(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
26 March 2015 (26.03.2015)

(10) International Publication Number
WO 2015/040407 A1

(51) International Patent Classification:
A61B 19/00 (2006.01) *A61D 1/00* (2006.01)

(21) International Application Number:
PCT/GB2014/052843

(22) International Filing Date:
18 September 2014 (18.09.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1316661.6 19 September 2013 (19.09.2013) GB

(71) Applicant: **RENISHAW PLC** [GB/GB]; New Mills, Wotton-under-Edge Gloucestershire GL12 8JR (GB).

(72) Inventors: **GILL, Steven Streatfield**; North Bristol NHS Trust, Southmead Hospital, Westbury-on-Trym, Bristol Bristol BS10 5NB (GB). **WOOLLEY, Maxwell Roy**; Renishaw PLC, New Mills, Wotton-under-Edge Gloucestershire GL12 8JR (GB).

(74) Agents: **BREWER, Michael** et al.; Renishaw PLC, Patent Department, New Mills, Wotton-under-Edge, Gloucestershire GL12 8JR (GB).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*

(54) Title: STEREOTACTIC DEVICE

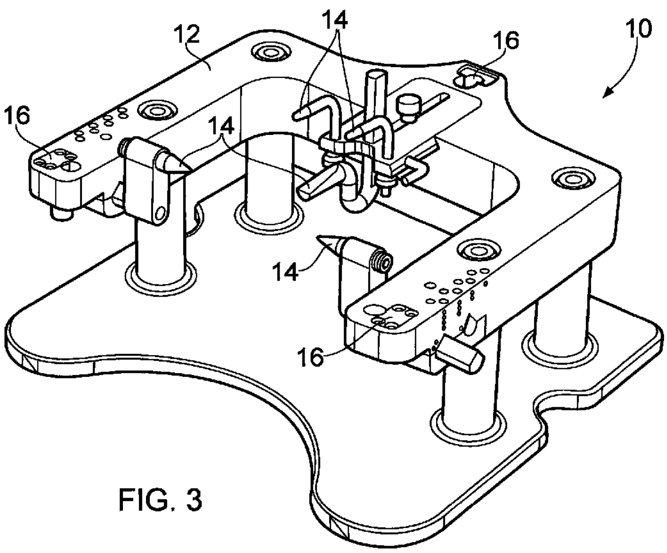


FIG. 3

(57) Abstract: An adapter (10) is disclosed for a human stereotactic device to adapt the human stereotactic device for use with an animal. An adapter (10) comprises at least one skull attachment feature (14) for attaching the adapter to the skull of an animal, and at least one device attachment feature (16) for attaching the adapter (10) to the human stereotactic device. The at least one device attachment feature (14) is or are substantially the same as or equivalent to or compatible with at least one attachment feature provided on a base ring or base ring platform for the human stereotactic device for attaching the base ring or base ring platform to the human stereotactic device. This allows the human stereotactic device to attach to the adapter without modification of the human stereotactic device.

WO 2015/040407 A1

Stereotactic Device

The present disclosure relates to a stereotactic device.

A stereotactic device is used in techniques for surgical treatment or scientific investigation that permit the accurate positioning of probes or similar instruments inside the brain or other parts of the body (such as the spine, lung, liver, pancreas, and prostate). In stereotactic neurosurgery, a neurosurgeon will often have to insert instruments to targets within the brain with millimetre or even sub-millimetre accuracy. The success of stereotactic functional neurosurgery is highly dependent on the accuracy with which neurosurgical instruments, such as electrodes or catheters or other types of implant, can be guided to a predetermined target site of the brain. Stereotactic devices can also be used to target specific points within the body non-invasively, for example using ionising radiation.

Stereotactic head frames for use in precision guided neurosurgery are known. Such head frames provide an external, three-dimensional frame of reference, for example based on a Cartesian or polar coordinate system, for locating points within the brain. The head frame has head-holding clamps, pins and bars which places the head into a fixed position relative to the coordinate system. The fixed position can be determined for example by use of Computed Tomography (CT) scanning of the head and frame with CT-opaque fiducials on or attached to the frame. With the frame secured to an operating table, the frame can be used to guide surgical instruments accurately to target particular points within the brain.

There are several known types of stereotactic frame systems. With a simple orthogonal system, the probe is directed perpendicular to a square base unit fixed to the skull. These provide three degrees of freedom by means of a carriage that moved orthogonally along the base plate or along a bar attached parallel to the base plate of the instrument. Attached to the carriage is a second track that extended across the head frame perpendicularly.

With a burr hole mounted system a limited range of possible intracranial target points is enabled via a fixed entry point. Such a system provides two angular degrees of freedom and a depth adjustment. The surgeon could place the burr hole over nonessential brain tissue and use the instrument to direct the probe to the target point from the fixed entry point at the burr hole.

With an arc-quadrant system, a probe is directed perpendicular to the tangent of an arc (which rotates about the vertical axis) and a quadrant (which rotates about the horizontal axis). The probe, directed to a depth equal to the radius of the sphere defined by the arc-quadrant, will always arrive at the centre or focal point of that sphere.

One specific type of stereotactic device is the Leksell® frame produced by Elekta AB, Sweden, which includes a base ring attachable to the base of the skull. The base ring can be locked to an operating table to immobilise the head and various neurosurgical instruments can also be secured to the base ring. Once the base ring is attached to the subject's head and has been imaged it acts as a platform of known position relative to the head. The base ring can thus be used as a reference position for acquired images and a platform from which instruments can be stereotactically guided to the required target site or sites in the brain.

Another type of stereotactic device is the Cosman-Roberts-Wells (CRW®) frame. Like the Elekta Leksell frame the Radionics CRW® stereotactic frame is comprised of a series of three linear axes (x, y, z), an arc which can rotate about the horizontal axis and a tool holder which is mounted to and moveable along the arc and which holds implements perpendicular to the tangent of the arc. By adjusting the linear axes of the frame, the user is able to move the centre point of the frame arc, with implements fed through the tool housing being set on a trajectory to the centre point of the arc. The stereotactic frame is attached to a human patient through a connection to a base ring platform. This platform is positioned over a subject's head and through it numerous pins or bolts are fed until contact is made with the subject's head, compressing and locking the two together. Once this base frame is in place, the stereotactic device can be mounted and locked into place using a series of three cam locks.

Because of the different anatomies involved, stereotactic devices produced for use on humans are quite different to those produced for use on animals, both in terms of size and in terms of the means of attaching the frame to the subject's head. For example, an animal-specific stereotactic device might be smaller than a human-specific stereotactic device. Also, the shape of the skull, as well as the type, position and orientation of features on the skull that offer suitable attachment points to a stereotactic device are very different from an animal to a human, and accordingly a very different type and arrangement of attachment features are required in a stereotactic device suitable for use on an animal (herein referred to as an animal stereotactic device) compared to a stereotactic device suitable for use on a human (herein referred to as a human stereotactic device). For example, in small laboratory animals the features on the skull that might offer suitable attachment points could be bone landmarks which are known to bear a constant spatial relation to soft tissue. Such bone landmarks could be the external auditory meatus, the inferior orbital ridges, the median point of the maxilla between the incisive teeth, or the bregma (confluence of sutures of frontal and parietal bones). On the other hand, in humans, suitable attachment points might be intracerebral structures which are clearly discernible in a radiograph or tomograph.

The present applicant proposes a system that enables a standard human stereotactic frame to be used with animals (i.e. animals other than humans, or non-humans). This is advantageous because it allows a surgeon to practice a surgical technique first on animals, and to use the same equipment during actual surgery on humans.

More particularly, an adapter is proposed for a human stereotactic device to adapt (having features which adapt) the human stereotactic device for use with or on an animal. With such an adapter, a standard human stereotactic device (i.e. an unmodified or substantially off-the-shelf human stereotactic device) can be used with animals. With such an adapter, no meaningful or significant customisation of the stereotactic device itself is required. In this way, a customised adapter can be produced to suit the intended subject, for use with a standard human stereotactic device, rather than having to make difficult, costly, time-consuming and animal-specific customisations to the stereotactic device itself. If a stereotactic device has been customised in any meaningful or significant way to enable it to be used for a particular animal, then that stereotactic device is not a 'human stereotactic device' within the context of this disclosure; rather, it is an animal stereotactic device because it has been tailored for a specific (non-human) animal or type of (non-human) animal.

