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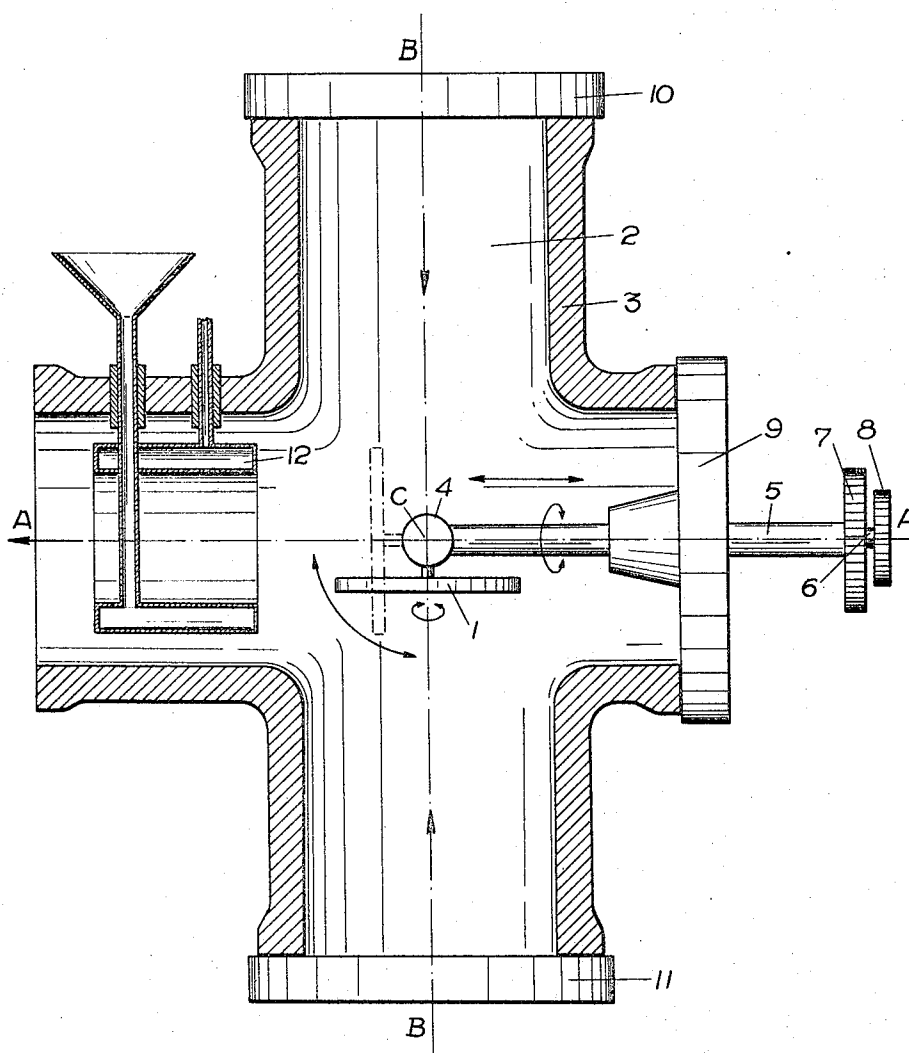
S. GESSNER ETAL
DEVICE FOR ADJUSTING THE SPATIAL POSITION OF
A SPECIMEN CARRIER

