

April 28, 1970

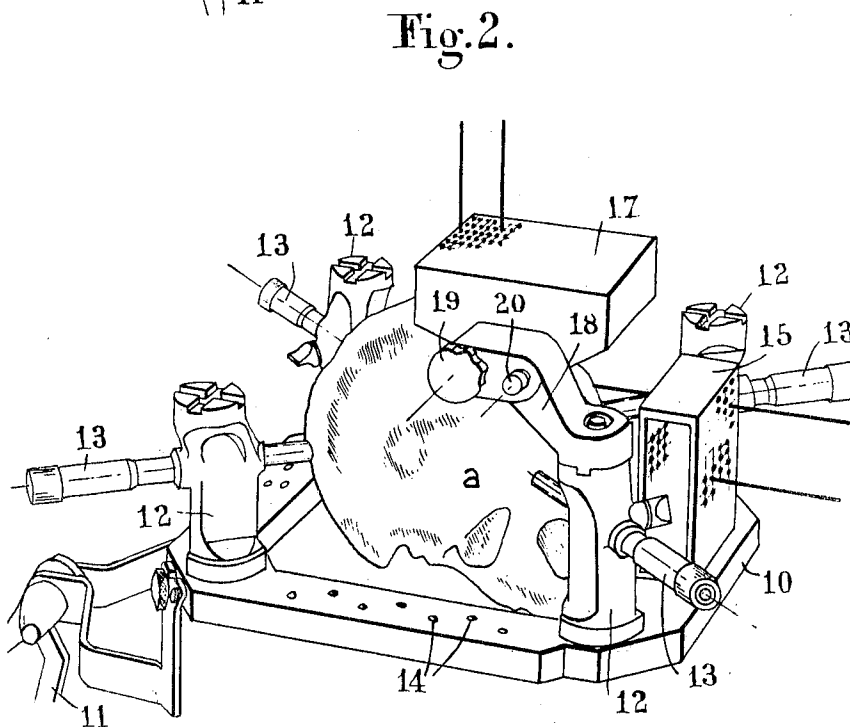
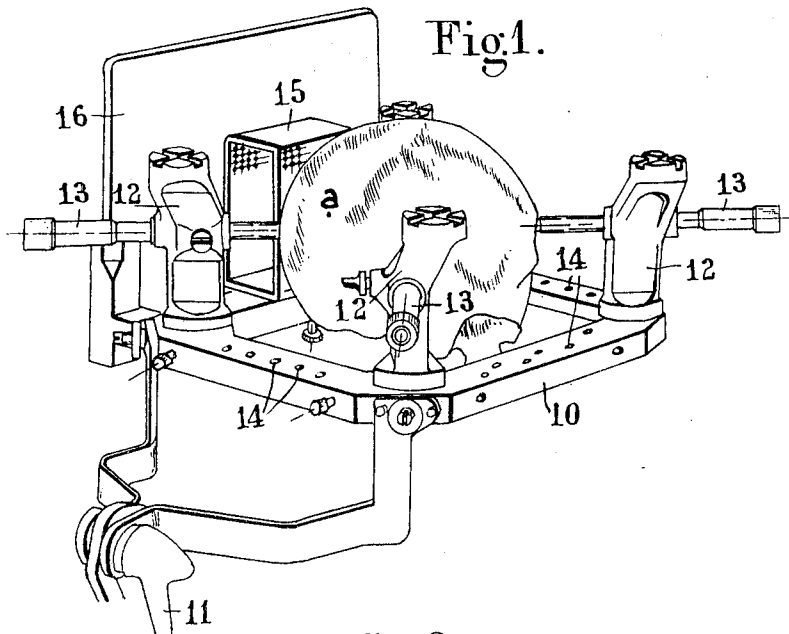
M. HAINAULT

3,508,552

APPARATUS FOR STEREOTAXIC NEUROSURGERY

Filed Oct. 23, 1965

3 Sheets-Sheet 1



3,508,552

3 Sheets-Sheet 2

Fig. 3.

A perspective view of a mechanical assembly. The assembly consists of a base plate (14) with several mounting holes. A central vertical support (12) holds a rectangular block (15a) which has a grid pattern on its front face. To the left, a horizontal rod (13) passes through a bracket (12) and is secured with a nut (10). A cylindrical component (21) is connected to the left side of the base. On the right, another bracket (12) is mounted on the base, also secured with a nut (13). A large rectangular block (17) is positioned on top of the central support, with a grid pattern on its top surface. A thin rod (20) is inserted into a hole in this block. A small circular feature (19) is visible on the side of the central support. The letter 'a' is marked on the side of the central support.

