May 21, 1968 C. E. ROCHA-MIRANDA ETAL 3,384,086

STEREOTAXIC ORIENTED MACROTOME DEVICE

Filed Jan. 10, 1966 2 Sheets-Sheet 1

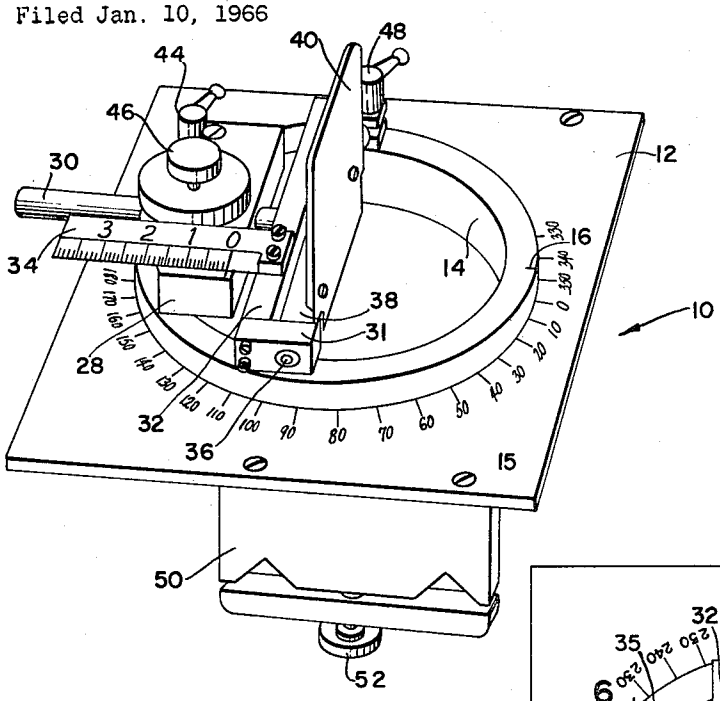

FIG. 1.

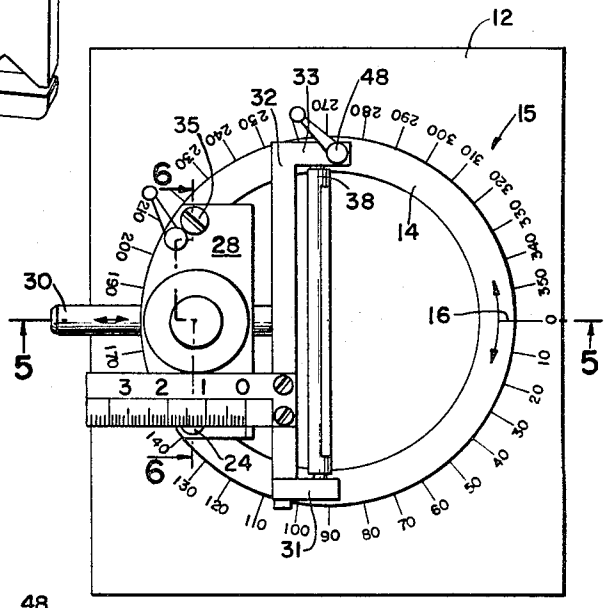

FIG. 2.

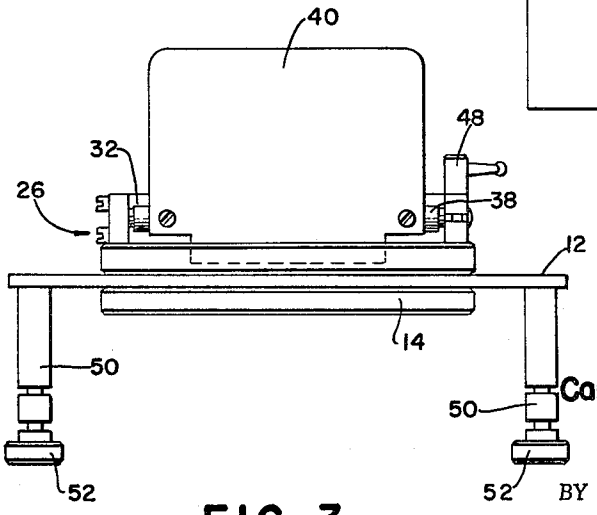

FIG. 3.