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2 Sheets-Sheet 1

FIG. 1



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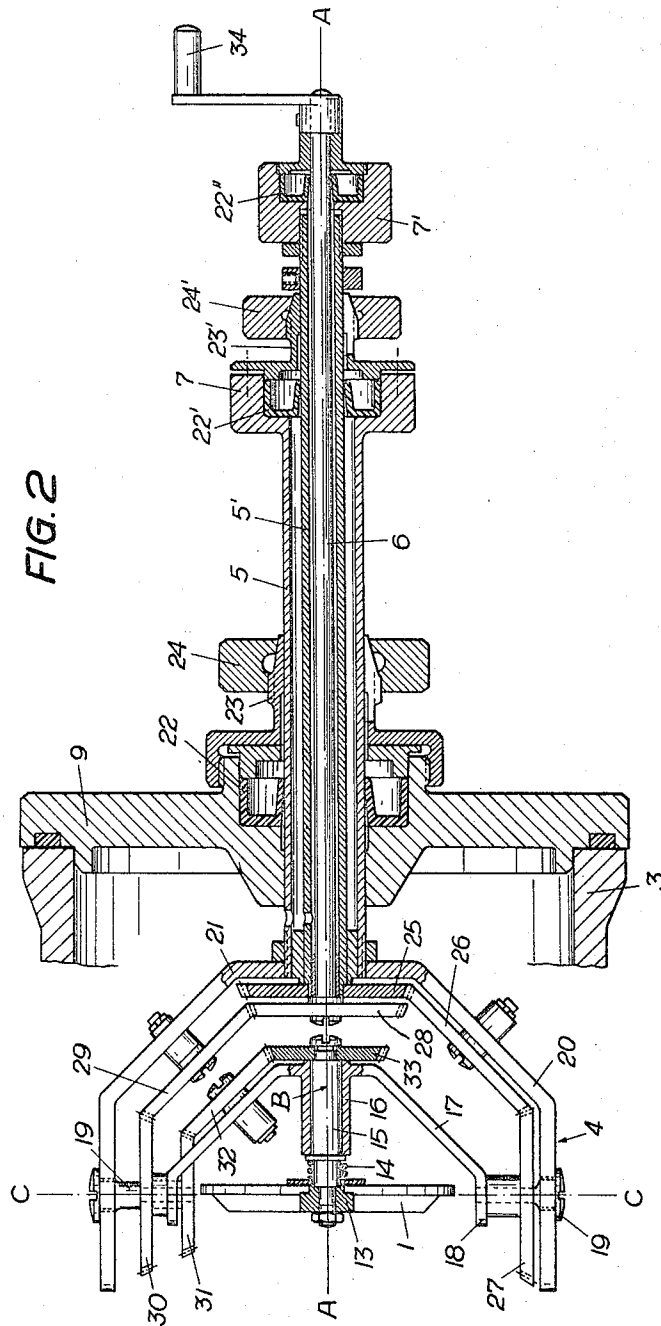


FIG. 2

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1

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DEVICE FOR ADJUSTING THE SPATIAL POSITION OF A SPECIMEN CARRIER

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9 Claims. (Cl. 118—69)

The invention relates to a device for adjusting the spatial position of a specimen carrier freely rotatable about two spatial axes arranged in perpendicular relation to each other and located inside a treatment chamber. In a conventional device of this type, the specimen carrier is rotatable about its axis and mounted on a crosspiece of a U-shaped strap the two legs of which are rotatable on a platform slidable inside the treatment chamber about an axis arranged in perpendicular relation to the axis of rotation of the specimen carrier. All motions of the specimen carrier are derived from separately driven spindles extending in the longitudinal direction of the treatment chamber.

In actual practice and as a result of subsequent developments in similar devices suitable for example, for the vaporization of objects in a high vacuum for the purpose of preparing specimens for electron microscopy as well as for the production of metallic or non-metallic coatings and other layers, the conventional device failed to give complete satisfaction under all circumstances both with regard to the space required and to the unimpeded passage of rays.

Accordingly, it is the object of the invention to improve upon and simplify the conventional device so as to provide satisfactory conditions for all applications. According to the invention, this aim is achieved by the provision of two individually rotatable driving shafts arranged in concentric relation to each other and preferably extending through the wall of the treatment chamber, the rotation of the specimen carrier about its two axes of rotation on the intersection of which it is preferably located, being derived from the said driving shafts. This highly space-saving design of the device permits its accommodation even under extremely narrow conditions, as is generally the case with treatment chambers for various technical and scientific purposes. While fully preserving the free rotatability of the specimen carrier, this design ensures the unimpeded passage of rays due to the absence of a special sliding platform with the driving elements that go with it. In addition, the insertion of the device in the chamber is greatly facilitated, as it may be freely introduced into the chamber through a single aperture. Provided the two driving shafts extend through the wall of the treatment chamber, the device being actuated from outside, this design offers an additional advantage by ensuring simple and positive sealing of the interior of the treatment chamber against the open air, which is particularly important for high-vacuum treatments. In that case, the one and only aperture of the chamber wall can be readily sealed by conventional means. Moreover, the coaxial arrangement of the driving shafts facilitates the operation of the device since all control handles are neatly grouped and arranged over a comparatively small area.