The adapter may have at least one skull (or head) attachment feature for attaching the adapter to the skull (or head) of an animal, and at least one device attachment feature for attaching the adapter to the human stereotactic device.

The at least one skull attachment feature may be configured so as to be locatable onto features on the skull of the animal for which the adapter is designed, those features on the skull being ones that offer suitable attachment points for the adapter.

The animal may be a non-human primate, such as a monkey, for example a Rhesus monkey.

Different adapters, with a different type and/or arrangement of skull attachment features, may be provided for use with the same stereotactic device but with or on different respective animals or types of animal.

The stereotactic device may comprise a frame member with an opening which at least partly encircles or surrounds the head of a subject when in use.

The stereotactic device may comprise at least one guiding feature for guiding a surgical instrument into the subject's head. The stereotactic device may comprise at least one position setting feature for setting the position and/or orientation of the guiding features so that a surgical instrument can be stereotactically guided towards a specific point in the subject's head. Depending on the type of stereotactic device, these position setting features may comprise guide bars and/or guides and/or rotation joints that offer adjustment in a number of degrees of freedom to achieve a desired position and/or orientation of the guiding features, thereby allowing a surgical instrument to be guided precisely towards and to a target point. The coordinates of the target point can be determined for example from a CT, Magnetic Resonance Imaging (MRI) or similar scan. For example, the guide bars and/or rotation joints may provide adjustment in at least some of the x, y, z and polar directions. The features may comprise high precision vernier scales which would allow the neurosurgeon to position the surgical instrument inside the brain at the calculated coordinates for the desired structure, for example through a small drilled or trephined hole in the skull.

Instead of or in addition to vernier scales, linear or rotary encoder scale systems (for example of the type made by Renishaw®) could be used for additional accuracy. For example, an absolute or incremental linear encoder scale and associated readhead could be used to measure movement of the parts that move in a linear (or arc-like) fashion, while an absolute or incremental rotary encoder scale and associated readhead could be used to measure rotation of rotation joints.

The device's frame member may be substantially rectangular, for example substantially square.

The stereotactic device may be any type of stereotactic device that is suitable for use on a human. The stereotactic device may be generally sized to be suitable for use on an adult human. An adult human head is typically between 13cm and 16cm wide and between 18cm and 24cm long. Accordingly, to accommodate such a head and any attachment features for attaching the adapter to the skull, a width of the opening of the device's frame member may be at least 17cm, more preferably at least 20cm, and more preferably at least 23cm. A length of the opening of the device's frame member may be at least 17cm, more preferably at least 20cm, more preferably at least 23cm, and more preferably at least 26cm.

The adapter may comprise a frame member with an opening which at least partly encircles or surrounds the head of a subject when in use.

The opening of the adapter's frame member may be smaller than the opening of the device's frame member, which would be appropriate for example to animals with a smaller head size than humans. However it is also possible that such an adapter can be made for animals with a larger-than-human head size. This is because the animal's head could for example be positioned with only the crown of its head within the opening of the device's frame member. In that case, the opening of the adapter's frame member might actually be larger than that of the device's frame member (to accommodate and at least partly encircle or surround the larger head). In that case, the at least one device attachment feature would space the adapter's frame slightly away from the device's frame (e.g. using posts) so that the larger part of the head is away from the opening of the device's frame. This would still allow the human stereotactic device to attach to the larger adapter without modification of the human stereotactic device because the same device attachment configuration can be used as that for attaching the human stereotactic device to a standard base ring or base ring platform designed specifically for the human stereotactic device. Supplementary, supporting software can be used to shift the arc centre of human stereotactic frames. In this way the arc centre of the frame can be positioned below the base ring of the frame while maintaining the intended trajectory; this would be of use, for example, with larger animals where the frame does not fit over the head.

The lateral dimensions of the opening of the adapter's frame member will depend upon the animal on which the adapter is intended to be used. For example, at least one lateral dimension (width and/or length) of the opening of the adapter's frame member may be less than 24cm, and more preferably less than 20cm, and more preferably still less than 18cm.

The adapter's frame member may be securable to the device's frame member.

The at least one skull attachment feature need not attach directly to the skull but may instead locate onto or into features of the subject's head or face (such as eye sockets or ear canals). The at least one skull attachment feature serves the purpose of holding the skull in a substantially fixed relationship to the adapter. The at least one skull attachment feature can be referred to instead as at least one skull or head positioning feature for positioning and/or holding the skull or head in a fixed relationship to the adapter.

The at least one skull attachment feature may comprise at least one pin.

The at least one skull attachment feature may comprise at least one clamp.

The at least one skull attachment feature may comprise at least one bar.

The at least one skull attachment feature may comprise at least one strap.

At least of the at least one skull attachment feature may be moveable on a slideable member to adjust for different sized subjects.

The at least one device attachment feature may comprise one or more bolts, straps, screws or pins, or a combination thereof. The at least one device attachment feature may comprise kinematic (or quasi kinematic) mounting features. As will be understood, and as for instance described in H. J. J. Braddick, "Mechanical Design of Laboratory Apparatus", Chapman & Hall, London, 1960, pages 11-30, kinematic design involves constraining the degrees of freedom of motion of a body or feature using the minimum number of constraints and in particular involves avoiding over constraining. The use of kinematic (or quasi kinematic) mounting features would enable the adapter to be re-mountable repeatably onto the stereotactic device in the same position relative to the stereotactic device.

The at least one device attachment feature is or are preferably substantially the same as or equivalent to or compatible with the at least one attachment feature which would be provided on a standard base ring or base ring platform (or similar head-fixation frame or component) provided as standard for attachment to the human stereotactic device and for holding the human subject's head in a fixed relationship to the stereotactic device. This allows the human stereotactic device to attach to the adapter without modification because the same attachment configuration is used as that for attaching the human stereotactic device to a standard base ring or base ring platform (or similar component) designed specifically for the human stereotactic device.

Although an adapter is described for adapting a human stereotactic device for use with or on an animal, it will be appreciated that this concept is applicable also to adapting a stereotactic device between other kinds of use type. For example an adapter can be provided for adapting an animal stereotactic device for use with or on a human. Or an adapter can be provided for adapting a stereotactic device for one kind of animal for use with or on another kind of animal. Or an adapter can be provided for adapting a stereotactic device for adult humans for use with or on younger humans.

Although the concept is described mainly in relation to use on a head of the subject, the adapter concept is equally applicable to use on other parts of the body.

A stereotactic device can be considered to be a device that has position setting and guiding features which permit the accurate positioning of surgical instruments inside the brain or other parts of the body.

The stereotactic device may be a CRW® or a Leksell® stereotactic device, or any other suitable type of stereotactic device.

The term 'surgical instrument' used herein is not intended to imply any limitation on the type of instrument that can be used. It would encompass invasive instruments such as probes, drills, electrodes and catheters, as well as non-invasive instruments such as beams of ionising radiation.

The adapter may be referred to as a fixation frame or a head-fixation frame.

The adapter may be provided on its own, or may be provided with the human stereotactic device, for example as a kit.

Reference will now be made, by way of example, to the accompanying drawings, in which:

Figures 1 to 5 are perspective views of an adapter for a human stereotactic device, with Figures 1, 2 and 5 also showing an example of a fiducial arc (or array) for attachment, or attached, to the adapter;

Figure 6 is an exploded view of the adapter, showing certain components more clearly;

Figure 7 is a perspective view of the adapter, below a frame member of a human stereotactic device to which the adapter is to be fitted;

Figure 8 is a perspective view of the adapter fitted to the frame member of the human stereotactic device;

Figures 9 and 10 are pictures from different angles of the adapter fitted to the human stereotactic device;

Figure 11 is a picture of the adapter with fiducial arc attached;

Figure 12 is a picture of the adapter within the frame of the stereotactic device, showing how attachment features of the adapter are adapted and arranged to hold an animal skull in position;

Figure 13 is a perspective view of another suitable adapter for a human stereotactic device; and

Figure 14 is a perspective view of the adapter of Figure 13 fitted to the frame member of the human stereotactic device.

The drawings illustrate a system that enables a human stereotactic frame to be adapted for use with animals. More particularly, the drawings illustrate an adapter 10 for a human stereotactic device 20. As described below, the adapter 10 has features which adapt the human stereotactic device 20 for use with or on an animal.