April 28, 1970

M. HAINAULT

3,508,552

APPARATUS FOR STEREOTAXIC NEUROSURGERY

Filed Oct. 23, 1965

3 Sheets-Sheet 3

Fig. 5.

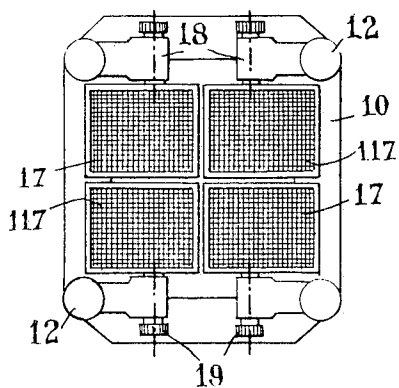


Fig. 6.

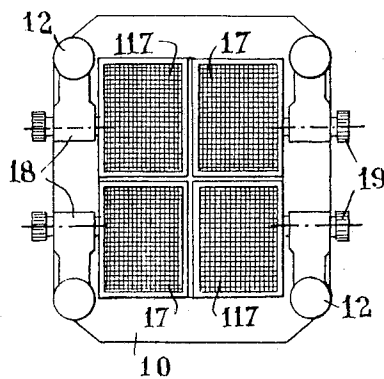


Fig. 7.

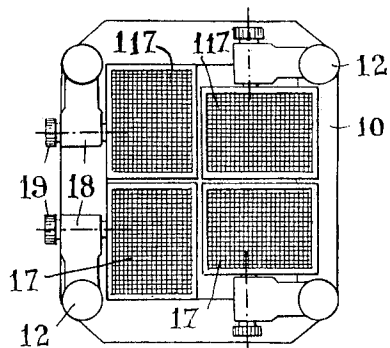
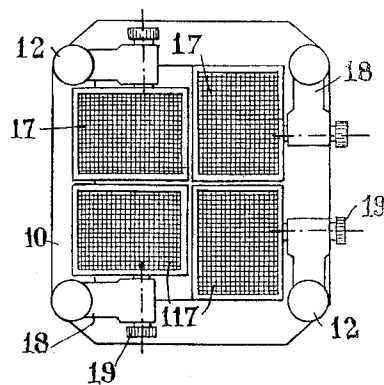


Fig. 8.



1

3,508,552

APPARATUS FOR STEREOTAXIC
NEUROSURGERY

Marcel Hainault, Paris, France, assignor to Alexandre
& Cie, Romainville, Seine, France, a société anonyme
Continuation-in-part of application Ser. No. 222,897,
Sept. 11, 1962. This application Oct. 23, 1965, Ser.
No. 503,678

Claims priority, application France, Oct. 27, 1961,
877,233

Int. Cl. A61m 19/00

U.S. Cl. 128—303

3 Claims

ABSTRACT OF THE DISCLOSURE

This apparatus comprises a rectangular frame provided with means for fastening same to the patient's skull and three double grids each formed with parallel rectilinear passages therethrough, said passages forming a regular square pattern. Two of these double grids acting as double locating grids are secured to two adjacent sides of said frame whereby an X-ray handling performed after having positioned the apparatus on the patient's skull makes it possible to determine, in each locating grid, the specific rectilinear passage leading to the point to be operated. The third grid acting as a guide grid for the operating spindle is mounted adjustable about an axis parallel to one of the frame sides. By using simple means and of the space reserved for the patient's skull it is possible to determine which is the rectilinear passage of the guide double grid which is to receive the operating drift, as well as the depth of penetration of this drift which is necessary for bringing its end at the intersection of two rectilinear passages located in the two location double grids.

This is a continuation-in-part of the U.S. Patent application Ser. No. 222,897, now abandoned.

