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NOTICE OF ENTITLEMENT

We, ORTHOFIX S.r.l., an Italian company of Via delle Nazioni 9, I-37012 Bussolengo, Italy, being the applicant in respect of *Application No. 62069/94* state the following:

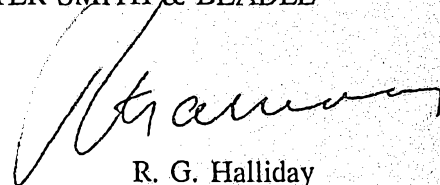
The person nominated for the grant of the patent have for the following reasons gained entitlement from the actual inventors:

**GIOVANNI FACCIOLI
DANIELE VENTURINI**

The inventors made the invention in the course of employment by the Nominated Person and the Nominated Person would, on the grant of a patent for the invention, be entitled to be assignee of the patent.

DATED this 8th day of April 1997.

ORTHOFIX S.r.l.
By Its Patent Attorneys
CARTER SMITH & BEADLE


R. G. Halliday



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METHOD AND APPARATUS FOR THE EXTERNAL SETTING OF FRACTURES
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(56) Prior Art Documents
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(57) Claim

1. An apparatus for the external setting of fractures, adapted for use in association with an external axial splint having bolt-holding clamps with spherical joints for fixing bone bolts which can be implanted into fractured pieces of bone, said apparatus comprising a central body (2) defining an axis, said body being elongatable along said axis and having end portions (3, 3') arranged for releasably coupling to corresponding bolt-holding clamps (44, 44') on the external axial splint (43) associated therewith, the said end portions (3, 3') being attached to the central body (2) by means of corresponding hinges (12, 12') which have axes (20, 20') which are parallel to each other and perpendicular to the axis of the body, characterized in that securing means (39, 39') are provided for selecting the orientation

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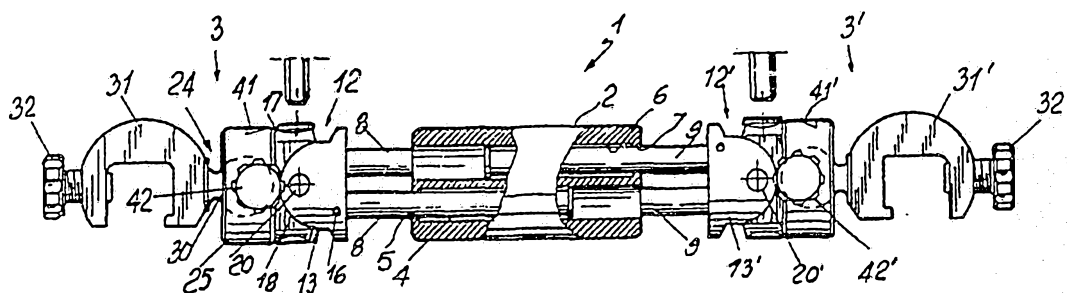
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of the axes (20, 20') of these hinges (12, 12') so as to allow the end portions (3, 3') to rotate in an identical single plane at a time of predetermined position.



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(54) Title: METHOD AND APPARATUS FOR THE EXTERNAL SETTING OF FRACTURES



(57) Abstract

An apparatus for the external setting of fractures, particularly adapted for use in association with an external axial splint having bolt-holding clamps with spherical joints for fixing bone bolts which can be implanted into fractured pieces of bone, said apparatus comprising a central body (2) which can be elongated axially and has end portions (3, 3') which can be releasably coupled to corresponding bolt-holding clamps (44, 44') on the external axial splint (43) associated therewith, characterised in that the said end portions (3, 3') are attached to the central body (2) by means of corresponding hinges (12, 12') which have axes (20, 20') which are parallel to each other and perpendicular to the axis of the body, securing means (39, 39') being provided for selecting the orientation of the axes (20, 20') of these hinges (12, 12') so as to allow the bolt-holding clamps (44, 44') to rotate in a single plane at a time of predetermined position.

METHOD AND APPARATUS FOR THE EXTERNAL SETTING OF
FRACTURES

DESCRIPTION

Field of application

This invention relates to a method and apparatus for the external reduction of fractures, which are particularly suitable for use in combination with an external splint for bone surgery.

A known method for stabilising pieces of broken bone without the use of orthopaedic plaster provides for the use of so-called external splints. Such devices comprise a set of bone bolts, generally in groups of two, which are inserted into the fractured pieces so that their ends project from the patient's skin and can be anchored to a rigid external member by means of clamps with orientatable joints.