According to a further feature of the invention, one of the driving shafts of hollow design can be axially slidable, the specimen carrier being additionally orientable about a third spatial axis arranged in perpendicular relation to its two axes of rotation, allowing it to be preferably elastically pressed against a cooling body provided in the treatment chamber. Thus it is possible for the specimen carrier to be cooled, as frequently required for cer-

2

tain types of treatment, by direct contact with the cooling body, thereby reducing the time during which the treatment has to be interrupted. In accordance with the same principle, the specimen can be periodically heated, the use of a combined heating and cooling body being most convenient in many cases. Nor will the easy sealing of the chamber be impaired by the additional degrees of freedom required for the displacement of the specimen carrier.

For the purpose of transmitting additional motion to the specimen carrier, two solutions are suggested according to the invention, one of which consists in a relative axial displaceability of the concentric driving shafts from which the swiveling motion of the specimen carrier is derived. According to the second solution, an additional, separately rotatable tubular driving shaft, coaxially extending through the hollow shaft is provided, from the rotation of which the swiveling motion of the specimen carrier is derived. Both embodiments of the invention distinguish themselves by a considerable simplicity of design and ease of operation, the choice between the two solutions in any given situation being left to the discretion of any person conversant with the art.

A preferred embodiment of the invention provides for the gimbal suspension of the specimen carrier by means of two U-shaped bows encompassing each other and interconnected by means of articulations attached to their legs, the shaft of the specimen carrier being rotatably mounted on the crosspiece of the inner bow and the outer bow centrally fixed on the inner extremity of the outer hollow shaft. Consequently, whatever its spatial position, the specimen carrier will always be arranged in central relation to its axes of rotation so as to remain in any case within the direct effective range of the source of radiation or vaporization.

With the specimen carrier suspended on gimbals, it appears advisable to connect the shaft of the specimen carrier according to another embodiment of the invention with the central driving shaft via a bevel gearing comprising a bevel gear at each of the free extremities of the said shafts and a pair of non-rotatably interconnected bevel gears, the axis of rotation of which coincides with the swivel axis of the specimen carrier, an additional bevel gear being provided, if necessary, at the inner and/or outer bow. The positive drive clearly associates the rotation of the shaft of the specimen carrier with that of the central driving shaft.

Finally, according to the invention, a bevel gear can be non-rotatably connected with the inner bow and engage with a bevel gear at the inner extremity of the hollow driving shaft, an additional bevel gear being interpolated, if necessary, between the above-said bevel gears. This provides clear association also between the swiveling motion of the specimen carrier and the motion of the tubular driving shaft.

Further details of the invention will appear from the following description of two embodiments of the invention with reference to the accompanying drawings in which

FIG. 1 is a schematic cross-sectional view of an embodiment of the invention, and

FIG. 2 a longitudinal cross-sectional view of another embodiment of the invention.

As shown in FIG. 1, the specimen carrier 1 is centrally arranged inside a treatment chamber 2 enclosed in a bi-axial housing 3. The specimen carrier 1 is rotatable about its own axis and mounted on a swivel head 4, whose center coincides with the intersection of the two axes A—A and B—B of the housing 3. The swivel head 4 is connected with the inner end of a tubular shaft 5 arranged in concentric relation to the axis A—A and inside which a central driving shaft 6 is freely rotatable and longitudinally slideable. The swivel head 4 is orientable about a

spatial axis C arranged in perpendicular relation to the two axes A—A and B—B.

The tubular shaft 5 extends through a lateral mounting flange 9 of the housing 3 and is both axially displaceable and rotatable in the bore of the flange 9. The aperture of the housing 3 opposite the flange 9 leads to a vacuum pump as indicated by the arrow for the purpose of permitting the evacuation of the treatment chamber 2. Reference numbers 10 and 11 designate the flanges for closing the lower and upper portion respectively, of the treatment chamber 2 which also serve to receive the vaporization or irradiation sources when treatments of this kind are to be performed.

