Aug. 12, 1969 D. C. ZEIS 3,460,537

STEREOTACTIC GUIDE FOR USE IN THE CREATION OF DESTRUCTIVE BRAIN LESIONS

Filed Sept. 26, 1966 2 Sheets-Sheet 1

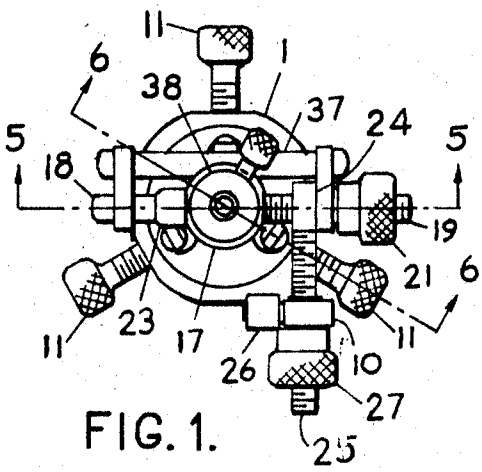


FIG. 1.

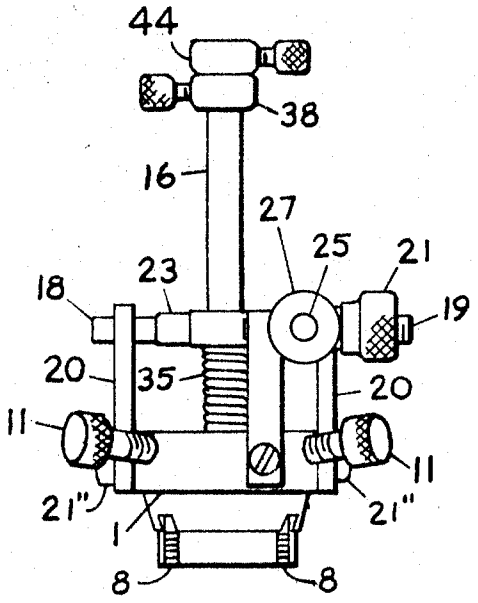


FIG. 2.

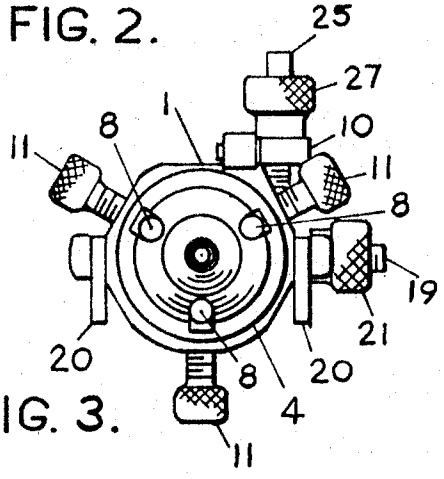


FIG. 3.

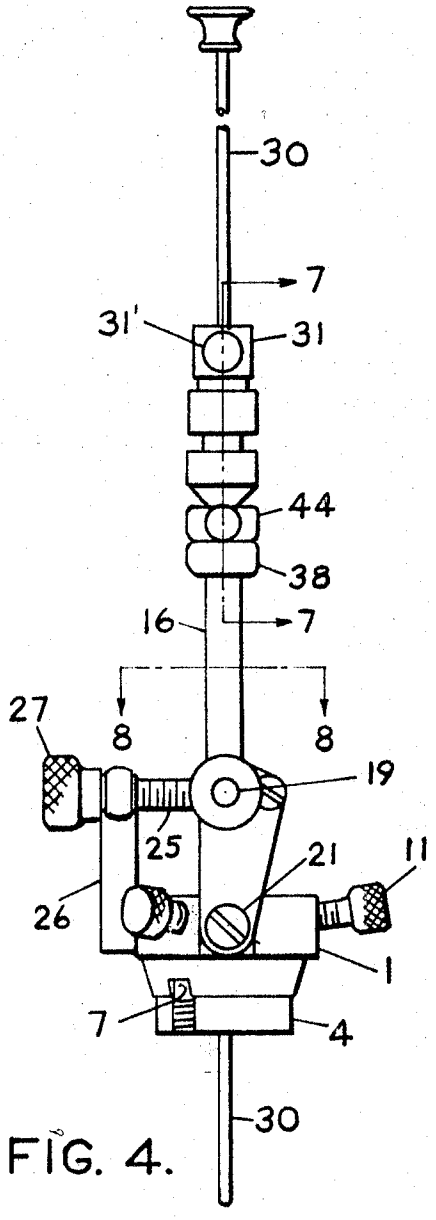


FIG. 4.

