Dec. 14, 1965 V. VLADYKA ETAL 3,223,087

STEREOTAXIC DEVICE

Filed June 15, 1961 3 Sheets-Sheet 1

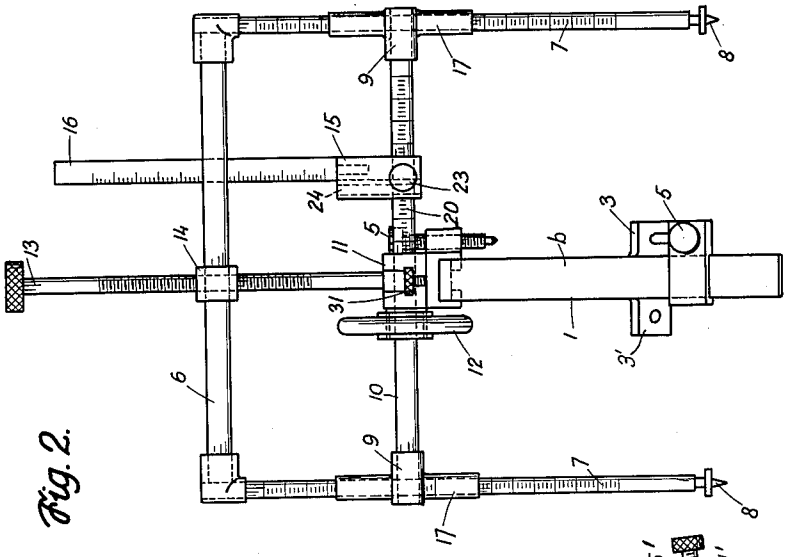


Fig. 2.

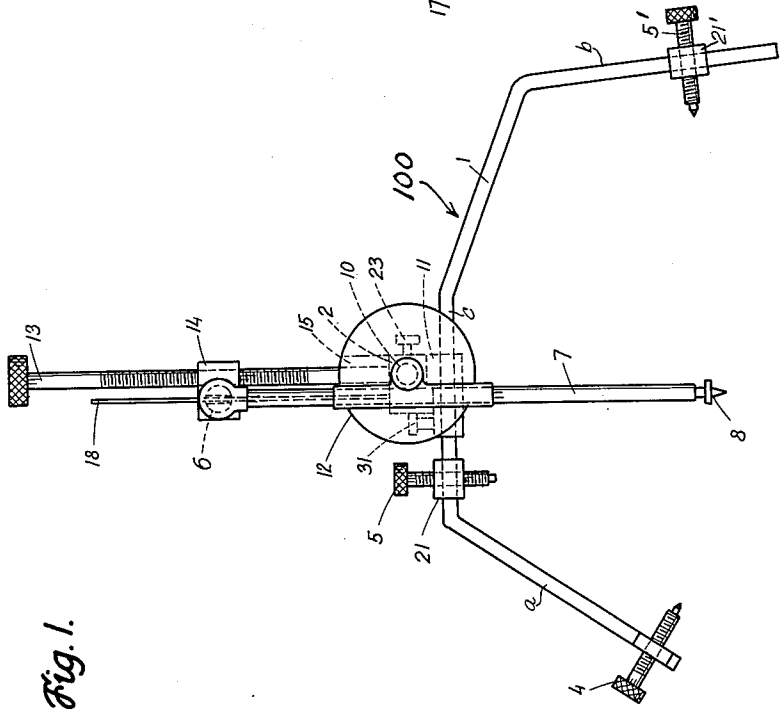


Fig. 1.

INVENTORS

Vilibald Vladyka and Pavel Ježek

BY

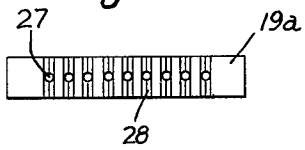
Atty's

Dec. 14, 1965 V. VLADYKA ETAL 3,223,087

STEREOTAXIC DEVICE

Filed June 15, 1961 3 Sheets-Sheet 2

Fig. 3.