A cooling cylinder 12 is also mounted in the preferably thermally insulated treatment chamber 2 opposite flange 9, said cylinder serving for the periodic cooling of the specimen carrier 1 as explained hereafter. For special uses the said cooling cylinder 12 may also comprise a cylindrical extension made of a heat-conducting material such as sheet copper, surrounding the specimen carrier 1 and appropriately recessed for the purpose of facilitating vaporization or irradiation of objects placed on the specimen carrier 1.

For the operation of the device, the driving shafts 5 and 6 comprise a control handle each, designated by reference numbers 7 and 8 respectively, at their respective extremities. The rotation of the specimen carrier 1 about its axis is derived from the central driving shaft 6 and brought about by turning the handle 8. By moving the central driving shaft 6 inside the tubular shaft 5 by means of the handle 8, the specimen carrier 1 is swivelled about the axis C. When the carrier 1 is swivelled away by 90 degrees from the position shown in the drawing, it occupies the position indicated by the dash-dotted lines where its axis coincides with the axis A—A of the driving shafts 5 and 6. Now the carrier 1 can be moved towards the cooling cylinder 12 by the axial displacement of the hollow shaft 5 by means of its handle 7 and cooled by direct thermal contact. The specimen carrier 1 is furthermore freely rotatable about the axis A—A by means of the handle 7.

Unless means for swivelling the specimen carrier 1 about the axis C are available, a cooling bridge, such as an elastic outrigger, can be provided for the cooling of the specimen carrier 1 either inside or outside the treatment chamber.

According to the embodiment of the invention illustrated in FIG. 2, a gimbal suspension is provided for the specimen carrier 1. The specimen carrier 1 is non-rotatably connected with its shaft 15 by means of a carrier 13 and equipped with a helical spring 14 supported by a shoulder of the shaft 15. The pivot bearing 16 of the shaft 15 is located on the crosspiece of an approximately U-shaped inner bow 17. The parallel legs 18 of the said bow have alining crossbores defining pivot bearings for the pivots 19 of the U-shaped outer bow 20 whose crosspiece 21 is centrally connected with the inner extremity of the outer tubular shaft 5. As in the first-mentioned embodiment of the invention, the tubular shaft 5 is so designed as to be rotatable and slidable in a bore of the flange 9 and sealed off against the flange 9 by means of a packing washer 22. A tapered chuck 23 attached to the flange 9 and comprising a threaded locking ring 24 makes it possible for the tubular shaft 5 to be fixed in any desired position.

The tubular shaft 5' extends through a separately rotatable hollow driving shaft 5 arranged in coaxial relation to same, which can be non-rotatably connected with the outer tubular shaft 5 by means of an additional clamping device consisting of a cone 23' and ring 24'. A packing washer 22' serves to seal the shafts 5 and 5' off against each other. A control grip 7' is mounted on the outer extremity of the hollow shaft 5' and a bevel gear 25 on its inner extremity.

The central driving shaft 6 extends through the hollow

shaft 5', being sealed off against the latter by an additional packing washer 22' and equipped with a crank 34 at its outer extremity. The inner extremity of the central driving shaft 6 also carries a bevel gear 28. The bevel gears 25 and 28 constitute the drive gears of two independent bevel gearings deriving the rotating and swivelling motions of the specimen carrier 1 from the concentric driving shafts 5' and 6.

The gearing for swivelling the inner bow 17 comprises the bevel gears 25, 26 and 27, the last-mentioned one being non-rotatably connected with a leg 18 of the inner bow 17, whereas the intermediate bevel gear is rotatably mounted on the outer bow 20 with an inclination of 45° each in relation to the axes of the bevel gears 25 and 27.

The gearing for driving the shaft 15 of the carrier 1 comprises a total of six bevel gears 28 through 33, among which the two middle bevel gears 30 and 31 are non-rotatably interconnected and supported by a sleeve rotatable in the crossbore of the leg of the inner bow 17 located opposite the bevel gear 27, the pivot 19 of the outer bow 20 protruding into the axial bore of said sleeve. The intermediate bevel gear 29 is rotatably mounted on the outer, and the intermediate bevel gear 32 on the inner bow. The axes of the intermediate bevel gears 29 and 32 are inclined by 45° in relation to the axes of the adjacent bevel gears with whom they are in engagement.