The adapter 10 illustrated in the drawings has a plurality of skull attachment features 14 for attaching the adapter 10 to the skull 40 of an animal, and at least one device attachment feature 16 for attaching the adapter 10 to the human stereotactic device 20. As illustrated most clearly in Figure 12, these skull attachment features 14 are particularly configured for attachment to features of an animal skull 40, and would not generally be suitable for attachment to features of a human skull.

As illustrated in Figures 7 to 10 and 12, the stereotactic device 20 comprises a frame member 22 with an opening 23 which at least partly encircles or surrounds the head 40 of a subject when in use. The stereotactic device 20 comprises guiding features 25 for guiding a surgical instrument 29 into the subject's head 40. The stereotactic device 20 comprises position setting features 27 for setting the position and orientation of the guiding features 25 so that a surgical instrument 29 can be stereotactically guided towards a specific point in the subject's head 40. Depending on the type of stereotactic device, these features 25, 27 may comprise guide bars and/or rotation joints that offer movement in a number of degrees of freedom to allow a surgical instrument to be guided precisely towards and to a target point. The coordinates of the target point can be determined for example from a CT or similar scan. For example, the guide bars and/or rotation joints may provide adjustment in at least some of the x, y, z and polar directions. The features 25, 27 may comprise high precision vernier scales (or, as described above, encoder scales) which would allow the neurosurgeon to position the surgical instrument inside the brain at the calculated coordinates for the desired structure, for example through a small drilled or trephined hole in the skull 40.

The device's frame member 22 may be substantially rectangular, for example substantially square. The stereotactic device 20 may be any type of stereotactic device that is suitable for use on a human. To accommodate a typical adult human head and any attachment features for attaching the adapter to the skull, a width 'W' of the opening of the device's frame member 22 may be at least 17cm, more preferably at least 20cm, and more preferably at least 23cm. A length 'L' of the opening of the device's frame member 22 may be at least 17cm, more preferably at least 20cm, more preferably at least 23cm, and more preferably at least 26cm.

The adapter 10 comprises a frame member 12 with an opening which at least partly encircles or surrounds the head 40 of a subject when in use. In this example, the opening 13 of the adapter's frame member 12 (see Figure 6) is smaller than the opening of the device's frame member 22 (see Figure 8). The lateral dimensions of the opening of the adapter's frame member 12 will depend upon the animal on which the adapter is intended to be used. For example, at least one lateral dimension (width 'W' and/or length 'L') of the opening of the adapter's frame member 12 may be less than 24cm, and more preferably less than 20cm, and more preferably still less than 18cm.

The adapter's frame member 12 is securable to the device's frame member 22. For this purpose, the at least one device attachment feature 16 may comprise one or more bolts, screws, pins or cam locks, or a combination thereof. The at least one device attachment feature 16 may comprise kinematic (or quasi kinematic) mounting features.

The illustrated adapter 10 has skull attachment features 14 in the form of pins for attachment to opposite sides of the skull 40, a bar for placement inside the mouth of the subject, and two pins for placement into respective eye sockets of the subject's head 40. Each of the skull attachment features 14 in the illustrated example is moveable on a slideable member to adjust for different sized subjects (one each for the side pins and another for the bar and eye socket pins). Each slideable member is securable in position by for example a bolt or clamp.

Figures 1, 2, 5 and 11 show a fiducial arc 30 for attachment to the adapter 10. With the fiducial arc 30 attached to the adapter 10, the position of the subject's head 40 can be determined relative to the adapter 10 (and relative to the device 20 with appropriate device attachment features 16, 26 such as kinematic features) by use of CT scanning of the head 40 and adapter 10 and making use of CT-opaque fiducials 32 set in known positions (with a known geometry) within the fiducial arc 30. Instead of CT, any suitable imaging technique could be used, such as MRI; in each case the fiducials 32 would be configured so as to be visible to the imaging device being used.

Figure 13 illustrates another example of an adapter for a human stereotactic device. Detail of certain parts of Figure 13 are also inset below the main illustration. Figure 14 shows the adapter 10x of Figure 13 fitted to the frame member 22 of the human stereotactic device. The adapter 10x of Figure 13 is similar to the adapter 10 described above and illustrated with reference to Figures 1 to 12, with like reference numerals referring to features with like functions, and a detailed description of the adapter 10x of Figure 13 is not therefore necessary. The adapter 10x of Figure 13 differs from the earlier-described adapter 10 in the following respects.

The frame member 12x of Figure 13 is securable to the stereotactic device's frame member 22 (see Figure 14) via device attachment features 16a, 16b. Whilst in the previously-described example these were described as comprising one or more bolts, screws, pins or cam locks (or a combination thereof), in the Figure 13 example the device attachment features 16a, 16b each comprise a slot slider arrangement, with a pin or ball 26 (see Figure 7) on the underside of the frame member 22 fitting into the enlarged part of the slot slider aperture, and sliding underneath the narrower part of the slot slider aperture, with the pin or ball 26 trapped within the slot in a manner that is well known in other applications of the slot slider arrangement. At least one of the device attachment features 16a, 16b (the one illustrated as 16a in Figure 13) also comprises a bolt for securely holding the pin or ball 26 in place within the slot slider and to prevent it sliding out unintentionally.

The device attachment features 16a, 16b of Figure 13 are advantageously coupled with spacer wedges 18a, 18b, which act to ensure a tight coupling between the frame member 12x and the frame member 22 when the pins or balls 26 are located within their respective slot sliders. This helps to increase the overall stability and rigidity of the connection between the frame member 12x and the frame member 22.

Like the adapter 10 of the previously-described embodiment, the adapter 10x of Figure 13 also has a plurality of skull attachment features 14a, 14b for attaching the adapter 10x to the skull 40 of an animal. The skull attachment features 14a, 14b are illustrated in Figure 13 without the pins that would be provided for attachment to the skull 40. The skull attachment features 14a, 14b are advantageously provided with guides or rails that slide into corresponding respective slots in the frame member 12x, allowing the skull attachment features 14a, 14b to be easily removable. This allows different configurations of skull attachment feature to be quickly and easily slotted into the frame member 12x. For example, in the detail panel inset into Figure 13, it can be seen that there are three different configurations of the skull attachment feature 14a, providing three different heights for a palette clamping plate. Of course, more or fewer such configurations can be provided for each attachment, not only to adapt the height but also to adapt the position in other directions. The skull attachment features 14b are also provided with multiple holes for holding skull-attachment pins at different respective positions, thereby providing additional flexibility in setting the head fixation position.

CLAIMS

1. An adapter for a human stereotactic device to adapt the human stereotactic device for use with an animal.

2. An adapter as claimed in claim 1, comprising at least one skull attachment feature for attaching the adapter to the skull of the animal, or at least for positioning and/or holding the skull in a fixed relationship to the adapter, and at least one device attachment feature for attaching the adapter to the human stereotactic device.

3. An adapter as claimed in claim 2, wherein the at least one skull attachment feature comprises at least one pin, clamp or bar.

4. An adapter as claimed in claim 2 or 3, wherein at least of the at least one skull attachment feature is moveable on a slideable member to adjust for different sized subjects.

5. An adapter as claimed in any one of claims 2 to 4, wherein the at least one device attachment feature comprises one or more bolt, screw, cam lock or pin, or a combination thereof.

6. An adapter as claimed in any one of claims 2 to 5, wherein the at least one device attachment feature comprises a kinematic or at least quasi-kinematic mounting feature.

7. An adapter as claimed in any one of claims 2 to 6, wherein the at least one skull attachment feature is configured so as to be locatable onto at least one feature on the skull of the animal for which the adapter is designed, those features on the skull being ones that offer suitable attachment points for the adapter.

8. An adapter as claimed in any one of claims 2 to 7, wherein the at least one device attachment feature is substantially the same as or equivalent to or compatible with the at least one attachment feature which would be provided on a standard base ring or base ring platform or similar head-fixation frame or component provided as

standard for attachment to the human stereotactic device and for holding the subject's head in a fixed relationship to the stereotactic device.

9. An adapter as claimed in any preceding claim, wherein the human stereotactic device is a standard or substantially unmodified human stereotactic device.

10. A human stereotactic device and an adapter as claimed in any preceding claim.

11. A stereotactic device and adapter as claimed in 10, wherein the stereotactic device and the adapter each comprise a frame member with an opening which at least partly encircles or surrounds the head of a subject when in use, and wherein the opening of the adapter's frame member is smaller than the opening of the device's frame member.