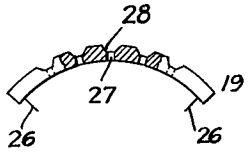
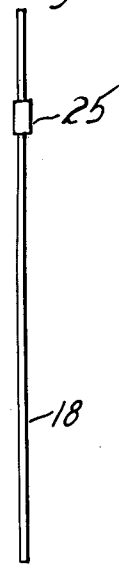


Fig. 4.

Fig. 7.



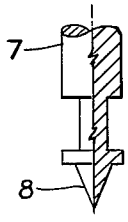


Fig. 8.

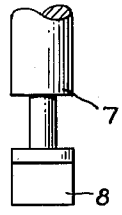


Fig. 9.

INVENTORS

Vilibald Vladyka and Pavel Ježek

BY Paul + V Smolka

ATTORNEY

Dec. 14, 1965 V. VLADYKA ETAL 3,223,087

STEREOTAXIC DEVICE

Filed June 15, 1961 3 Sheets-Sheet 3

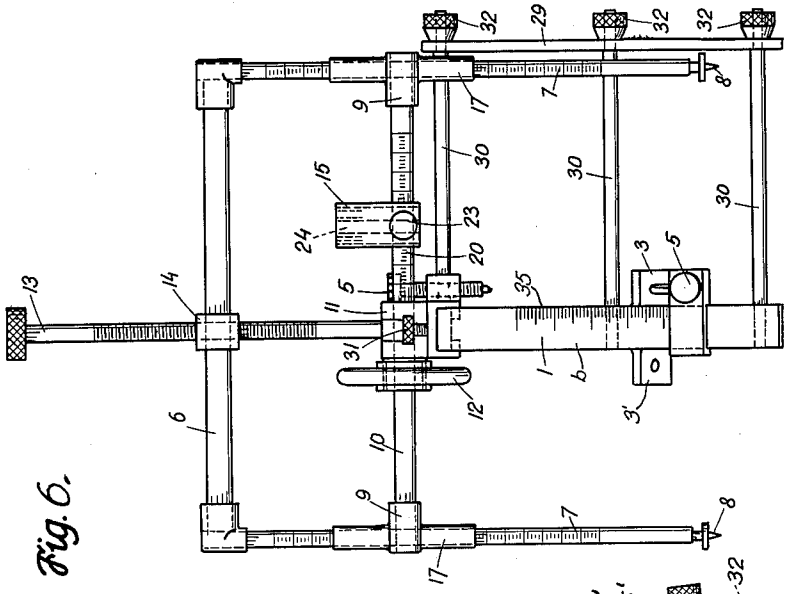


Fig. 6.

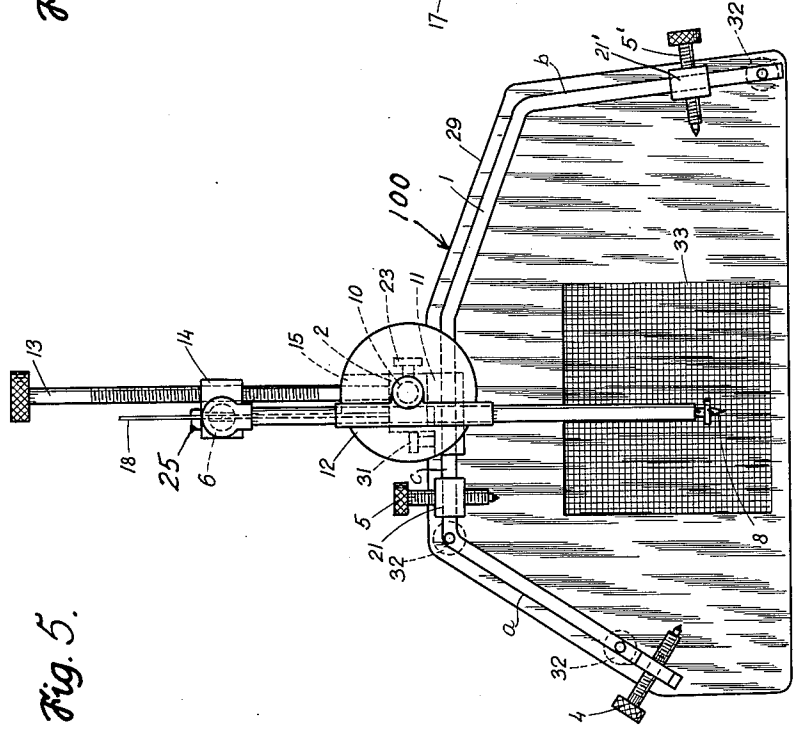


Fig. 5.