Apparatus designed for stereotaxic neurosurgery are already known which comprise a frame adapted to be rigidly secured to the head of the patient and at least one reference grid adapted to be mounted on one side of the frame in front of an X-ray receiving plate for obtaining a picture showing simultaneously the image of the interior of the patient's brain and said reference grid, the latter acting in this case as a positioning grid. This picture, on which the point of the patient's brain which is to be operated is designated by the end of a surgical drift, permits of locating in the grid a rectilinear passage leading to this point to be operated. By repeating this operation with the same grid or a similar grid mounted on another side of the frame at right angles to the preceding grid, it will be possible to determine another passage leading to the point to be operated and the intersection of these two passages will locate this point geometrically within the brain. To operate, it is then only sufficient, after removing the X-ray apparatus, to engage the surgical drift in that one of the passages in said grid (becoming then the guide grid) which leads to the point to be operated and to drive this surgical drift to a depth easily measured on the X-ray picture corresponding to the other position of said grid. However, these apparatus, while constituting a substantial improvement over the previous state of the art, are objectionable in that the only choice with which the surgeon is confronted for directing the surgical drift is to utilize, as a guide grid, the grid disposed in one or the other of said two locating positions. Thus, one or the other of the two corresponding directions of the surgical drift is therefore a direction parallel to the general plane of said frame, although the surgeon might deem more desirable to drive the surgical drift in a direction either parallel, or more

2

or less inclined, to the perpendicular to the general plane of said frame.

It is a first object of this invention to provide a stereotaxic neurosurgery apparatus of the general type set forth hereinabove, wherein the surgeon disposes for guiding the surgical drift of a latitude such that he can select a penetration direction in a plane lying at right angles to the general plane of said frame.

It is another object of this invention to provide a stereotaxic neurosurgery apparatus of the general type set forth hereinabove, wherein the conventional grid or grids serve only positioning or locating purposes, and this apparatus comprises in addition at least one guide grid pivotally mounted with an adjustable inclination about a fixed pivot axis underlying the aforesaid frame and parallel to the general plane of said frame.

It is a further object of this invention to provide a stereotaxic neurosurgery apparatus comprising means for determining in a simple yet reliable manner the passage to be selected in the double guide grid for engaging the surgical drift in the direction of the point to be operated as geometrically determined by the passages located in the two positions of said guide double grid, and setting on this drift a stop member adapted to engage said guide double grid to limit the penetration of said surgical drift to the depth corresponding to the position in which its operative end attains the point to be operated in the patient's brain.

It is a complementary object of this invention to provide a stereotaxic neurosurgery apparatus comprising several guide double grids having all their axes of oscillation either parallel to the same two opposite sides of the frame, or parallel the ones to a pair of opposite sides of said frame and the others to the other pair of opposite sides of said frame.

The features and advantages characterizing this invention will appear more completely from the following description given hereinafter by way of example with reference to the accompanying drawing, in which:

FIGURE 1 illustrates the apparatus positioned on the patient's head shown diagrammatically by the contour of the skull, this apparatus being equipped on one side of the frame with a double positioning grid and with an X-ray receiving plate;

FIGURE 2 shows the same apparatus after the positioning in the guide double grid of the passage leading to the point of the brain which is to be operated and after the positioning and securing of the guide double grid above the frame in the operative position of said grid which is desired by the surgeon;

FIGURE 3 is a fragmentary view showing the same apparatus after the mounting of the guide double grid on an adjacent side of the frame, upon completion of the X-ray determination of the passage, in this new position of the guide double grid, leading to the point of the patient's brain which is to be operated;

FIGURE 4 is a fragmentary view showing the same apparatus during the use of auxiliary equipment for locating the passage to be selected in the guide double grid for engaging the operating drift, and also for fitting on this drift a stop member adapted to engage said guide double grid when the operative end of the drift has attained the point to be operated;

FIGURES 5 to 8 are plan views from above showing the apparatus equipped with four guide grids according to four different mounting procedures.

The apparatus comprises a rectangular frame 10 secured to the operation table with an adjustable setting by means of adequate connecting means 11, this frame carrying at its four corners four support means 12 in which adjustable bone clamping rods 13 are mounted, these rods 13 being adapted to secure the patient's skull *a* to said frame 10. Each one of the four sides of said frame 10 has

3

formed therethrough perforations 14 for detachably securing a positioning double grid 15 as shown in FIGURE 1. This double grid 15 comprises two parallel flat walls in which circular holes are formed to constitute a regular chequer-work with the same relative spacing, on the two walls, to constitute pairs of aligned holes having parallel axes. An X-ray equipment is provided for forming on a receiving plate 16, by means of rays adjusted in the direction of said pairs of holes in said double grid 15, a first X-ray picture showing the interior of the skull and the grid. After removing the grid, another picture will show the interior of the skull without the grid, and the point of the skull which is to be operated. Besides, the order in which these two X-ray pictures are taken may be reversed. A simple comparison between the two pictures will permit of determining which one of the rectilinear passages through the grid leads to the point of the patient's brain which is to be operated, as will clearly appear from the passage of the following description which deals with FIGURES 3 and 4 of the drawing.