12. A stereotactic device and adapter as claimed in claim 10 or 11, wherein the human stereotactic device is a standard or substantially unmodified human stereotactic device.

13. A stereotactic device and adapter as claimed in claim 10, 11 or 12, when dependent on claim 2, wherein the stereotactic device comprises at least one attachment feature for attachment of a base ring or base ring platform or similar head-fixation frame or component for holding a human subject's head in a fixed relationship to the stereotactic device, and wherein the at least one device attachment feature of the adapter is configured to be compatible with and cooperate with the at least one attachment feature of the stereotactic device.

14. An adapter for adapting an animal stereotactic device for use with a human.

15. An adapter for adapting a stereotactic device for one kind of animal for use with another kind of animal.

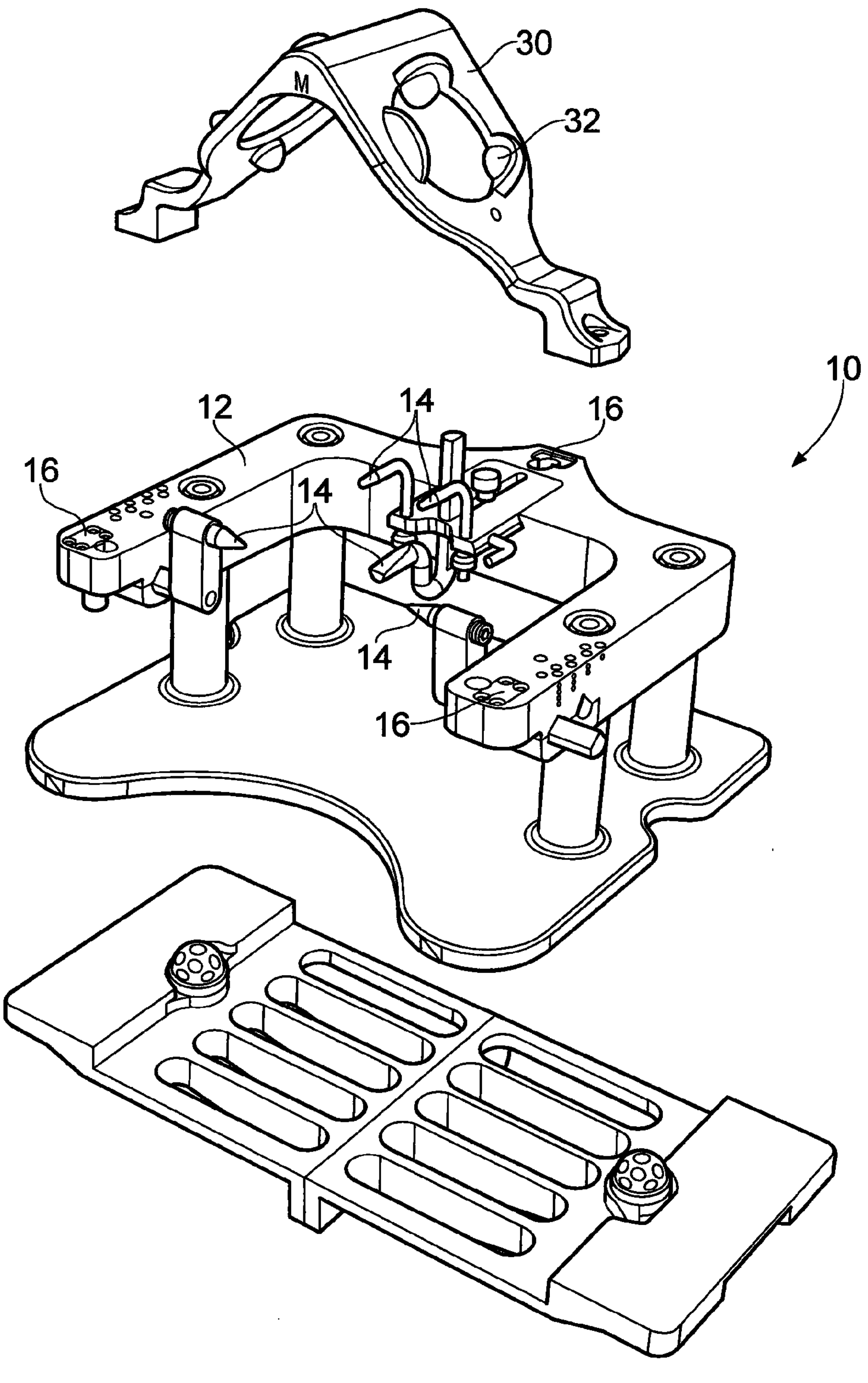


FIG. 1

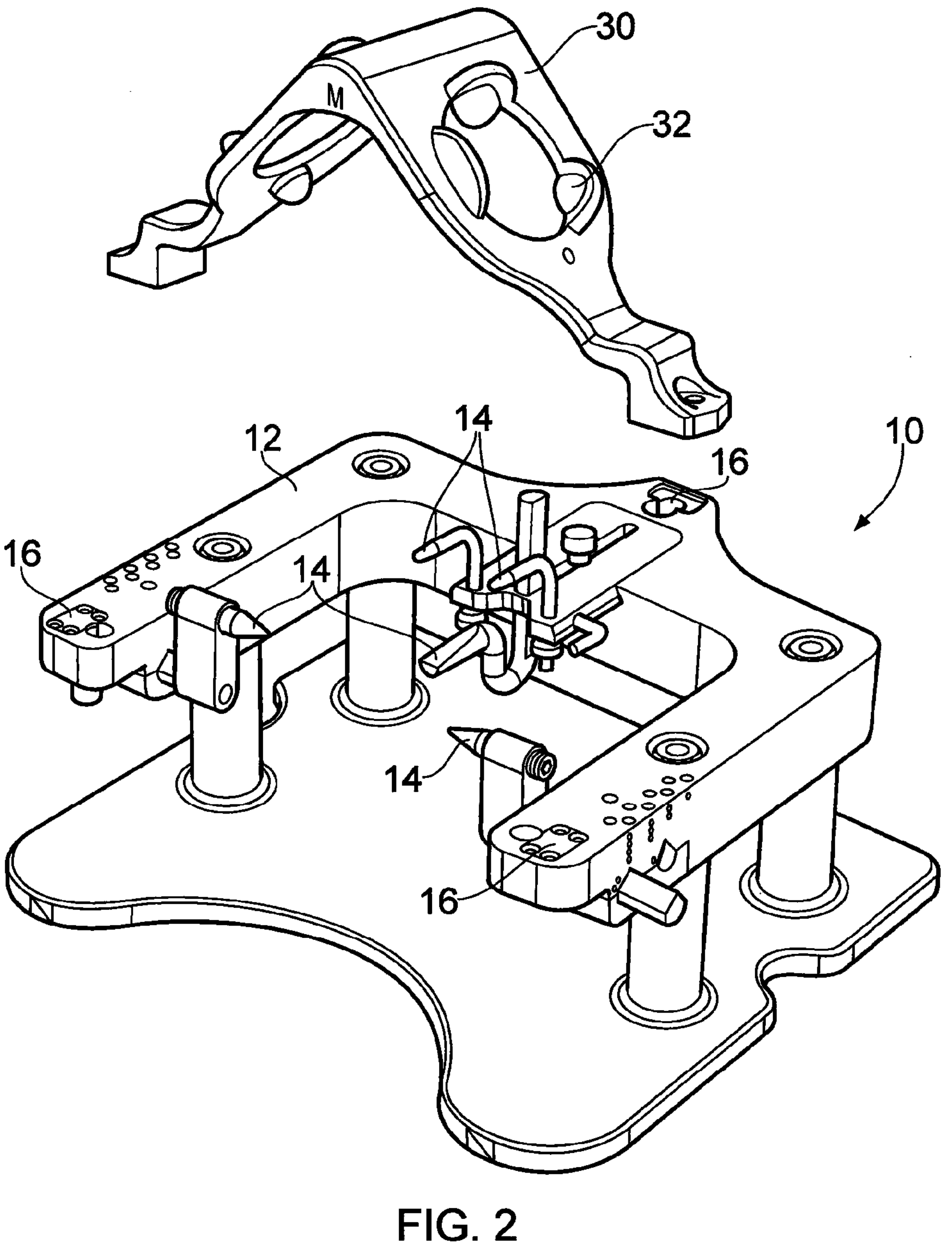


FIG. 2

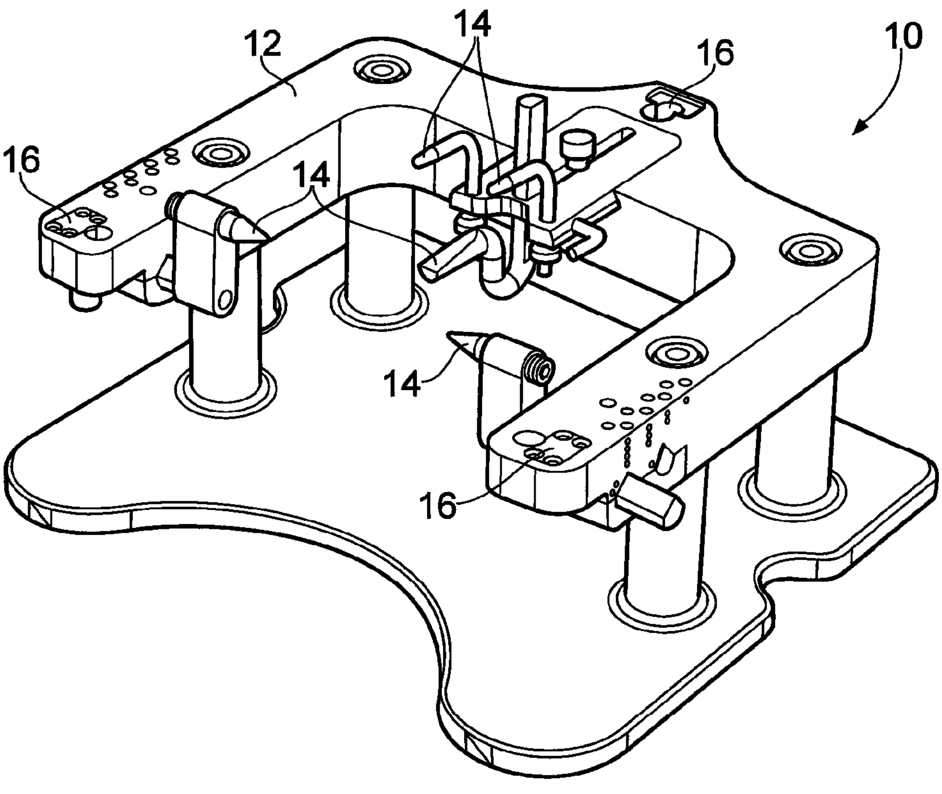


FIG. 3

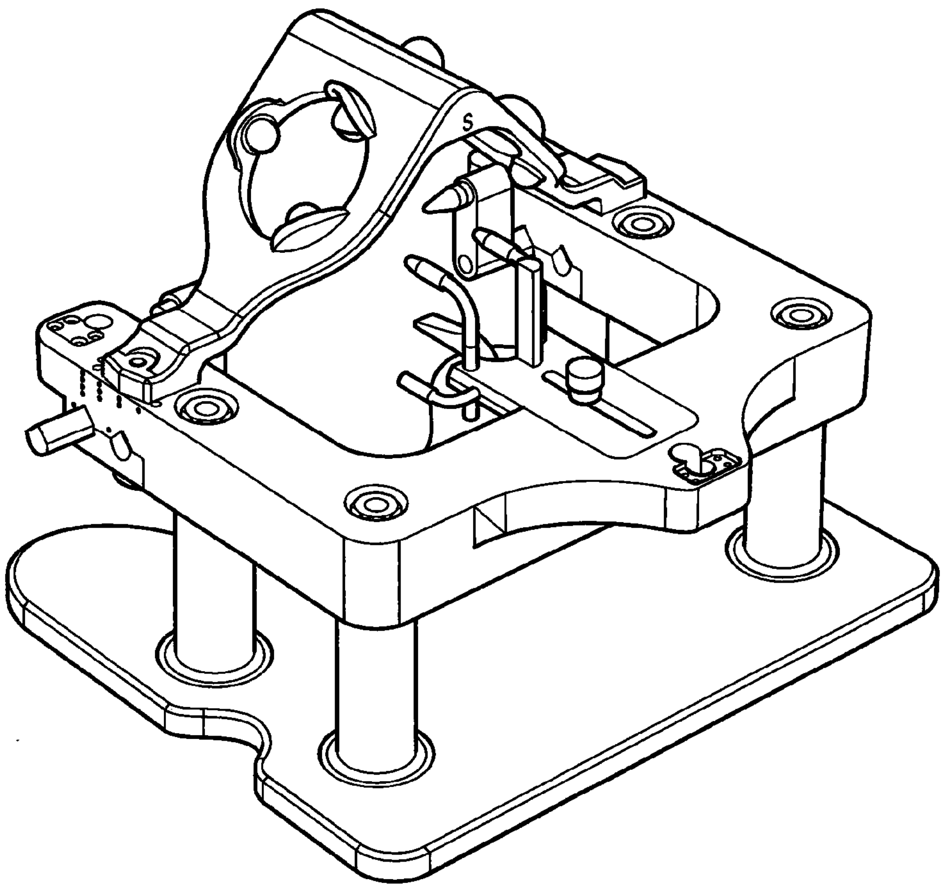


FIG. 4

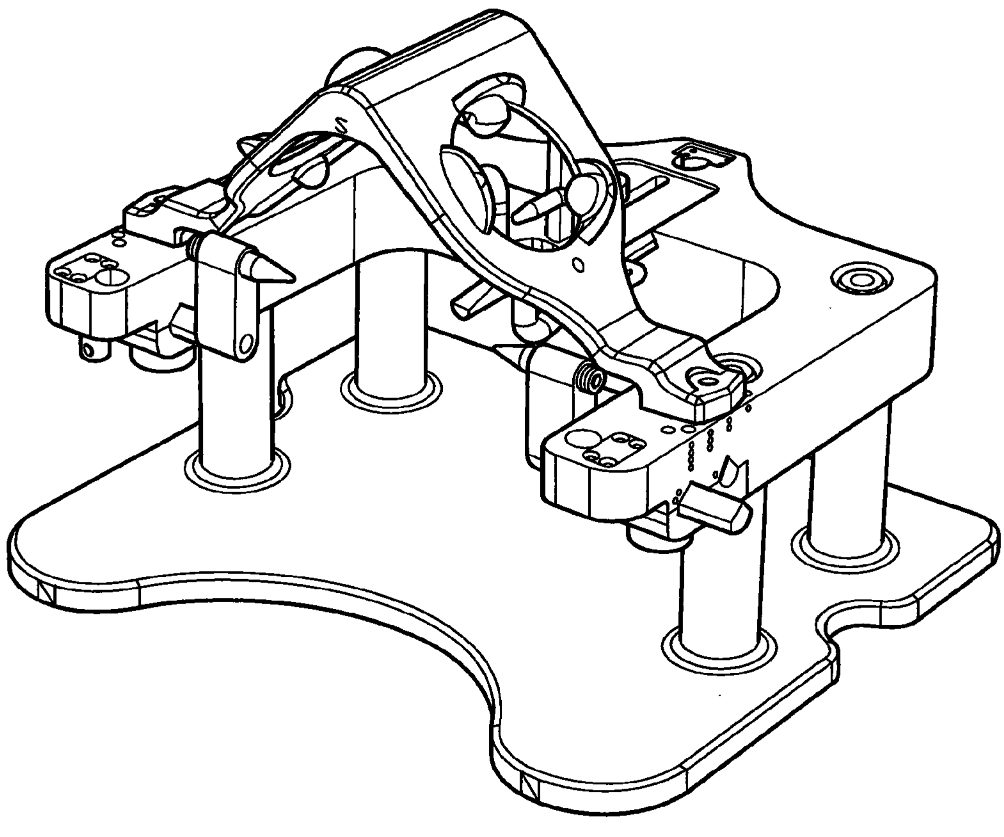


FIG. 5

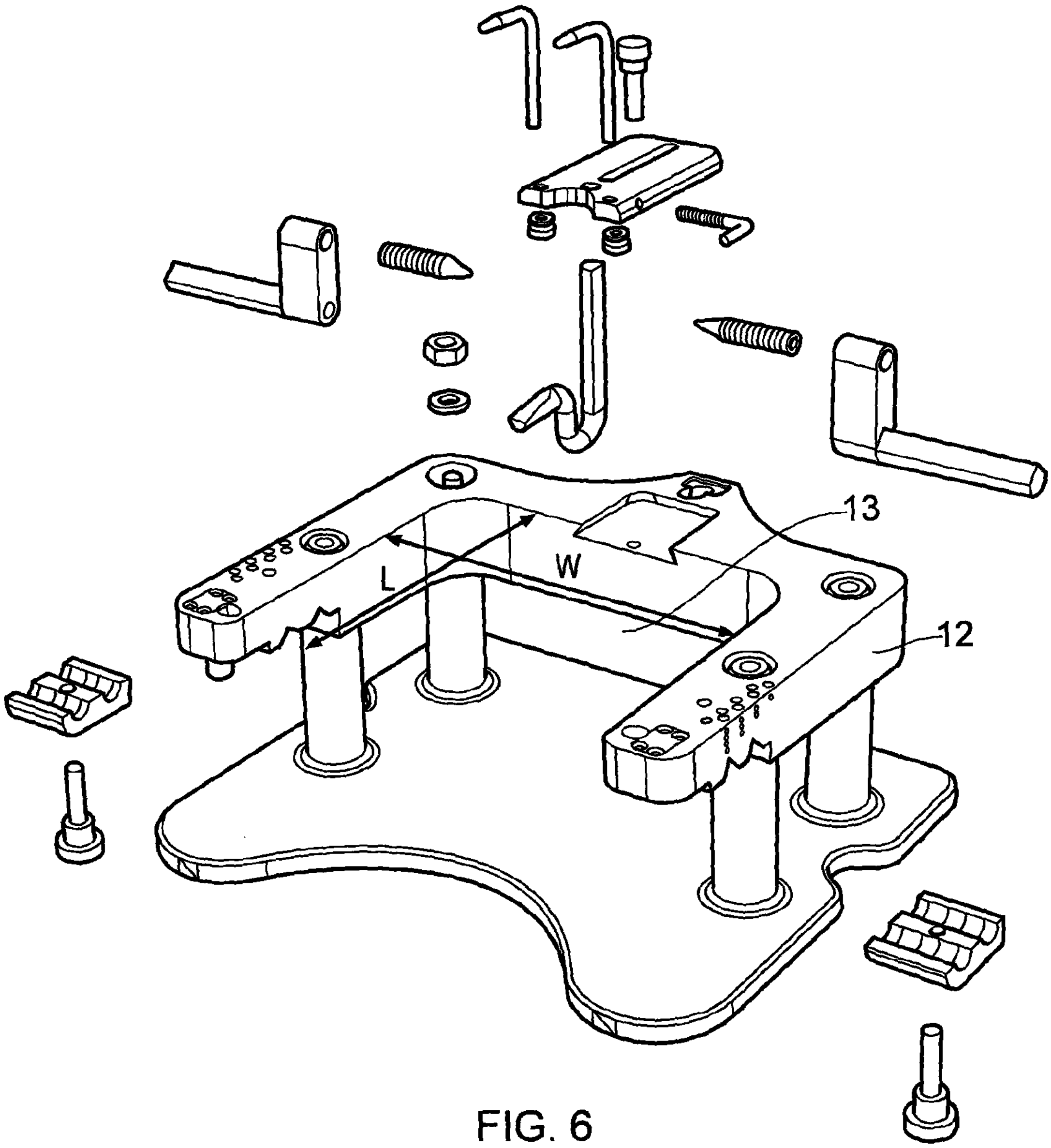