INVENTORS

Vilibald Vladyka and Pavel Ježek

BY

United States Patent Office 3,223,087 Patented Dec. 14, 1965

3,223,087

STEREOTAXIC DEVICE

Vilibald Vladyka and Panel Ježek, both of Prague, Czechoslovakia, assignors to Chirana Praha, národní podnik, Prague, Czechoslovakia, a corporation of Czechoslovakia

Filed June 15, 1961, Ser. No. 133,004
Claims priority, application Czechoslovakia, June 18, 1960, 3,937/60
2 Claims. (Cl. 128—303.13)

This invention relates to a stereotaxic device enabling surgical operations on the human brain.

Surgical operation and treatment of the brain tissues inside the skull are always rather difficult due to the delicacy and complexity of the brain structure and to its inaccessibility. For certain treatments, the risk of the operation has been up to now so great that some areas of the brain have been practically inaccessible for any operation and consequently patients have remained without help and their cases have had to be given up as lost.

At present there are a number of known stereotaxic apparatus which should relieve this undesired state. These apparatuses are partly suitable in some cases and for areas of the brain. They are, however, very complicated and heavy and require very skillful manipulation.

It is, accordingly, an object of this invention to provide a stereotaxic apparatus which is easy to manipulate, which guarantees the required accuracy, and which enables the performance of different kinds of operations with the minimum discomfort to the patient, and the weight of which is sufficiently light that it requires no complicated supports and can be directly affixed to the patient's head.

The stereotaxic apparatus in accordance with this invention is directly affixed to the patient's skull by at least three threaded bolts, the pointed ends of which partly enter into the skull bones. The apparatus is affixed to the skull by means of a yoke supporting said threaded bolts, the threaded bolts entering the patient's skull along a line corresponding to the central cerebral line, leaving said yoke beyond said line. A frame, whose angular position and distance from said yoke is adjustable, is supported by said yoke with an electrode holder, and extensions bearing X-ray reference marks are provided on said frame. The relative positions of different elements of said apparatus are determined on scales.

The invention is described in detail in the following specification in conjunction with the accompanying drawings which show by way of example different illustrative embodiments thereof.

In the drawings, FIG. 1 is a side view of the apparatus;

FIG. 2 is the corresponding front view;

FIG. 3 is a top view of a reference strip for X-ray examination;

FIG. 4 is a side elevation of another X-ray reference strip;

FIG. 5 is a side view of an apparatus with a plate provided with a network of lines for X-ray examination and

FIG. 6 is the corresponding front view.

FIG. 7 shows an electrode used for treatment of brain tissues; and

FIGS. 8 and 9 show a section and side view of a sidebar.

As shown in FIGS. 1 and 2, the fundamental frame of the apparatus which has to be affixed to the patient's skull is represented by a yoke **1** which is bent to the shape of, or part of, an open planar polygon member, such that the parts thereof which bear threaded bolts **4**, **5** and **5'** and have to be affixed to the patient's skull, are approximately parallel with that part of the skull where said bolts have to be affixed. The yoke **1** includes

a first end portion *a*, a second end portion *b*, and an intermediate portion *c*. End portion *a*, which falls near the patient's forehead, is provided with two lateral extensions **3** and **3'** of approximately rectangular shape with cut threads for receiving the threaded bolt **4**, which can be alternately selectively inserted into one of said extensions as determined by the place where the treatment has to be performed. As depicted, one extension projects from one side of the yoke and the other extension from the other side. The threaded bolt **4** is pointed on its end, such point being in line with the central cerebral line. The remaining part of the yoke **1** bears at least two sleeves **21** and **21'** with set screws **5** which are equally displaced from the axis of symmetry of the yoke **1**. Sleeve **21** is slidable along the intermediate portion *c*, and sleeve **21'** along the second end portion *b*.