To reduce the fracture the surgeon drills the broken pieces, inserts the bolts and secure them to the corresponding clamps on the splint, and then lines up

the edges of the fracture using an X-ray source. Once the fracture has been reduced the surgeon immobilises the orientable joints of the clamps to hold the bone pieces in a predetermined position, allowing the bone tissue to grow back correctly and the fracture to heal.

Two types of disadvantages can arise while a fracture is being reduced.

The first lies in the difficulty of applying the splint to the bolt-holding clamps because of the fact that the joints are rather bulky and of complex structure. In order to overcome this disadvantage, the reduction is effected by removing the central member of the splint and inserting a suitable device in its stead. After a fracture has been reduced as correctly as possible the clamps are also attached to the splint in the predetermined position, and then are released from the device, which can then be used to reduce other fractures.

This procedure is rather complex and laborious, requires greater surgical time, and runs the risk that the bone bolts may become loose in their corresponding seats. These difficulties may occur again if post-operative action is necessary to correct any misalignments in the broken pieces which may become

apparent while healing is in progress.

A second disadvantage lies in the fact that long bones have to be reduced in at least two major planes at right angles to each other, namely the frontal and sagittal planes. Because the image provided by an X-ray source is bidimensional, it is not possible to set a fracture correctly in both planes at the same time. Also, alignment of the pieces in one plane may cause changes in the alignment already achieved in the previous plane.

State of the art

US Patent No. 4,628,922 (University College London) describes a device for the external fixation of fractures comprising two clamps or bone bolts which can be implanted into the broken pieces of a fracture and located at the ends of an extendable rod, in which each clamp has means for rotation with respect to the rod around three axes which are mutually at right angles which intercept at a single point located within the bone, and in which the two points of interception of the corresponding clamps are spaced apart longitudinally along the axis of the bone. In practical use the reduction device is mounted on clamps to effect setting and is only removed after the splint

has been fitted.

US Patent no. 4,488,542 (Helland) discloses a devices for the external setting of fractures comprising end clamps mounted on an extendable bar of polygonal cross-section by means of supports which can be orientated in two planes at right angles to each other. Each support comprises a first part which is integral with the bar and a second integral with the clamp. The first part has the shape of a guide curve with a radius of curvature corresponding approximately to the distance between the clamp and the axis of the bone and with a toothed portion formed on the outer side of the guide. The second part has an endless screw which engages the toothed portion of the curved guide of the first part and can be rotated about an axis which is substantially perpendicular to the plane in which the guide lies. One of the clamps can rotate by a few degrees with respect to the corresponding support around a longitudinal axis which is parallel to the axis of the bar to compensate for slight torsional defects in the fracture.

This device permits accurate adjustment in three planes at right angles to each other, but it has a rather complex and expensive structure that is difficult to use. Also, the excessive size of the

orientatable supports does not make it easy to apply the device to small axial splints, and in particular it is not suitable for use on external splints with spherical or universal joints, e.g. of the types described in US Patent No. RE 31 809 or Italian Patent application no. VR 92A000070. In fact because of the considerable compactness and orientability of their joints, these types of splints may remain anchored to the clamps while the fracture is being reduced, providing minimum obstruction to the surgeon, a factor which is particularly advantageous during the subsequent interventions which are necessary to correct any defects in positioning or alignment caused by post-operative accidents.

The reduction of a fracture using this type of splint has the following disadvantage. After the broken pieces have been aligned in a first plane using X-rays, the clamps of the splint are immobilised and the limb is rotated through approximately 90° with respect to the X-ray source, the clamps are then released and the segments are then aligned in a second plane perpendicular to the first. Too often, however, releasing of the clamps make lose all trace of the previous position and it is therefore necessary to repeat the alignment in the two planes through

successive attempts in order to approximate as closely as possible to the optimum position. This results in increased surgery time and increased exposure to X-rays on the part of both the patient and the medical personnel, with results which are not always satisfactory.

It can therefore be said that splints with spherical joints do not have a "memory" of the initial position and therefore do not lend themselves to being easily used with the setting devices currently commercially available.

Description of the invention

The main object of this invention is to overcome the abovementioned disadvantages by means of an apparatus for the reduction of fractures which can be used with an external axial splint both during the initial intervention in the operating theatre and in subsequent out-patient interventions to correct random or accidental positioning errors.