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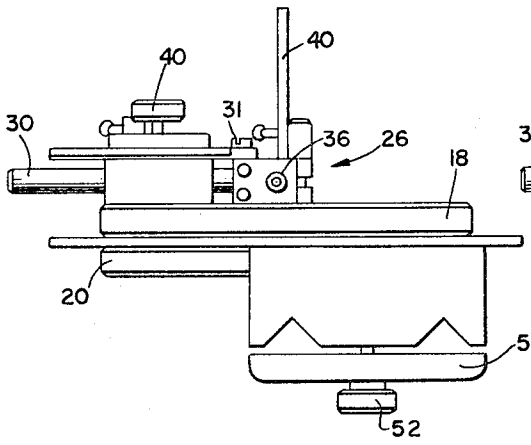

FIG. 4.

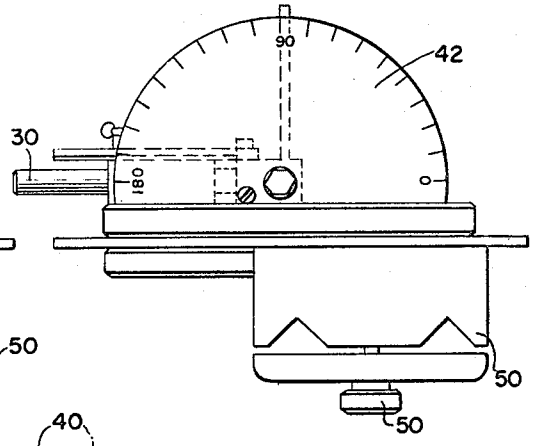

FIG. 4A.

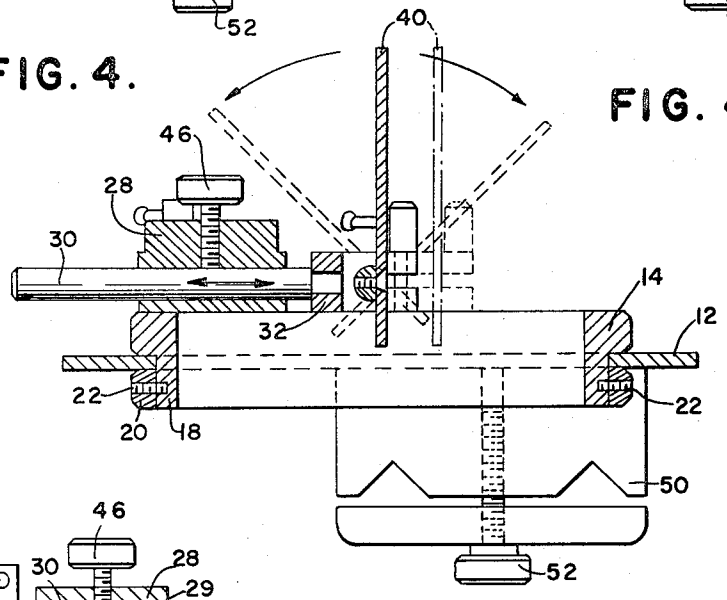

FIG. 5.

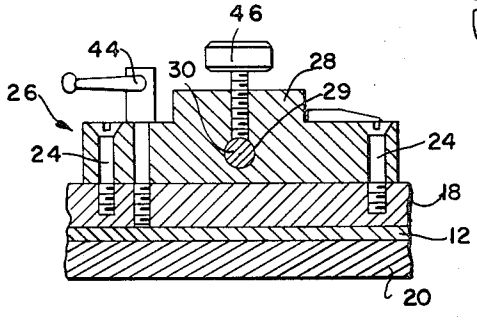

FIG. 6.

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STEREOTAXIC ORIENTED MACROTOME DEVICE

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The present invention relates to a stereotaxic oriented macrotome device and, more particularly, to a device for orienting the brain in stereotaxic rectangular and polar coordinates so as to permit the taking of histological brain sections along desired planes.

Stereotaxic devices are known in the art. Among these the Horsley-Clarke stereotaxic instrument receives wide usage in the field. In addition, a number of instruments, particularly in recent years, has been developed to aid in the accurate exercise of surgical stereotaxic brain operations. Among these are the devices shown in the patents to Heyer 3,017,887; De Dobbeleer 3,061,936; and Mocarski 3,073,310. An early patent showing a similar instrument is the patent to Clarke 1,093,112.

However, up to the present time, no instrument has been developed for taking sections of the brain with respect to coordinate systems presently in use (e.g. Horsley-Clarke frontal or saggital, polar, etc.) for histological purposes. Such devices are needed for anatomical verification of electrophysiologic experiments.

It is therefore an object of the present invention to provide a macrotome device for orienting the brain in stereotaxic rectangular and polar coordinates for the taking of histological brain sections.

It is another object of the present invention to orient the brain in stereotaxic coordinates.

It is another object of the present invention to provide a macrotome device which may be directly attached to a known stereotaxic device for the taking of histological brain sections.