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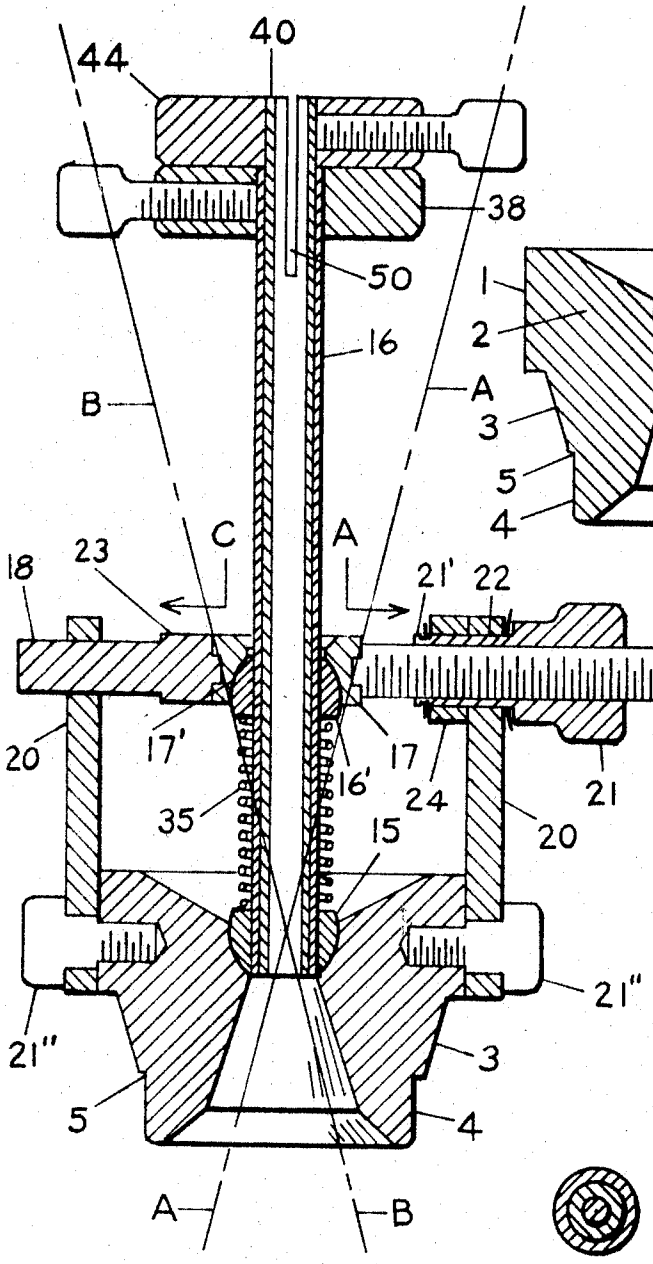


FIG. 5.

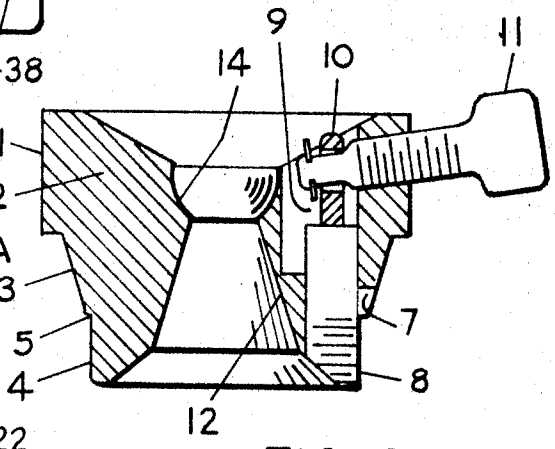


FIG. 6.