A particular object is to provide an apparatus especially suitable for use with an axial splint provided with universal or spherical joints so as to allow fractures to be reduced in two planes at right angles to each other and in one plane at a time, memorising the position adopted in each plane, so as

to reduce operation times and exposure to X-rays.

Another particular object is to provide an apparatus for the external reduction of fractures which have a particularly simple and compact structure so as to permit great flexibility and ease of use.

These objects are accomplished by an apparatus for the external reduction of fractures which are particularly suitable for use in association with an external axial splint having bolt-holding clamps with spherical joints for fixing bone bolts which can be implanted in pieces of fractured bone, in which the said apparatus comprises an axially elongatable central body having coupling means at its ends for releasable attachment to corresponding bolt-holding clamps on the external axial splint with which the apparatus is associated, characterised in that the said coupling means are connected to the longitudinal ends of the central body by means of a pair of hinges which have axes which are parallel to each other and perpendicular to the axis of the said body, securing means being provided for the selective orientation of the axes of these hinges so as to permit rotation of the bolt-holding clamps in a plane at a time having a selected position.

Through the abovementioned orientatable hinges, the apparatus according to the invention can easily be

used in combination with an axial splint with spherical joints for reducing the fracture in one plane at a time, without any risk of altering the "memorised" position, because the subsequent rotation performed after the orientation of the hinges has been changed will take place in a plane which is completely different from the first.

Preferably each hinge comprises a fork-member hinged to a connecting block by means of a pin perpendicular to the axis of the central body.

Each fork member can be attached telescopically to one end of the central body by means of longitudinal axial guide means which can vary the total length of the device in a longitudinal direction.

The coupling means may comprise stirrups attached to the corresponding hinges by means of spherical joints equipped with immobilising means.

The stirrups may be provided with fixed bolts to elongate and immobilise a pair of operating handles having terminal jaws which can be engaged on the corresponding bolt-holding clamps of the associated external splint.

In this way the fracture can be reduced without separating the clamps from the central member of the axial splint with spherical joints.

In a particular embodiment each hinge may comprise a fork member hinged to a connecting member by means of a pin perpendicular to the axis of the central body.

Every joint may comprise a spherical head housed in a cavity of complementary shape provided in a ferrule connected to a corresponding connection member.

Each connection member may be connected to the ferrule by means of a bayonet joint and be provided with means for immobilising the joint.

Each stirrup may have an opening with a securing screw for releasable attachment to a corresponding manual manoeuvring member, which can in turn be attached to a corresponding bolt-holding clamp of the external axial splint used in combination with the device.

Thus, an orthopaedic surgeon may reduce a fracture by acting manually on the clamps of an external axial splint without separating it from its clamps for the bone bolts, simplifying the reduction procedure and reducing X-ray exposure times.

Brief description of the figures

For a better understanding of the invention a preferred but not exclusive embodiment of apparatus for the external reduction of fractures, illustrated by way of a non-restrictive example with the help of the appended drawings, will be described below.

In these drawings:

Figure 1 shows a front view of an apparatus according to the invention, in partial cross-section in an axial plane,

Figure 2 shows a view of the apparatus in Figure 1 from above, in partial cross-section in an axial plane perpendicular to the first,

Figure 3 shows an exploded front view of an end portion of the apparatus of Figure 1,

Figure 4 shows a view from above of the apparatus of the preceding figures attached to an axial splint with bolts inserted in pieces of fracture bone.

Figure 5 shows a perspective view of the apparatus according to the invention in the configuration in Figure 4 and in a first stage of operation,

Figure 6 shows a perspective view of the means according to the invention in the configuration in Figure 4 in the second stage of operation.

Description of a preferred embodiment

With reference to the cited figures, an apparatus according to the invention generally indicated with the reference number 1, comprises a central body 2 with two identical mirror-image end portions 3, 3'.

Central body 2 may be formed of a rigid member, preferably of cylindrical shape and made of metal,

e.g. aluminium alloy, coupled telescopically to end portions 3, 3' by longitudinal guide means to adjust the overall length of the device.

The longitudinal guide means may comprise four through holes in two identical pairs, of substantially constant and accurate diameter, placed parallel at the same radial distance from the axis of the body and offset angularly from each other by about 90°.

A first pair of diametrically opposed holes 4, corresponding to the left hand end of body 2, has annular steps 5 which project towards the interior. The second pair of diametrically opposed holes 6, offset by 90° with respect to the former, have annular steps 7 similar to the above at the left hand end of body 2.