These and other objects and the nature and advantages of the present invention will be more apparent from the following detailed description taken in conjunction with the drawing, wherein:

FIG. 1 is a perspective view of a device in accordance with the present invention;

FIG. 2 is a top plan view of the device of FIG. 1;

FIG. 3 is a side elevation of the device of FIG. 1;

FIG. 4 is a front elevation of the device of FIG. 1; and FIG. 4A is another front elevation with an additional element thereon;

FIG. 5 is a section taken along line 5—5 of FIG. 2; and

FIG. 6 is a section taken along line 6—6 of FIG. 2.

The macrotome device of the present invention, shown generally at 10, provides accurate and reproducible histological sections oriented with reference to stereotaxic coordinates for the histological examination of brain sections for plotting electrode tracks, reference marks or other manipulations. The macrotome device 10 permits the blocking of the brain at either of two orthogonal stereotaxic planes (coronal or saggital) or any angular deviations thereof when the animal's head is positioned in a stereotaxic apparatus of the type known in the art. The macrotome device 10 has an access of rotation of the sectioning plane passing through the point of intersection of the three orthogonal planes. It can thus also be used in conjunction with Ellsworth's polar orientation, after a 6.5 mm. displacement.

The macrotome device 10 comprises a base plate 12 of generally rectangular shape and a rotatable annular ring 14 mounted in the center thereof. The ring 14 and

the base plate 12 define a circular opening therethrough which is used to reach the brain for cutting the histological sections therefrom. Suitable indicia 15 are provided on the upper surface of the plate 12 about the periphery of the circular opening and adjacent the annular ring 14 to indicate the annular displacement of the ring 14 in degrees as such ring 14 is caused to rotate with respect to the plate 12. A corresponding score mark 16 is provided on a ring 14 for such purpose.

The annular ring 14 is provided with a generally U-shaped cross-section (note FIG. 5) and comprises a first annular L-shaped element 18 with a second annular element 20 mounted thereon by suitable attaching means, such as bolts 22. The annular U-shaped groove of the ring 14 mates with the inner periphery of the base plate 12 defining the circular opening. If desired, the annular U-shaped groove of the annular ring 14 may be provided with a bearing surface or may be suitably lubricated to inhibit binding with the plate 12 so that the ring 14 may freely rotate about the circular opening. As is clear, the rotation of the ring 14 with respect to the plate 12 provides the first degree of adjustment for providing the desired orientation of the macrotome.

Mounted on the ring 14 by suitable attaching means, such as bolts 24, is a movable carriage 26. The carriage 26 is supported on a first member 28 which is rigidly anchored to the ring 14 by the bolts 24. The rigidly attached member 28 is provided with a bore 29 extending therethrough which bore 29 is parallel to the plane of the plate 12. Slidably passing through the bore 29 of the first member 28 is a rod 30. Rigidly attached to the rod 30 and disposed in a direction over the circular opening within the annular ring 14 is a second carriage member 32 of generally U-shape having leg portions 31 and 33.

The second carriage member 32 of the carriage 26 is rigidly connected to the rod 30 and slides therewith as the latter moves through the bore 29 of the first member 28. This movement, shown in phantom in FIG. 5, permits the position of the second member 32 to be changed over the circular opening. This permits the second degree of adjustment to provide the desired orientation. In order to provide proper support to the second member 32 and to prevent is rotation about the axis of the bore 29, the second carriage member 32 is constructed to ride or slide upon the top surface of the annular ring 14. However, it will be understood that the bore 29 through the first member 28 and the corresponding rod 30 may take a shape other than the cylindrical shape shown, and this will accomplish the same result.

Rigidly attached to the second member 32 is a suitable linear measuring device 34 having suitable indicia thereon for determining the linear displacement of the second carriage member 32 from the first member 28. It will be understood, of course, that the linear scale 34 could be attached to the first member 28, if desired, although the arrangement illustrated is preferred. Similarly, the rod 30 could be rigidly attached to the first member 28 and the bore 29 could be provided through the second member 32, although the illustrated embodiment is preferred.

The second carriage U-shaped member 32 is provided with a pair of facing circular bores 36 passing through the legs 31 and 32 thereof. Rotatably supported in the bores 36 is a third carriage member 38. Rigidly attached to the third carriage member 38 is a sectioning plate 40 which is used as a guiding plane for a suitable sectioning blade of a microtome. The third degree of adjustment of the macrotome is provided by rotation of the carriage member 38 within the bores 36 as shown in phantom in FIG. 5. The position of the sectioning plate 40 can be adjusted in inclination or tilt approximately 50° in either direction from the vertical plane. To measure the degree of rotation

of the third carriage member 38, protractor 42 (note FIG. 4A) may be rigidly bolted to the second member 32.