The apparatus proper comprises a horizontal tube **6** on the ends of which there are mounted two graduated vertical sidebars **7**, which, with tube **6**, effectively provide a U-shaped frame **100** for the apparatus. The tube **6** serves as the means connecting respective ends of the sidebars. The lower ends of the sidebars **7** are provided with pointed extensions **8** which can be utilized to provide reference marks for X-ray examination. The marks made by extensions **8** should be in line with the affected portion of the brain so that when the electrode is lowered, its active electrode portion will be at the affected portion of the brain. Sleeves **9** supporting a horizontal sliding crossbar **10** are slidably supported by sleeves **17** on the vertical sidebars **7**, the longitudinal disposition of crossbar **10** being laterally displaced from the axes of the sidebars **7**. The crossbar **10** is provided at a point displaced from its midpoint with a cylindrical portion which is coaxial with the axis of the crossbar and is engaged in a sleeve **11** which itself is in sliding engagement with yoke **1**, to which it may beaffixed by a set screw **31**. The cylindrical portion **2** together with the bar **10** can be rotated in the support **11** to any position with an inclination of from zero to 360° and the required position can be fixed by the arresting means **12** which functions as a stop. The base of a threaded bolt **13** is pivotally engaged in the cylindrical portion **2** of the crossbar **10** and threaded portion passes through a nut **14** mounted on the horizontal tube **6**. The thread of the screw **13** suitably has a large pitch and enables a quick relative displacement of the horizontal tube **6** upwards or downwards with respect to the horizontal crossbar **10**. The longer part of the crossbar **10** is provided with a scale **20**, the zero position of which corresponds after adjustment of the yoke **1** to a position corresponding to the central cerebral line of the patient.

A holder **15** for electrodes **18** (FIGS. 3 and 4) can be shifted on the crossbar **10** to the right or left and is provided with a scale **16** thereon for determining the depth to which the electrode has to enter into the cerebral tissue. The holder is fixed in the proper position on the crossbar **10** by a set screw **23**. Alternatively the holder can be arranged so as to allow an inclination with respect to the crossbar **10**.

The electrode **18** is inserted into a bore **24** of the holder **15**, the axis of said bore being in the same plane as the axis of the vertical bars **7** and parallel to these axes. Thus there is achieved the result that the electrode **18** can be exactly in line with the bars **7** and the electrode **18** can be thus introduced into the proper place of the cerebral tissue in accordance with the information resulting from previously taken X-ray pictures.

The depth for which the electrode **18** has to enter the cerebral tissue can be determined by the different scales provided on the apparatus.

The electrode **18**, as shown in FIG. 5, has a stop member **25** which cooperates with the horizontal tube **6** so

that when stop **25** is in engagement with said tube, the tip of the electrode element is in the same plane as the extensions **8** with the marks for X-ray examination.

The proper adjustment of the apparatus is furthermore enabled by reference strips **19**, **19***a* which are used for the determination of the central cerebral line. FIG. 5 shows a top view of one of these strips and FIG. 6 shows an elevation of another strip. The strips are provided with a number of bores **27** therein, such as, for example, ten bores in like and a transverse cut **28** is provided in the axis of each bore **27** to enable the identification of the position of each bore in the course of X-ray examination. The strips **19**, **19***a* are further provided with two pins **26** to enable their being affixed to the skull bones. The strip **19***a* as shown in FIG. 5 is straight and is fixed to the forehead of the patient. The strip **19** as shown in FIG. 6 is bent and is affixed to the rear part of the skull. The pins **26** are exactly in line with the bores **27**.