Two pairs of cylindrical rods 8, 9, also of stainless steel and having a minimum diameter slightly less than the diameter of annular steps 5, 7, are slidably mounted in the corresponding pairs of axial holes 4, 6, and project from body 2 towards the left and right side respectively. Rods 8 have at the right end an expansion 10 with an external diameter slightly less than the maximum diameter of holes 4, to abut against steps 5. Rods 9 have an expansion 11 at the left end, having the same diameter as expansion 10, intended to

abut against step 7 in holes 6. In this way the rods are guided in their corresponding holes without being able to escape from them from the opposite ends.

The ends of shafts 8, 9 which project from body 2 are linked to the end portions of means 3, 3' by hinges 12, 12' having axes which are parallel to each other and perpendicular to the longitudinal axis of the body.

As the end portions 3, 3' and the corresponding hinges 12, 12' are identical mirror-images, only the left hand end of the device shown in Figures 1 to 3 will be described below. Thus, each of these end members will be identified with progressive reference numbers and those corresponding to the opposite ends, even if not visible or shown, will be represented by the same numbers with apexes.

In particular, hinge 12 comprises a fork member 13 with side portions 14, 15 attached to the end of rods 8 by means of pins 16 and hinged to a collecting member 17 by means of a pin 20 perpendicular to the longitudinal axis of body 2.

Towards the right hand end member 17 has a pair of longitudinal parallel surfaces 18, 19 inserted between the lateral extensions 14, 15 of fork member 13, and towards the left end a collar 21 with a pair of

diametrically opposite flat sides 22, 23.

Hinge 12 is connected to end portion 3 by means of a spherical joint 24. The latter is formed in a ferrule 25 having an internal diameter which is less than the diameter of collar 21 of block 19 and a pair of internal radial projections 26, 27 which are diametrically opposite and have flat edges corresponding to flat sides 22, 23 of collar 21 so as to form a bayonet attachment. Thus after flat sides 22, 23 have been aligned with internal projections 26, 27, collar 21 can be inserted into ferrule 25, and then it can be rotated by approximately 90° to secure members 19 to ferrule 27.

Ferrule 25 has a transverse base wall 28 with a central recess 29 designed to receive a spherical head 30. The latter is secured to an end stirrup 31 which is generally U-shaped with a securing screw 32 which is used to immobilise it on a part of complementary shape of an operating handle 33. An identical handle 33' is attached to the other end portion 3' of the equipment by means of an identical stirrup 31' with a securing screw 32' as may be seen in Figures 4, 5 and 6.

Member 17 has an axial internal cavity 34 which houses a bush 35 which has one substantially flat end, a



transverse substantially cylindrical recess 36 and at the opposite end a cavity 37 of a hemispherical concave shape which is complementary to spherical head 30.

Also there is within member 17 a transverse cylindrical hole 38 into which an eccentric pin 39 is inserted so as to engage recess 36 of bush 35, and at one end there is a hexagonal recess 40 for a hexagon key. When eccentric pin 39 is rotated, this result in axial movement of bush 35 and this member is forced against head 30, which is in turn compressed against recess 29 in ferrule 25, causing it to be locked by friction in spherical joint 24.

It will be noted that on the outer surface of ferrule 25 there is a reference mark 41 which is intended to identify the position of the axis of hinge 12 when the device is fully assembled. A similar reference mark 41' is placed on the other ferrule 25' of joint 24' to identify the orientation of the axis of corresponding hinge 12'. To prevent the separation of members 17 from corresponding ferrules 25, 25' the latter are provided with screws 42, 42' which tighten against a flat 21, 21' on collars 23, 23' of corresponding members 17, 17'.

Figures 4, 5 and 6 show an apparatus 1 in combination



with an axial splint of the type illustrated and described in the Italian patent application VR92000070 and generally indicated with the reference number 43. Splint 43 essentially incorporates a pair of clamps 44, 44' for corresponding bone bolts 45, 45' which can be inserted into fractured bone pieces 46, 47 and attached to a central member 48 by means of corresponding end joints 49, 49'. A securing screw 50 is provided on central member 48 to set the axial length, together with eccentric pins 51, 51' to immobilise the corresponding terminal spherical joints.

Handles 33, 33' have terminal jaws 52, 52' which can be immobilised on corresponding clamps, 44, 44' of splint 43, making the end portions 3, 3' of the apparatus 1 integral with fractured bone pieces 46, 47.