The gimbal suspension of the specimen carrier 1 facilitates its free rotatability also about the axis C—C so that the carrier 1 is able to occupy any desired spatial position.

The orientability and rotatability of the specimen carrier 1, a feature common to both embodiments of the invention, offers not only the advantage of simplified cooling or heating, but also the possibility of moving the specimen for example, alternately over two evaporating dishes.

Further embodiments of the invention are possible within the scope of the invention, such as for example, a variant wherein the specimen carrier is inserted in a ring so as to leave its center free to receive the specimen, a feature that may prove advantageous in many instances. The scope of the invention also extends to embodiments wherein the driving mechanism for the device is located inside the treatment chamber, a special motor being provided, if necessary, for each individual drive of the specimen carrier.

We claim:

1. A device for adjusting the spatial position of a specimen carrier, comprising a housing enclosing a treatment chamber, the said specimen carrier being located inside the said treatment chamber, freely rotatable about two axes arranged in perpendicular relation to each other, a first driving shaft for the rotation of the specimen carrier about one of the said axes of rotation, a second driving shaft designed as a tubular shaft and surrounding the said first driving shaft in concentric relation and serving for the rotation of the specimen carrier about the second of said axes, both driving shafts being freely rotatable independently of each other, said tubular shaft being axially slidable, and said specimen carrier being orientable about a third axis arranged in perpendicular relation to the said two axes of rotation of the specimen carrier.

2. A device as claimed in claim 1, wherein the said two driving shafts extend through the wall of the said treatment chamber.

3. A device as claimed in claim 1, wherein the said specimen carrier is located at the intersection of the said two axes of rotation.

4. A device as claimed in claim 1, comprising a cooling body inside the treatment chamber, and means to move said specimen carrier into operative association with said cooling body.

5. A device as claimed in claim 1, featuring relative coaxial displaceability of the said two driving shafts and comprising means for deriving the swivelling motion of

5

the specimen carrier about the said third axis from the relative displacement of the said two driving shafts.

6. A device as claimed in claim 1, comprising a third driving shaft of tubular design and freely rotatable in a coaxial position inside the first-mentioned tubular shaft, and means for deriving the swivelling motion of the specimen carrier about the said third axis from this relative rotation of the said tubular driving shaft in relation to the first-mentioned tubular shaft.

7. A device as claimed in claim 6, comprising two U-shaped bows encompassing each other, the legs of the said bows having gear means attached thereto, the said bows being rotatably interconnected by means of the said gear means, the said specimen carrier having a shaft rotatably mounted on the crosspiece of the inner bow, the outer bow being attached to the inner extremity of the first-mentioned tubular shaft.

8. A device as claimed in claim 7, wherein the said shaft of the specimen carrier is positively connected with the said first driving shaft by means of a bevel gearing comprising a bevel gear at the free extremity of the said shaft of the specimen carrier, a bevel gear at the inner extremity of the said first driving shaft, a pair of bevel gears non-rotatably interconnected and rotatably mounted on one of the said legs of the U-shaped bows in coaxial relation to the third axis of rotation of the specimen carrier, an intermediate bevel gear rotatably mounted on the said outer bow and engaging both with the said bevel gear

6

at the inner extremity of the first driving shaft and with one bevel gear of the said pair of bevel gears, an additional intermediate bevel gear rotatably mounted on the said inner bow and engaging both with the said bevel gear at the free extremity of the shaft of the specimen carrier and with the other bevel gear of the said pair of bevel gears.

9. A device as claimed in claim 7, comprising a bevel gear non-rotatably connected with the said inner bow, another bevel gear at the inner extremity of the said third driving shaft and an intermediate bevel gear rotatably mounted on the said inner bow and engaging both with the said bevel gear non-rotatably connected with the inner bow and with the said bevel gear at the inner extremity of the third driving shaft.

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