This apparatus, as shown in FIGURE 2, comprises a guide double grid 17 identical with the positioning or locating grid 15 and provided with an arm 18 on which it is pivotally mounted about an axis parallel to one of the two series of rows of holes of the grid. This arm carries a clamping knob 19 for locking the guide double grid 17 in the desired angular position in relation to the arm 18. The upper ends of said support means 12 are formed with coupling means corresponding to reverse means formed on the relevant end of the arm 18 of said double grid 17, or of another grid which may be either the same or symmetrical thereto, with the knob 19 directed to the outside of frame 10 and the axis of rotation of the double grid 17 extending parallel to one of the sides of said frame. This axis is parallel to the side of frame 10 on which the locating double grid 15 is mounted. The axes of the pairs of coaxial holes of the guide double grid 17 are disposed at spaced intervals along rows extending in parallel, equally spaced planes disposed at right angles to the pivot axis of said double grid 17, and the guide double grid 17 and positioning double grid 15 are so mounted on the frame 10 that these parallel planes are coincident with the planes containing the axes of the pairs of holes of the corresponding rows of said guide double grid 15. The positioning effected by means of the pair of passage holes in the positioning double grid 15 will thus automatically determine the specific row containing the pair of passage holes in the guide double grid 17. The element 20 of arm 18 is a spring-loaded bolt tending to lock the guide double grid 17 in a particularly conventional position, namely in a position parallel to the plane of frame 10.

Then another locating grid 15a identical with grid 15 is mounted on another side of frame 10 adjacent to the first side, as shown in FIGURE 3, and the same procedure as that described hereinabove with reference to FIGURE 1 may be followed. A proper adjustment then permits of taking radiographic pictures in the direction of the rectilinear passages formed through the grid 15a. A first picture will show the interior of the brain and the grid. After removing the grid, a further X-ray picture will show the interior of the patient's brain without the grid and the specific point of the brain which is to be operated. However, the order in which these X-ray pictures are taken may be reversed. A subsequent comparison between the two X-ray pictures will permit of determining which is the rectilinear passage formed through the grid which leads to the brain point to be operated. The grid 15a is subsequently restored as shown in FIGURE 3, or replaced by another one, if desired, for example an identical grid but having thicker walls which can act as a guide grid.

Under these conditions it is possible, as already known, to perform the operation by using said double grid 15a as a guide grid for the surgical drift by inserting this drift to the depth known from the radiographic picture taken

4

facing the double locating grid 15, as already described with reference to FIGURE 1. There is shown by way of example in the drawing a small electromotor 21 of which the rectilinear drill engaging the pair of holes located in the double 15a performs the drilling operation necessary for inserting a surgical drift for example an electrode.