In use, after bone bolts 45, 45' have been implanted in bone pieces 46, 47, the surgeon secures them to clamps 44, 44' of splint 43. The fracture can then be reduced using all the movements permitted by the splint, using the apparatus according to the invention.

In particular, to elongate the central member 48, screws 50, 50' can be slackened, and eccentric pins

51, 51' can be rotated by means of a suitable tool not illustrated in the drawings to allow clamps 44, 44' to rotate freely about joints 49, 49'.

Handles 33, 33' attached to clamps 44, 44' by tightening jaws 52, 52' can be used to aid manoeuvring and to secure the apparatus 1 to the splint. In turn the apparatus 1 is rigidly secured to handles 33, 33' by means of end stirrups 31, 31'.

At this point the surgeon can reduce the bone in a first plane, e.g. the plane of the paper in Figure 4, which we will call the horizontal plane. To this end he rotates the eccentric pins 39, 39' of the apparatus 1 using a hexagon key inserted in corresponding hexagonal recesses 40, 40' to release bushes 35, 35' from spherical heads 30, 30' and allow each hinge 12, 12' to rotate freely. After rotating hinges 12, 12' until the axes of each pin 20, 20' and corresponding reference 41, 41' are in the vertical position illustrated in Figures 4, 5, eccentric pins 39, 39' are again immobilised. From now on the stirrups, handles and bold holding clamps of the splint can be rotated only in a horizontal plane as indicated by arrows F1 and F2. Using an X-ray source the surgeon can find the best alignment and spacing between bone pieces 46, 47 in that plane, and can then immobilise

screws 50 and eccentric pins 51, 51' of splint 43, "remembering" the position adopted in this first plane.

In order to reduce the bone in a second plane perpendicular to the first, the surgeon must release pins 39, 39' from the device and must rotate the hinges through 90° so as to bring the axes of hinges 20, 20' into a horizontal position, as shown in Figure 6. Then he will again immobilise pins 39, 39' and release splint 43, unscrewing screws 50 and pins 51, 51'. At this point the surgeon can rotate the stirrups, handles and bold holding clamps only in a vertical plane in the directions indicated by arrows G1 and G2 shown in Figure 6. After having aligned the fracture at best in this plane too making use of X-ray equipment, the surgeon can then make a further check in the previous plane, and finally can immobilise the axial splint in the reduced position.

At the end of the operation, the apparatus can be separated from the clamps on the splint to be used on another patient or for further work on the same fracture at a subsequent time.

From what has been described above it is clear that the apparatus according to the invention achieves the stated objects and in particular permits easy and

rapid reduction of a fracture while keeping the splint fixed at all times to the bone pieces. Also it makes it possible to "remember" and maintain the alignment in each plane in which it has been orientated, appreciably reducing setting times and exposure to X-rays. Finally it makes it possible to act again on a fracture which has already been reduced, without having to make a minimum change in the position of the splint already fitted, with an appreciable simplification in corrective work for any positioning errors or displacements caused by post-operative accidents.

The apparatus described above are susceptible of many modifications and variants, all of which fall within the scope of the invention expressed by the appended claims. All details may be replaced by equivalent technical members which it is intended should also be equally protected.

Amended claims

1. An apparatus for the external setting of fractures, adapted for use in association with an external axial splint having bolt-holding clamps with spherical joints for fixing bone bolts which can be implanted into fractured pieces of bone, said apparatus comprising a central body (2) defining an axis, said body being elongatable along said axis and having end portions (3, 3') arranged for releasably coupling to corresponding bolt-holding clamps (44, 44') on the external axial splint (43) associated therewith, the said end portions (3, 3') being attached to the central body (2) by means of corresponding hinges (12, 12') which have axes (20, 20') which are parallel to each other and perpendicular to the axis of the body, characterized in that securing means (39, 39') are provided for selecting the orientation of the axes (20, 20') of these hinges (12, 12') so as to allow the end portions (3, 3') to rotate in an identical single plane at a time of predetermined position.