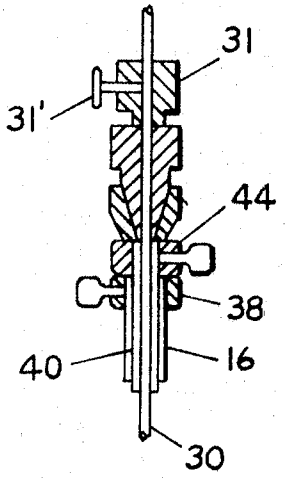


FIG. 7.

FIG. 8.

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STEREOTACTIC GUIDE FOR USE IN THE CREATION OF DESTRUCTIVE BRAIN LESIONS

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U.S. Cl. 128—303 3 Claims

ABSTRACT OF THE DISCLOSURE

The present invention comprises attaching means for firmly and rigidly attaching a cannula guide used in the cryosurgical treatment of various diseases centered in the brain of a patient which includes means for insertion into the trephine or hole cut in the cranium or skull and anchoring means for securely locking the attaching means to the skull in such a manner as to prevent possible independent movement of the skull and attaching elements, together with means to limit the insertion of the attaching element into the trephine.

This invention relates to a stereotactic guide for holding and adjusting a cannula with maximum accuracy and a positive finite degree, for use by surgeons in the cryosurgical treatment of Parkinson's disease, deep seated brain tumors, hyperkinetic disorders and other maladies of the human brain, in which an accurately placed destructive cryosurgical lesion is desired in the form of treatment.

The present invention comprises a cannula holder and guide for the purpose specified, which is small, compact, is easy to sterilize and store when not in use, one which is a single compact structure embodying no parts which must be removed for storage or added when applying it to a patient.

The stereotactic guide for cannulas is so designed and constructed that it may be attached directly to the skull of a patient without any accessory devices and embodies means to rigidly hold the guide in place on the patient's skull, whereby movement of the patient's head or body will not affect the positioning of the cannula.

Further the stereotatic guide embodies means whereby when the cannula is in position in and anchored to the guide, the cannula may be moved in conjunction with its holding element in controlled micromatic movement in a substantially longitudinal plane through an arc of three hundred and sixty degrees (360°) to provide substantially infinite positioning of the brain treating end of the cannula within such range and also provides means for firmly locking the cannula in such position, while permitting limited longitudinal movement of the cannula.

In the drawings:

FIGURE 1 is a top plan view of the stereotactic guide.

FIGURE 2 is a side elevation of the stereotactic guide.

FIGURE 3 is a bottom plan view of the guide.

FIGURE 4 is a side elevation of the stereotactic guide taken at right angles to the view shown in FIGURE 2 and showing a cannula in place in the guide.

FIGURE 5 is a fragmentary vertical section through the guide taken on the line 5—5 of FIGURE 1.

FIGURE 6 is a detail vertical section through the attaching element of the ring and taken on the line 6—6 of FIGURE 1.

FIGURE 7 is a fragmentary longitudinal section taken on line 7—7 of FIGURE 4.

FIGURE 8 is a cross section taken on line 8—8 of FIGURE 4.

In cryosurgical treatment of Parkinson's disease, deep seated brain tumors, hyperkinetic disorders and other maladies of the human brain the seat or source of the ailment in the brain is destroyed or treated by a cryosurgical lesion created by the use of a cannula inserted into the brain to the exact point of the seat or source of the malady and it is necessary that no other part of the brain be affected by the lesion, therefore extreme accuracy and positive minimum of movement of the cannula is necessary. With the apparatus in use today by surgeons performing such operations any movement of the head of the patient may prove fatal to him, and consequently expensive complicated apparatus is required, which is also very difficult to sterilize.

The stereotactic guide for cannulas is so designed and is rigidly attached to the skull of the patient and is moveable as a whole with any movement of the head of the patient, thereby eliminating liability of a damaging accident due to movement of the patient's head or body.

To permit rigid attachment of the guide to a patient's head the guide embodies an attaching element **1** which includes the main body **2** having a tapered ring **3** depending therefrom. An inserting ring or collar **4** is formed on the outer end of the tapered ring **3**. The inserting ring **4** is of a width equal to the thickness of a human skull. The ring or collar **4** is inserted in a skull trephination of such size and shape that the outer surface or wall of the collar **4** will fit fairly snugly therein, and the collar **4** terminates, at its junction with the ring **3**, in a shoulder **5** which forms a stop for limiting the insertion of the ring **4** into the patient's skull.