To adhere to the procedure of this invention by engaging the surgical drift through the double guide grid 17, it is necessary to complete the selection of the pair of guide holes to be used for, so far, only the row containing this pair of holes (which was determined from the data obtained by means of the double locating grid 15) is known, as already described with reference to FIGURE 2. To this end, the perpendicular row is determined by using, as shown in FIGURE 4, very simple means comprising a positioning bracket 23 and a gauging stick 22. The positioning bracket 23 has a flat under face bounded by a rectilinear edge 27 and is provided with two studs (not shown in the drawing) whereby said bracket can be secured with its flat under face bearing against the upper face of the guide double grid 17 and with the rectilinear edge of said flat under face along one of the rows of holes of said guide double grid parallel to its axis of oscillation. This positioning bracket 23 extends beyond the side of the frame 10, in an arm 28 having a small flat upper face 29 coplanar with the under flat face of the bracket 23. Said arm 28 is bored to have rectilinear guiding holes 30 having a same axis and crossing perpendicularly the flat upper face 29 of arm 28 and meeting the alignment of the rectilinear edge 27 of the flat underface of the positioning bracket 23. The gauging stick 22 is to be engaged through said rectilinear passage of the double grid 15a that meets the point of the patient's brain to be operated with a part projecting outwardly under the arm 28 of positioning bracket 23. The surgical drift 24 provided with an adjustable stop member 25 is engaged from above through the holes 30 of arm 23 till the lower end of said surgical drift halts at a level beneath the outward projecting part of the gauging stick 22. The surgical drift 24 is left in such a position by adjustable setting of its adjustable stop member 25 bearing on the small upper face 29. The bracket 23 is moved on the upper face of the guide double grid 17, by releasing and re-engaging its knobs, to its use position wherein the lower end to the surgical drift 24 contacts the outward projecting part of the gauging stick 22. The surgical drift 24 is then pulled upwards till its lower end abuts, as shown in FIGURE 4, the outward projecting part of the gauging stick 22 and gauge in said position by setting its adjustable stop member 25 on the small upper face 29. The rectilinear edge of the positioning bracket 23 will thus register with the row of holes parallel to the pivotal axis along which the pair of holes to be used for guiding the drift are positioned. This pair of holes is thus definitely located and it is only necessary to operate by engaging therein the surgical drift 24 provided with the thus adjusted stop member 25 which will automatically stop the movement of translation of the drift when its end has attained the point to be operated.

Of course, the handling of this apparatus may be further facilitated by providing two double locating grids mounted for example on the frame before the operation respectively in the two selected positions where they can be left until the operation is completed and the assembly removed from the apparatus.

Several double guide grids of the type set forth hereinabove may advantageously be used, if desired. More particularly four guide grids comprising a first pair of identical grids and a second pair of grids symmetrical to those of said first pair, may be provided, these grids being mounted separately on the four supports 12. With this set of guide grids comprising two guide grids 17 identical with the guide grid 17 of FIGURES 2 to 4, and two guide grids 117 having symmetrical structure and disposal, it is possible to devise different mountings of

5

the apparatus for example as shown in FIGURES 5 to 8. In the mounting shown in FIGURE 5 all the grids permit of inclining the operating drift in a plane at right angles to the major axis of said frame 10. In the mounting of FIGURE 6, all the double guide grids permit of inclining the operating drift in a plane at right angles to the minor axis of said frame. In the mountings shown in FIGURES 7 and 8, which are symmetrical to each other, the planes of said double guide grids permit of inclining the operating drift in a plane perpendicular to the minor axis of the frame, and the other pair of double guide grids permit of inclining this drift in a plane perpendicular to the major axis of the frame.

Although the present invention has been described in conjunction with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention, as those skilled in the art will readily understand. Such modifications and variations are considered to be within the purview and scope of the invention and appended claims.

What I claim is:

1. An apparatus for treating at least one point of the brain by means of the end of at least one surgical drift, which comprises a rectangular frame, supports carried by said frame at each corner, bone clamping rods extending from each support for securing the frame to the patient's skull, first and second locating double grids each comprising two opposite parallel surfaces formed with circular openings defining parallel rectilinear passages disposed in a regular square pattern, said first and second locating double grids being removably secured respectively to a first side and to a second side perpendicular to said first side, with the rectilinear passages of each double grid extending at right angles to the relevant

6

frame side and disposed to form two series of aligned passages lying in planes parallel to the frame plane, a selected passage of each one of said two locating grids leading to a point of the brain which is to be operated upon, which has previously been located by as X-ray method, an arm mounted on one of said supports extending over the frame, a guide double grid of the same construction as said locating double grids, means pivotally mounting said guide double grid on said arm for rotation about an axis parallel to said frame, and means for locking said guide double grid in a desired position of angular adjustment.

2. The structure of claim 1 wherein a plurality of arms are mounted on a plurality of supports and a pivotally mounted guide double grid is carried by each arm.

3. The structure of claim 1 wherein adjustable stop means are provided cooperating with said guide double grid for limiting the insertion of a surgical drift.

References Cited

UNITED STATES PATENTS

581,540	4/1897	Dennis	128—92
1,129,333	2/1915	Clarke	128—2
3,061,936	11/1962	Dobbeleer	33—174
3,223,087	12/1965	Vladyka et al.	128—303 X

FOREIGN PATENTS

1,282,623	12/1961	France.
-----------	---------	---------

DALTON L. TRULUCK, Primary Examiner

U.S. Cl. X.R.

33—174; 128—2