CLAIMS

~~1. An apparatus for the external setting of fractures,~~
particularly adapted for use in association with an
external axial splint having bolt-holding clamps with
spherical joints for fixing bone bolts which can be
implanted into fractured pieces of bone, said
apparatus comprising a central body (2) which can be
elongated axially and has end portions (3, 3') which
can be releasably coupled to corresponding bolt-
holding clamps (44, 44') on the external axial splint
(43) associated therewith, characterised in that the
said end portions (3, 3') are attached to the central
body (2) by means of corresponding hinges (12, 12')
which have axes (20, 20') which are parallel to each
other and perpendicular to the axis of the body,
securing means (39, 39') being provided for selecting
the orientation of the axes (20, 20') of these hinges
(12, 12') so as to allow the bolt-holding clamps (44,
44') to rotate in a single plane at a time of
~~predetermined position.~~

2. Apparatus according to claim 1, in which each
hinge (12, 12') comprises a fork member (13, 13')
hinged to a connecting member (17) by means of a pin
(20) perpendicular to the axis of the central body
(2).



3. Apparatus according to claim 2, in which each fork member (13, 13') is attached telescopically to one end of the said body by means of longitudinal axial guide means (4-11) capable of varying the total length of the central body in a longitudinal direction.

4. Apparatus according to claim 3, in which the said guide means comprise at least one pair of longitudinal rods (8, 9) slidably housed in axial holes (4, 6) in the said central body (2).

5. Apparatus according to claim 2, in which each attachment member (17) for the said hinges is connected to a corresponding coupling stirrup (31, 31') by means of a spherical joint (24, 24') provided with immobilising means.

6. Apparatus according to claim 5, in which each coupling stirrup (31, 31') is substantially U-shaped with a securing screw (32, 32') for releasable anchoring to a corresponding manual manoeuvring member (33, 33') which can in turn be attached to a corresponding bolt-holding clamp (44, 44') on the associated external axial splint (43).

7. Apparatus according to claim 5, in which each spherical joint (24, 24') comprises a spherical head (30, 30') anchored to a corresponding stirrup (31, 31') and inserted in a central hole of complementary

shape (29, 29') made in a ferrule (25, 25') which is connected to an adjacent connecting member (17, 17').

8. Apparatus according to claim 5, in which a bush (35, 35') having a hemispherical cavity (37, 37') supported against the countershaped head (30, 30') of the joint (24, 24') is inserted between each connecting member (17, 17') and the ferrule (25, 25').

9. Apparatus according to claim 7, in which the said securing means for each joint comprise an eccentric pin (39, 39') inserted in a transverse hole (38) in a corresponding connecting member (17) in a position such as to force the said bush (35) against the corresponding head (30) of the joint.

10. Apparatus according to claim 6, in which each hinge (12, 12') has a reference marking (41, 41') on an external surface thereof to indicate the position of the axes (20, 20') and to identify their plane of rotation.

~~11. Method for aligning bone-holding clamps of an~~
external axial splint of elongatable type with universal spherical joints, in which said bone-holding clamps have been already anchored to pieces of bone, said method comprising the following steps:
- providing an apparatus having an axially elongatable central body and provided with end portions,



11. Method for aligning bolt-holding clamps of an axial splint of elongatable type with universal spherical joints, the method comprising the following steps:

- providing an apparatus having a central body defining an axis, said body being elongatable along said axis and being provided with end portions,
- providing the end portions of said body with means for the rigid attachment of said portions to the bolt-holding

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clamps of the axial splint in such a way to place the apparatus in a position substantially parallel to the axial splint by means of manual manoeuvring members,

- providing said apparatus with a pair of hinges with orientatable axes which are parallel to each other and to the axis of the central body, to join together the end portions of the said body with the said connection means,

- selectively positioning and locking of the axes of the said hinges in a first direction to permit rotation of the bolt-holding clamps in a first predetermined plane,

- acting on the said manual manoeuvring members to rotate the connecting means in the said first plane and align the clamps using optical means,

- selectively positioning and locking of the axes of the said hinges in a second direction perpendicular to the first direction to allow the bolt-holding clamps to rotate in a second plane at right angles to the first plane,