The macrotome device 10 also preferably contains suitable means for locking each of the elements in position after they have been arranged for the desired orientation. Thus, a set screw 44, best shown in FIG. 6, is provided on the first member 28 to lock the ring 14 in position on the plate 12 and prevent its rotation thereon. Similarly, a set screw 46, best seen in FIGS. 5 and 6, is provided on the first member 28 to prevent the rod 30 from sliding within the bore of the first member 28. Lastly, a set screw 48 is provided on the leg 33 of the U-shaped second member 32 to inhibit the rotation of the third member 38 within the bores 36 of such second member 32.

On the underside of the base plate 12 is provided a pair of support elements 50. These support elements 50 may take any form, but the preferred form is the double ear bar locking members illustrated which are controlled by suitable set screws 52.

The macrotome device 10 may be used in the following manner: A wide craniotomy is performed with the animal in a stereotaxic instrument, followng brain perfusion. The macrotome device 10 is then attached via the ear bar attaching means 50 to the ear bars of the stereotaxic instrument. The plane of sectioning is then adjusted by rotating the annular ring 14 to the desired position, tightening the set screw 44; sliding the second member 32 to the desired position, tightening the set screw 46; and tilting the sectioning plate 40 and tightening the set screw 48. The brain is then sliced to obtain the desired block using a suitable microtome blade, such as a Stadie microtome blade (Arthur H. Thomas Co., No. 7120–D), the face of the sectioning plate 40 acting as a guide. The histological blocks thus prepared has their faces at the desired orientation and position in respect to the coordinate system in use (e.g. Horsley-Clarke frontal or saggital, polar, etc.).

When mounting the histological block in a microtome, one of the faces is used as a base, the block holder being adjusted for for parallelism between the blade and the upper face.

The present system provides a high degree of accuracy in orienting the plane of section, whole electrode tracks or reference needles being present in a few sections. Cutting in Dry Ice has frequently yielded sections with deviations of no more than a fraction of degree from the desired plane.

The macrotome device of the present invention is useful for accurate cutting along various predetermined ordinates. Such a procedure is needed for anatomical verification of electrophysiologic experiments. It can be used as an adjunct to a Horsley-Clarke stereotaxic instrument or it may be used with other stereotaxic instruments.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification, but only as indicated in the appended claims.

What is claimed is:

1. A macrotome device for orienting the brain in stereotaxic rectangular and polar coordinates for the taking of histological brain sections comprising: a base plate; means on said base plate to connect said macrotome device to a stereotaxic apparatus; an annular ring rotatably supported on said base plate, said base plate and said ring defining a generally circular opening therethrough; carriage means supported by said annular ring for movement along a line parallel to said base plate and said carriage means carrying a sectioning plate for rotation about an axis both parallel to said base plate and perpendicular to said line of movement, said sectioning plate adapted for mounting and guiding a microtome blade.

2. A device in accordance with claim 1 wherein: said base plate is rectangular and is provided on the upper surface with indicia about the periphery of said hole adjacent said annular ring; said macrotome device connecting means comprise a pair of double ear bar clamps extending downwardly from the bottom surface of said plate; said ring projects upwardly above said plate; the support for said carriage comprises a first member rigidly mounted on said ring, said carriage comprises a second member slidably engaged with said first member for effecting said movement along a line parallel to said base plate, and a third member rotatably supported by said second member for said rotation about said axis, said sectioning plate being rigidly mounted on said third member.

3. A device in accordance with claim 2, further comprising a first locking means on said ring to maintain said ring in a desired position on said plate, a second locking means on said carriage support to maintain said first and second members at a desired distance from one another, and a third locking means on said second member to maintain said sectioning plate in a desired position on said carriage.

4. A device in accordance with claim 3, further comprising a linear scale attached to one of said first and second members to measure the distance therebetween.

5. A device in accordance with claim 4, further comprising a protractor mounted on said second member to measure the angle of inclination of said sectioning plate.

6. A device in accordance with claim 2, further comprising a linear scale attached to one of said first and second members to measure the distance therebetween.

7. A device in accordance with claim 6, further comprising a protractor mounted on said second member to measure the angle of inclination of said sectioning plate.

8. A device in accordance with claim 2, further comprising a protractor mounted on said second member to measure the angle of inclination of said sectioning plate.

9. A device in accordance with claim 3, further comprising a protractor mounted on said second member to measure the angle of inclination of said sectioning plate.

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LAWRENCE W. TRAPP, *Primary Examiner.*