3** and the central part of the tilting platform **4** are shown in elevation in FIG. 1.

The supporting frame **5** comprises two horseshoe-shaped ring segments **6** and **7** superjacent in spaced relation to each other, and interconnected at their open ends by brackets **8** and **8'** respectively and on the closed side by another bracket **9**.

The supporting frame **5** is mounted on slide bars **10**, **10'** traversing the bracket **9** and maintained in position at their upper extremity by means of a ring **11**, in such a manner as to be shiftable in the longitudinal direction of the device. The ring **11** is further supported by columns **12**, **12'** provided outside the supporting frame **5**. The supporting frame **5** is displaced by means of a threaded spindle **13** rotatably mounted with its upper extremity in the ring **11**, said spindle traversing the bracket **9** and co-operating with a female thread **14** provided in same. For the swiveling of the tilting platform **4** a grooved shaft **15** traversing the bracket **8** is provided, whereas the specimen carrier **3** is rotated by another grooved shaft **15′** traversing the bracket **8′** and operating the specimen carrier **3** via shaft **16**.

Within the area of displacement of the specimen carrier **3** a cooled body is provided, comprising a tube **17** extending through the ring **11** of the holder and the horseshoe-shaped ring segment **6** as far as the area of the supporting frame **5**, said tube presenting a flange **18** at its upper extremity, said flange being mounted on the ring **2** of the cooling jacket **1** by means of bolts **19**. Surrounding the tube **17** a plurality of ring segments **20** are provided and pressed against sliding surfaces on the outer shell of the tube **17** by means of slotted spring rings **23** and **24** located in peripheral grooves **21** and **22**. In lieu of spring rings **23**, **24** annular helical springs or the like can be used. The ring segments **20** are slideable in the axial direction of the tube **17** against the action of helical pressure springs **25** engaging in bores **26** of the ring segments **20** and supported by the flange **18**. The bottommost position of the ring segments **20** is determined by a shoulder **27** of the tube **17** against which corresponding shoulders of the ring segments **20** abut. The ring segments **20** are elastically displaceable in the direction in which they can be approached by the specimen carrier **3**, so as to provide a close heat-conduction contact between them and the specimen carrier **3** and also to preclude the risk of the threaded spindle **13** producing a deadlock when the specimen carrier **3** abuts against the ring segments **20**.

As appears from FIG. 2 the ring segments **20** are arranged with a clearance around the entire periphery of the tube **17**, each ring segment **20** having a bore **26** to receive a return spring **25** of its own, so that the ring segments **20** are free to move within a certain area independently from one another and to apply themselves closely against the surface of the specimen carrier **3**. This arrangement ensures a positive heat transfer between the specimen carrier **3** and the ring segments **20**.

In order to achieve also an effective heat transmission from the ring segments **20** to the tube **17**, the ring segments **20** are of comparatively great height, so as to present correspondingly large sliding surfaces applied against the tube **17** and chiefly responsible for the transfer of heat. As a result, a positive heat conduction is provided via the ring segments **20**, the tube **17**, the flange **18** and the ring **2** between the specimen carrier **3** and the cooling jacket **1**, thus ensuring efficient and rapid cooling of the specimen carrier.

We claim:

1. A device for adjusting and altering the spatial position of articles, in particular of specimens in a treatment chamber for irradiation or vacuum-coating for electron microscopy, comprising a specimen carrier receiving the article to be treated and mounted to be displaceable and rotatable around at least two axes, a cooled body provided within the area of displacement of the said specimen carrier, the latter may be brought into a heat-conductive contact with the cooled body, the said cooled body comprises a tube, ring segments mounted on said tube to be displaceable thereon in an axial direction and flexible means for maintaining the said ring segments in position on the said tube.

2. A device according to claim 1, in which springs are provided acting on the said ring segments in an axial direction and opposing the displacement of the ring segments.

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