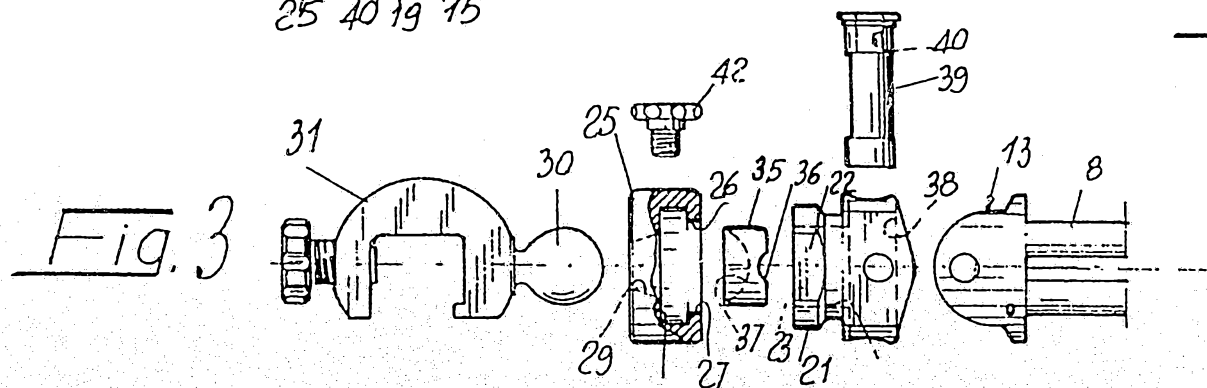
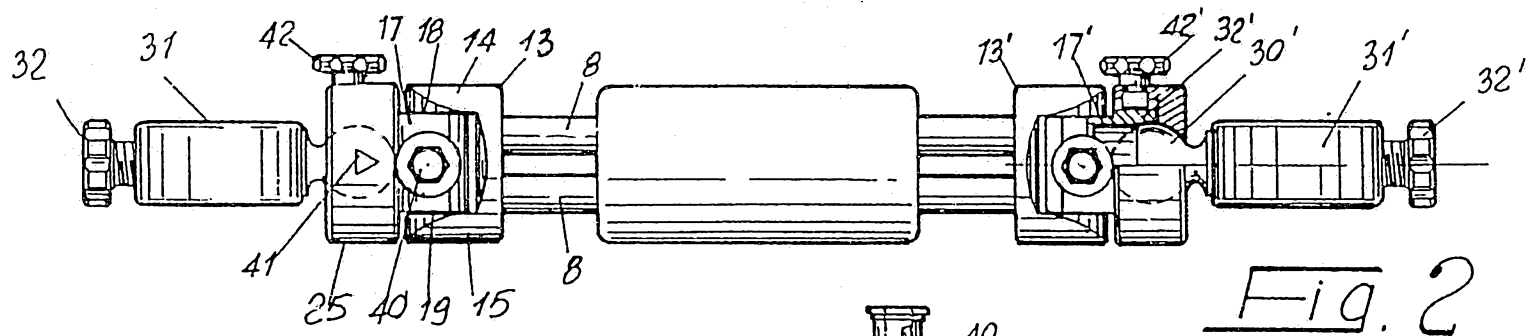
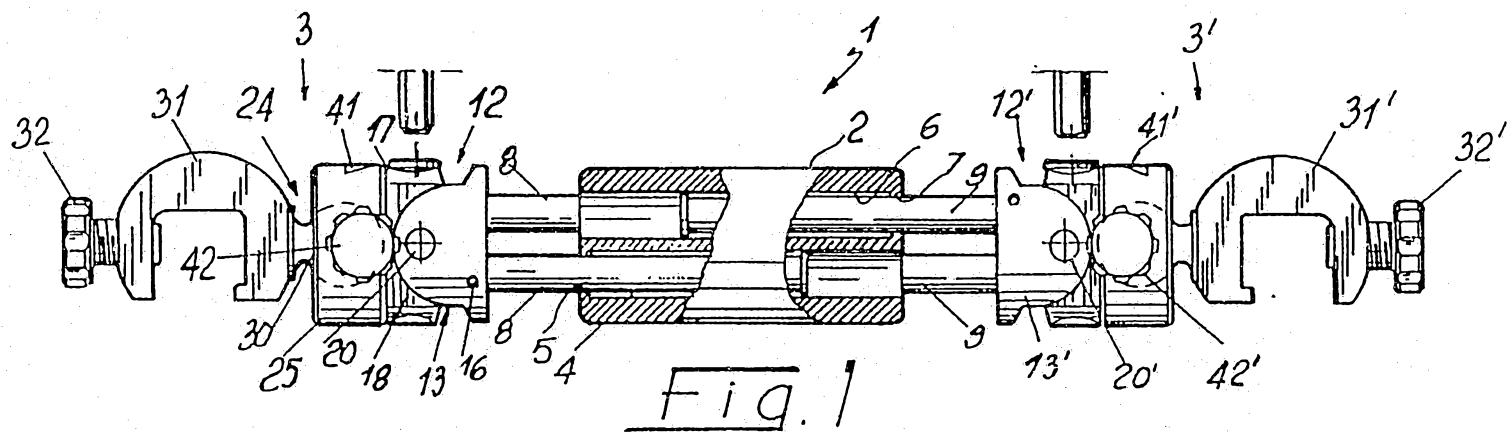
- acting on the said manual manoeuvring members to rotate the connection means in the said second plane in such a way as to complete the alignment of the clamps in the said second plane using optical means,

- releasing the coupling means provided at the end portions of the said body after having finally immobilised the axial splint.