Anchoring means are provided for firmly anchoring the attaching element to the patient's skull in such manner as to prohibit possible independent movement of the skull and attaching element, and since the entire stereotactic guide is rigidly carried by the attaching element (as hereinafter described) any movement, as a whole, of the guide relative to the head of the patient will be prevented and vice versa.

One such anchoring means is shown in FIGURE 6 of the drawings, and while the structure shown has been found satisfactory in actual use, it is to be understood that this invention is not to be limited to the specific anchoring means shown and hereafter described except only as limited by the claims hereof.

The attaching element **1** has a plurality of openings **7** therein, located at circumferentially spaced points about its vertical axis which openings **7** open out through the ring **3** and collar **4** at their outer sides. Skull gripping pins **8** are inserted in the openings **7** and extend up into the enlarged portions **9** of the openings **7**, wherein the upper diameter-reduced portions **10** of the pins **8** are engaged by the adjusting screws **11**. The adjusting screws **11** are threaded in the attaching element **1** and threaded movement of the screws **11** move the pins **8** on fulcrums at the point of contact of the pins **8** with the walls of the openings **7** at the upper terminus of the portions of the openings **7** which open out through the outer walls of the tapered rings **3**. The pins **8** extend upwardly into the openings at a slight angle to the vertical while the adjusting screws are inclined at a slight angle to the horizontal, thus when the adjusting screws are threaded

inwardly the lower ends of the pins 8 will be moved outwardly for engagement, through the openings in the inserting ring or collar 4 with the wall of the opening in the skull of the patient. The surfaces of the pins 8 which engage the wall of the skull opening are roughened as by threading, knurling or in any other suitable manner to firmly grip the walls of the skull opening and prevent any movement whatever of the attaching element relative to the patient's head.

The body 2 of the attaching element 1 has an axial bore 12 intermediate the ends of which is formed a seat 14, the walls of which are curved to form a seat for the ball 15 which is formed on the lower end of the cannula guiding and holding tube 16. The bore 12 tapers outwardly as it extends upwardly from and downwardly from the seat 14 as clearly shown in FIGURE 6 of the drawings.

The tube 16 slidably passes through a ball 16' which engages in a seat 17' formed in the collar 17. A spring 35 is mounted upon the tube 16 and its ends engage the balls 15 and 16' to spring load these balls and maintain them in their seats, thereby eliminating any misalignment. This structure will also compensate for the slight variation in the radial arc links generated in the movement of the tube 16 during positioning of a cannula as will be hereinafter described. This manner of mounting of the tube 16 will also eliminate any play in its movement, which might affect adversely the positioning of a cannula.

The trunnions 18 and 19 are slidably supported by brackets 20 which are pivotally attached to the attaching element 1 such as by screws 21'', or in any other suitable manner.

The trunnion 19 is threaded and has a thumb nut 21 threaded upon its outer end. The hub 22 of the nut 21 engages the bracket 20 so that when the nut 21 is rotated the trunnion will be moved longitudinally in either direction depending upon the direction of rotation of the nut 21. At the time of longitudinal movement of the trunnion 19 the trunnion 18 will also move longitudinally, sliding in its bearing in the bracket 20, and thus the tube 16 will be moved on, its pivot point formed by the ball 15 in the socket 14, in paths such as indicated by the dot and dash lines A and B in FIGURE 5 of the drawings. A shoulder 23 is formed upon the trunnion 18 and provides a stop for the pivotal movement of the tube 16 in its direction indicated by arrow C by its contact with the bracket 20.

The hub 21' of the nut 21 extends through the bracket 20 and its inner end forms a stop for limiting the pivotal or swinging movement in the direction indicated by the arrow A. These stops are necessary as to prevent a cannula carried by the tube 16 (see FIGURE 4 of the drawings) from engaging the walls of the tapered opening 12, because the cannula is a very delicate instrument and such contact might injure it.