FIG. 6

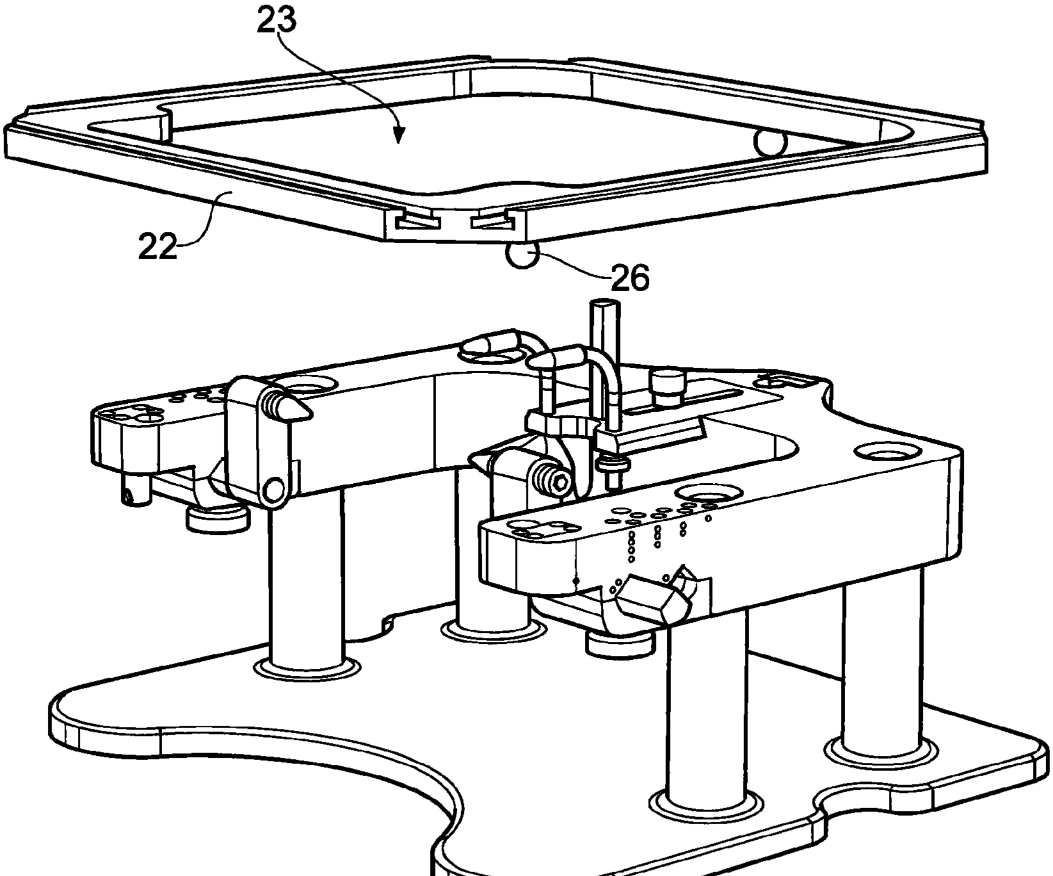


FIG. 7

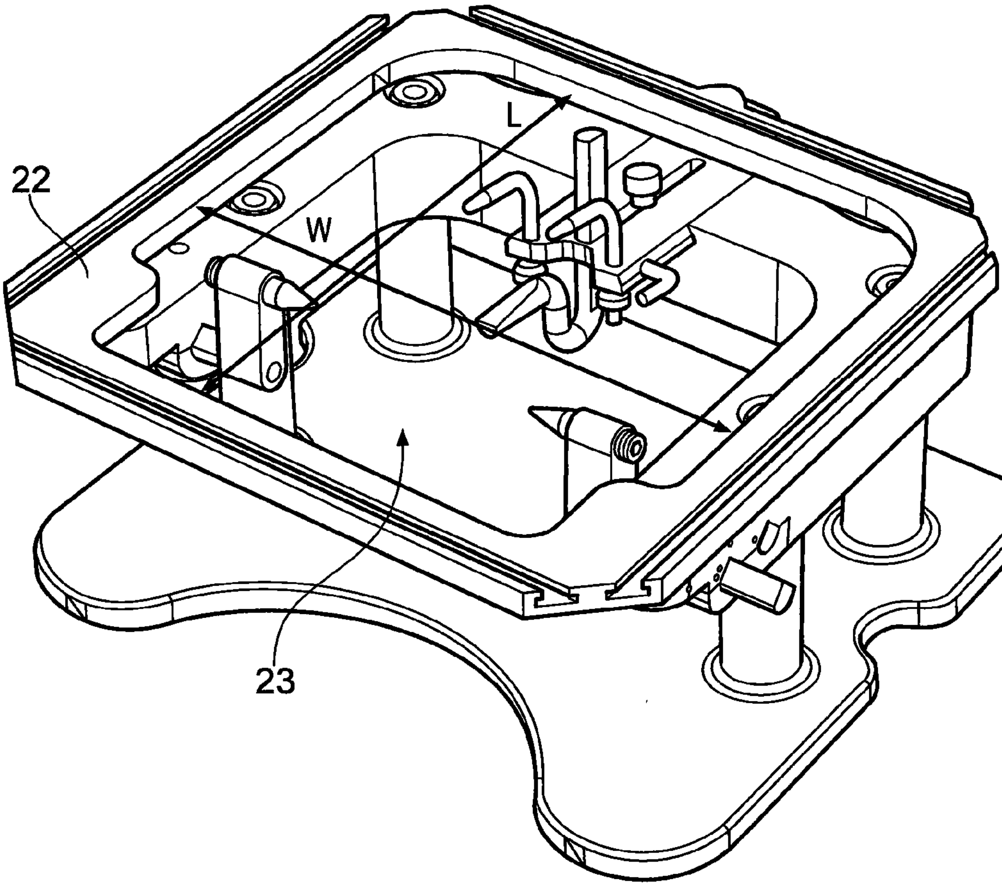


FIG. 8

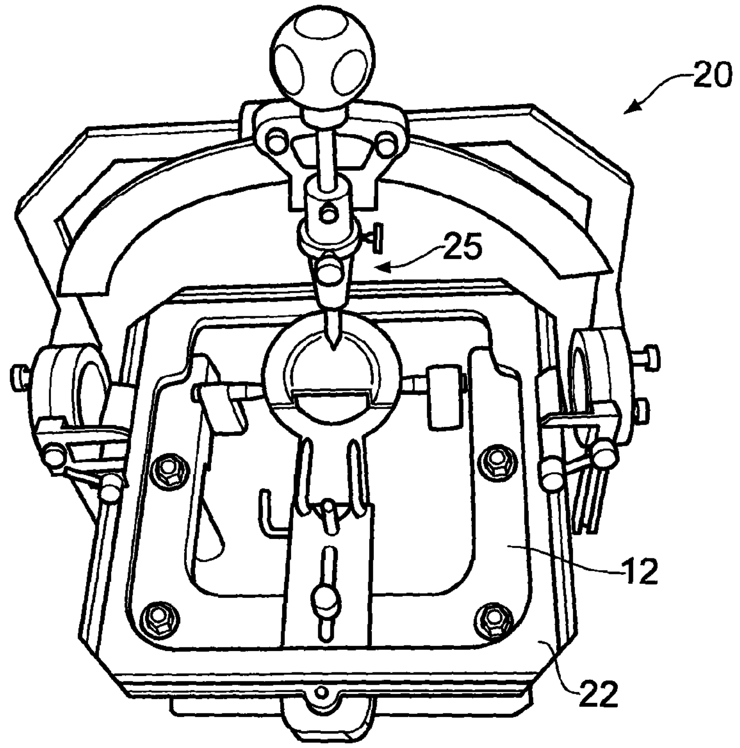


FIG. 9

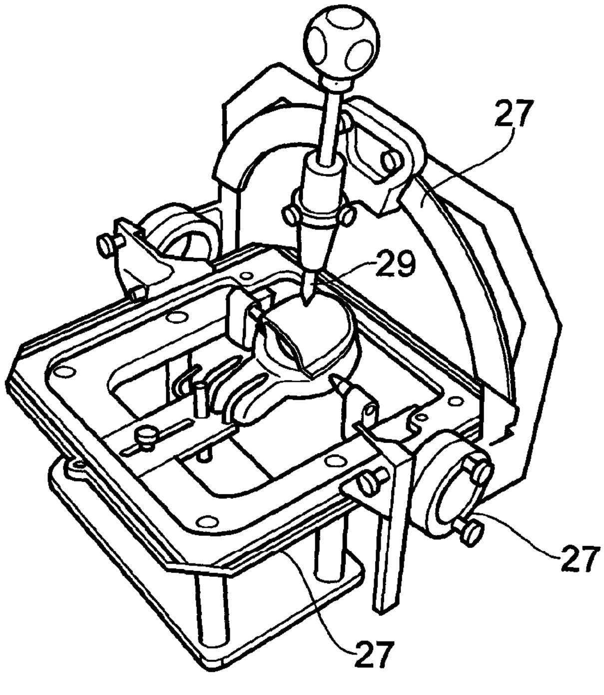


FIG. 10

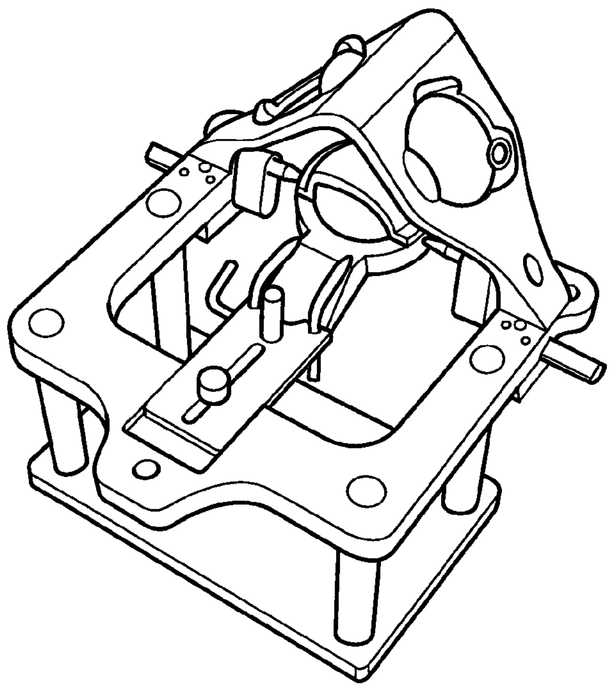


FIG. 11

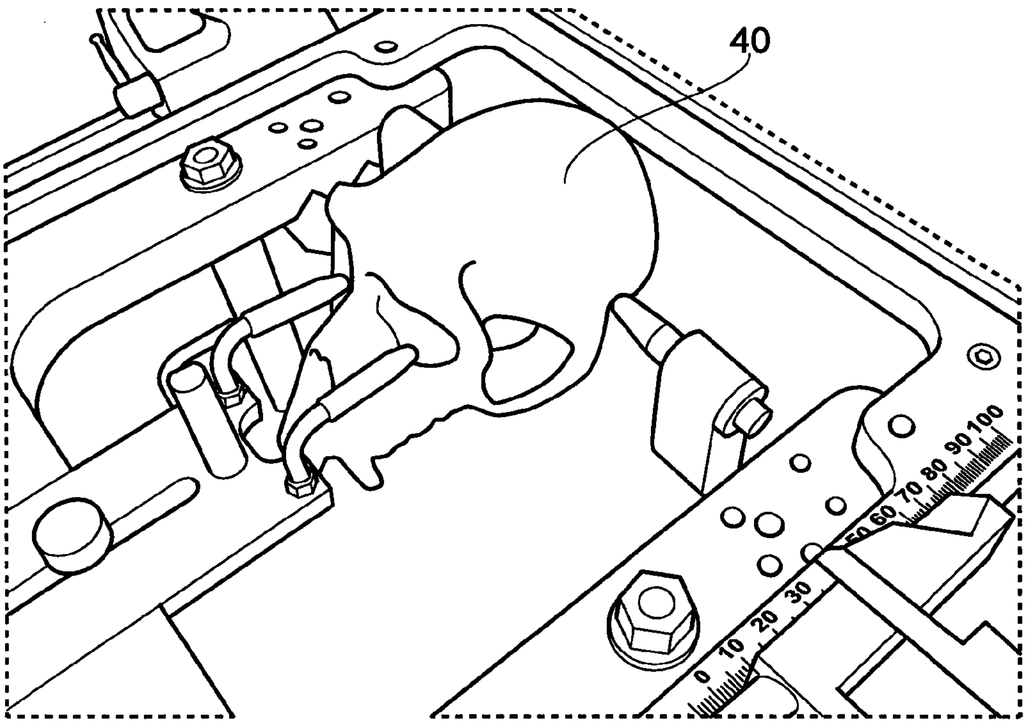


FIG. 12

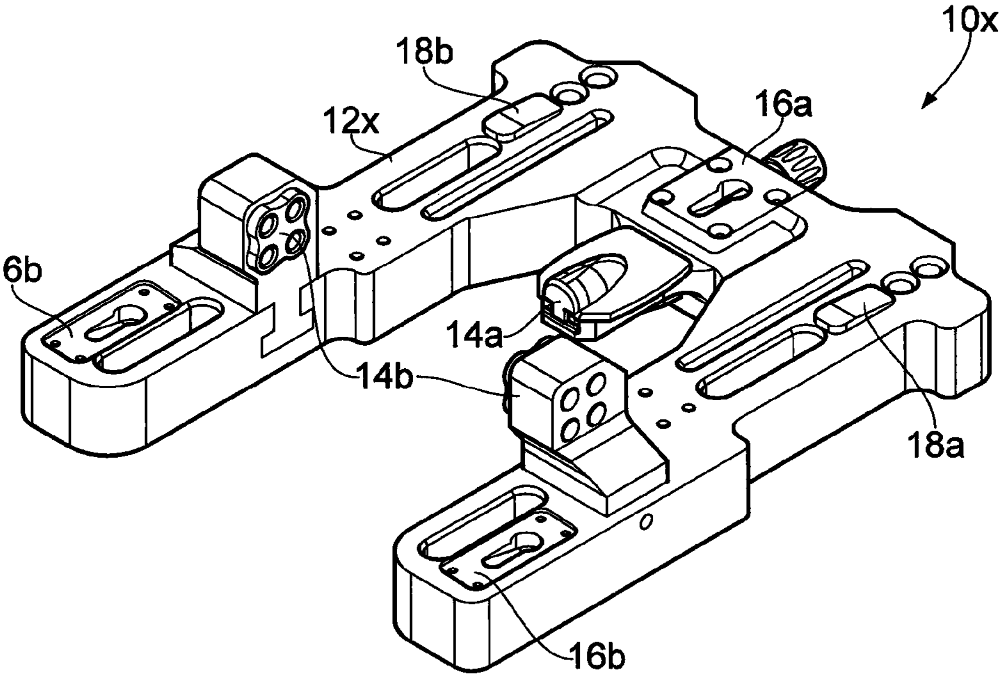
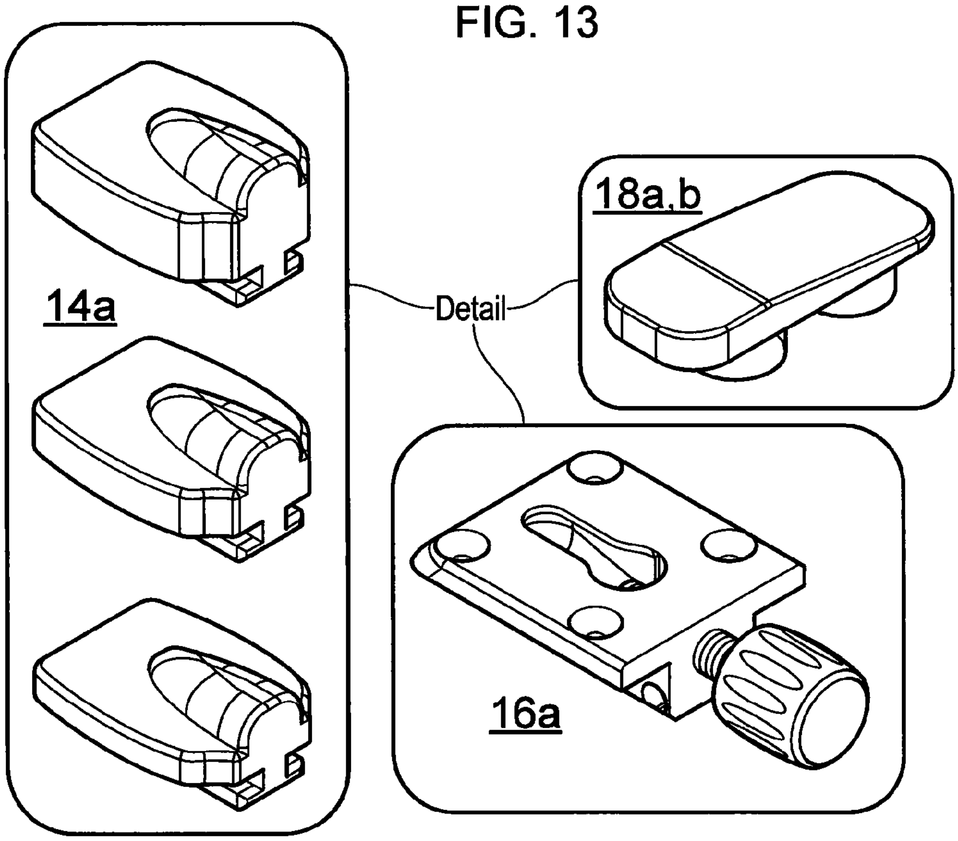


FIG. 13



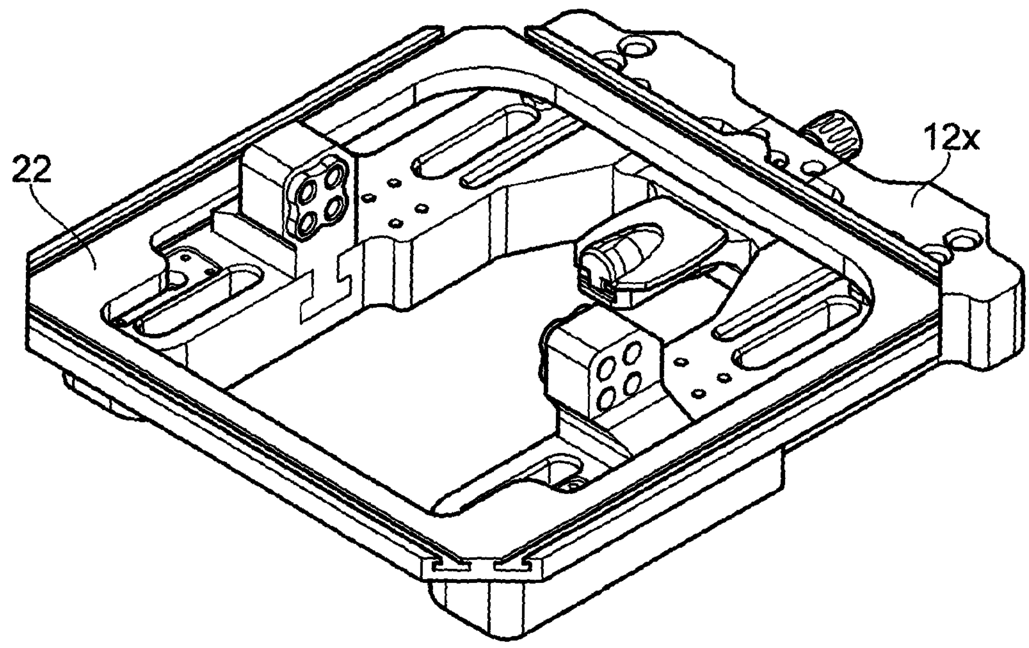


FIG. 14

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2014/052843