Prior to applying the apparatus, the central cerebral line of the patient is determined. First the reference strips **19**, **19***a* are respectively affixed to the forehead and to the rear part of the skull of the patient and an X-ray picture is taken of the cerebrum and the bores **27** marked on the strips **19**, **19***a* which are in line with the central cerebral line. These marked places on the skull are bored to a certain depth and the yoke **1** of the apparatus fixed to the skull by inserting the pointed ends of the threaded bolts **4** and **5** into these bores. The whole yoke, supporting the tube **6** of the apparatus, with the electrode holder, is thus affixed to the skull by means of these pointed ends of the bolts **4** and **5**. The support **11** is thereafter shifted together with the sidebars **7** to a place in which the extensions **8** of the bars **7** are in line with the place of the brain which is to be treated. The correct place is determined by X-ray examination. Subsequently a trephine hole is made at the proper place and the electrode is inserted in the desired position through this hole, and the respective treatment of the cerebral tissue is started.

The electrode **18** has a chosen diameter and length and beyond its active parts it is covered with a special insulating lacquer such as the type used for high frequency electric current equipment.

In order to enable to determine more accurately and with the minimum of X-ray pictures the correct place where the electrode has to be applied, a plate **29** is affixed by means of bolts **30** and nuts **32** to the yoke **1** (see FIGS. 7 and 8). Plate **29** is provided with a network of lines **33**, which contribute to the exact localization and adjustment of the electrode holder to the respective place already indicated by the first X-ray picture. This plate **29** is advantageously constructed of a transparent material in order to enable also the visual control, together with the network of lines **33** applied by means of a material which is distinct when X-rayed. It should be advantageously in close proximity to one of the X-ray marks **8**. In this embodiment the end portion *b* of the yoke **1** is shown provided with scale divisions **35**.

It is further advantageous for all of the threaded bolts **4** and **5** and all adjustable sleeves and holders or their counterparts respectively to be provided with scales thereon in order to enable the reproduction of the position of the apparatus in case a second operation or treatment is required.

While one specific embodiment of my invention has been shown and described in detail, to illustrate the application of the principles of my invention, it will be understood that the same may be differently embodied without departing from such principles.

What I claim as my invention is:

1. A stereotaxic apparatus for surgical treatment of the human brain, comprising:

(a) an open partially polygonal planar yoke having respective first and second end portions and an intermediate portion;

(b) a first pointed bolt engaging said first end portion near its end for application to the front of the skull;

(c) a second pointed bolt engaging said second end portion near its end for application to the rear of the skull;

(d) at least one sleeve slidably mounted on said yoke and adapted to be adjustably moved along said intermediate portion of the yoke;

(e) a third pointed bolt engaging said sleeve for application to the top of the skull;

(f) a support slidably mounted on said intermediate portion of the yoke;

(g) a crossbar held by said support and rotatable therein;

(h) a U-shaped planar frame comprising a pair of vertical sidebars and a horizontal base connected to each of said sidebars, said sidebars constituting a vertical frame of reference, and the ends of said sidebars being pointed for application to the skull to serve as reference points, each of said sidebars being slidably mounted on the crossbar, said base being substantially parallel to said crossbar;

(i) arresting means connecting said yoke and said frame for fixing the disposition of said frame relative to said yoke;

(j) an electrode holder slidably mounted on said horizontal crossbar; and

(k) an electrode slidably mounted in said holder so as to be displaceable vertically in the vertical plane defined by said sidebars.

2. A stereotaxic apparatus as defined in claim **1** wherein the longitudinal axes of said first and second bolts are located in a common plane.

References Cited by the Examiner

UNITED STATES PATENTS

3,053,256	9/1962	Cooper et al.	128—303
3,061,936	11/1962	De Dobbeleer	128—303
3,073,310	1/1963	Mocarski	128—303
3,115,140	12/1963	Volkman	128—410
3,135,263	6/1964	Connelley	128—303

FOREIGN PATENTS

634,460	3/1950	Great Britain.

OTHER REFERENCES

Verne et al. Journal de Chiruagie 1946, vol. 62, No. 5 (28 pages, only page 198 relied upon).

Cooper (Neurological Alleviation of Parkinsonism), published by C. C. Thomas, Springfield, 1956 (13 pages, only pages 72, 74, 75, 77, 79, 80, and 83 relied upon).

RICHARD A. GAUDET, *Primary Examiner.*

JORDAN FRANKLIN, H. R. GOLDBERG, SIMON BRODER, *Assistant Examiners.*