A collar 24 is mounted on the hub 21' adjacent to the bracket 20 and it has a threaded stem 25 attached thereto and extending substantially at right angles to the trunnion 19. The outer end of the threaded stem 25 is supported by a bracket 26 attached to and extending upwardly from the attaching element 1. A nut 27 is mounted on the stem 25 and engages the bracket 26 so that when the nut 27 is rotated the trunnions 18 and 19 will move longitudinally and consequently the tube 16 will be moved upon the pivots provided by the screws 21' in a path at right angles to the path of movement provided by rotation of the nut 21. Any suitable stops (not shown) may be provided to limit the movement of the tube 16 by the stem 25 and nut 27. Thus by rotation of the nuts 21 and 27 a cannula indicated at 30 in FIGURE 4 of the drawings may be moved in small increments provided by alternate rotation of the nuts 21 and 27 into infinite positions within the 360 degree radius permitted by the ball 15 and socket 14 and confined by the walls of the tapered opening 12 in the attaching element 1.

The cannula 30 which forms no part of this invention has a stop collar 31 mounted thereon which carries a locking screw 31', so that a surgeon may tighten the stop collar at the desired position on the cannula to insure the proper length of the portion of the cannula which projects beyond the collar 4.

A steadying or bracing rod 37 is carried by the brackets 20 and engages the collar 17 as clearly shown in FIGURE 1 of the drawings, to prevent rotation or rocking of the collar 17 and the trunnions 18 and 19 while the nut 21 or 27 is being rotated or adjusted.

Cannula are made in different diameters, and to compensate for slight variances in the dameter of one cannula from another, the upper end of the sleeve 16 is split as shown at 50 in FIGURE 5 for a short distance inwardly from its end and a clamping collar 38 is mounted thereon by means of which the split end of the sleeve 16 may be pinched into tight clamping engagement with a cannula.

For the purpose of permitting use of cannulas of small diameter, a sleeve 40 is provided which slides into the sleeve 16 when needed and which is tightly clamped in the sleeve 16 by the clamping nut 38. The sleeve 40 is also split for a short distance inwardly from its receiving end and has a clamping nut 44 thereon to clamp a cannula tightly in position in the sleeve 40.

The threads on the trunnion 19, stem 25, and nuts 21 and 27 provide micrometer adjustment of the angles of the position of the sleeve 16 and by knowledge of this and the degree of movement provided by each turn or partial turn of the nuts 21 and 27, a surgeon may in conjunction with X-ray place the cannula in the exact spot to treat the affected part of a human brain, without liability of slippage or mispositioning of the cannula.

While various specific structures to provide the desired degrees of adjustment, locking of elements in position, etc. are shown and described herein, it is to be understood that the invention is not limited to the structure shown and described, but may be varied as practice may dictate without departing from the invention, so long as such structures are embraced in the claims hereto appended.

What is claimed is:

1. In a stereotacetic guide for use in cryosurgical treatment of a brain, an attaching element for direct attachment to the skull of a patient, a cannula carrying guide carried by said attaching element and means supported from said attaching element to provide substantially infinite adjusted positioning of a cannula carried by the guide, a collar formed on said attaching element for fitting in an opening in a skull, and means on said collar to limit the degree of insertion of the collar into the opening in the skull, means carried by the attaching element for projection beyond the circumference of said collar to grip the walls of a skull opening, and means for moving said gripping means into and out of gripping position.

2. In a stereotactic guide, as claimed in claim 1, wherein said attaching element has an axial bore extending therethrough with an intermediate portion shaped to form a concave curved seat, a ball formed on the lower end of said cannula guide and seated in the seat formed in the attaching element, the portion of the bore extending outwardly from said seat being tapered to form substantially a conical space opening out through the lower end of the attaching element.

3. In a stereotactic guide for use in cryosurgical treatment of a brain, an attaching element for direct attachment to the skull of a patient, a cannula carrying guide carried by said attaching element and means supported from said attaching element to provide substantially infinite adjusted positioning of a cannula carried by the guide, said attaching element has an axial bore extending therethrough with an intermediate portion shaped to form a concave curved seat, a ball formed of the lower end of said cannula guide and seated in the seat formed in the attaching element, the portion of the bore extending out-

wardly from said seat being tapered to form substantially a conical space opening out through the lower end of the attachment element the outer surface of said attaching element being smooth for sliding into the opening in a skull, and means carried by said attaching element for projection beyond its outer smooth surface for gripping the wall of the skull at separated points about the wall of the opening, and means for moving said skull walled gripping means into and out of gripping position.

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