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B19/00 A61D1/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61B A61D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/055035 A1 (COSMAN ERIC RICHARD [US]) 10 March 2005 (2005-03-10) paragraph [0065] - paragraph [0067]; figures 12, 13 -----	1-15
X	US 2003/125753 A1 (SARACIONE JOSEPH [US]) 3 July 2003 (2003-07-03) paragraph [0044] - paragraph [0046]; figures 1a, b 15 paragraph [0093] - paragraph [0096] -----	14,15
X	AT 413 331 B (VETERINAERMEDIZINISCHE UNI WIE [AT]) 15 February 2006 (2006-02-15) page 3, line 7 - line 21 -----	1,15
X	US 2011/160727 A1 (ARN THOMAS [SE]) 30 June 2011 (2011-06-30) abstract; figure 1 -----	1,14,15

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 November 2014	21/11/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Moers, Roelof

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2014/052843

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005055035 A1	10-03-2005	NONE	
US 2003125753 A1	03-07-2003	AU 3377600 A	14-09-2000
		AU 3377700 A	14-09-2000
		US 6258103 B1	10-07-2001
		US 2003125753 A1	03-07-2003
		WO 0049959 A1	31-08-2000
		WO 0049960 A1	31-08-2000
AT 413331 B	15-02-2006	NONE	
US 2011160727 A1	30-06-2011	NONE	