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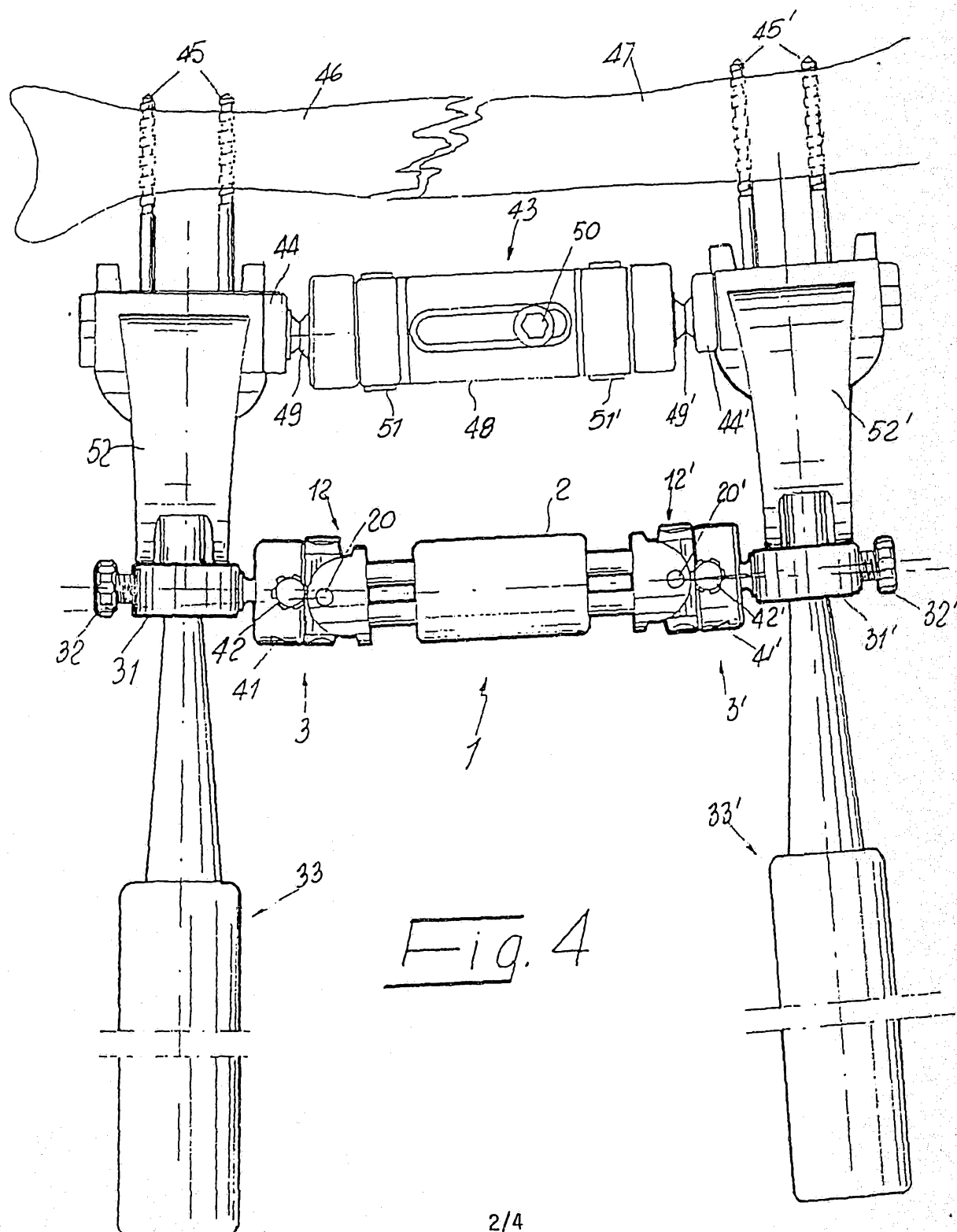


Fig. 4

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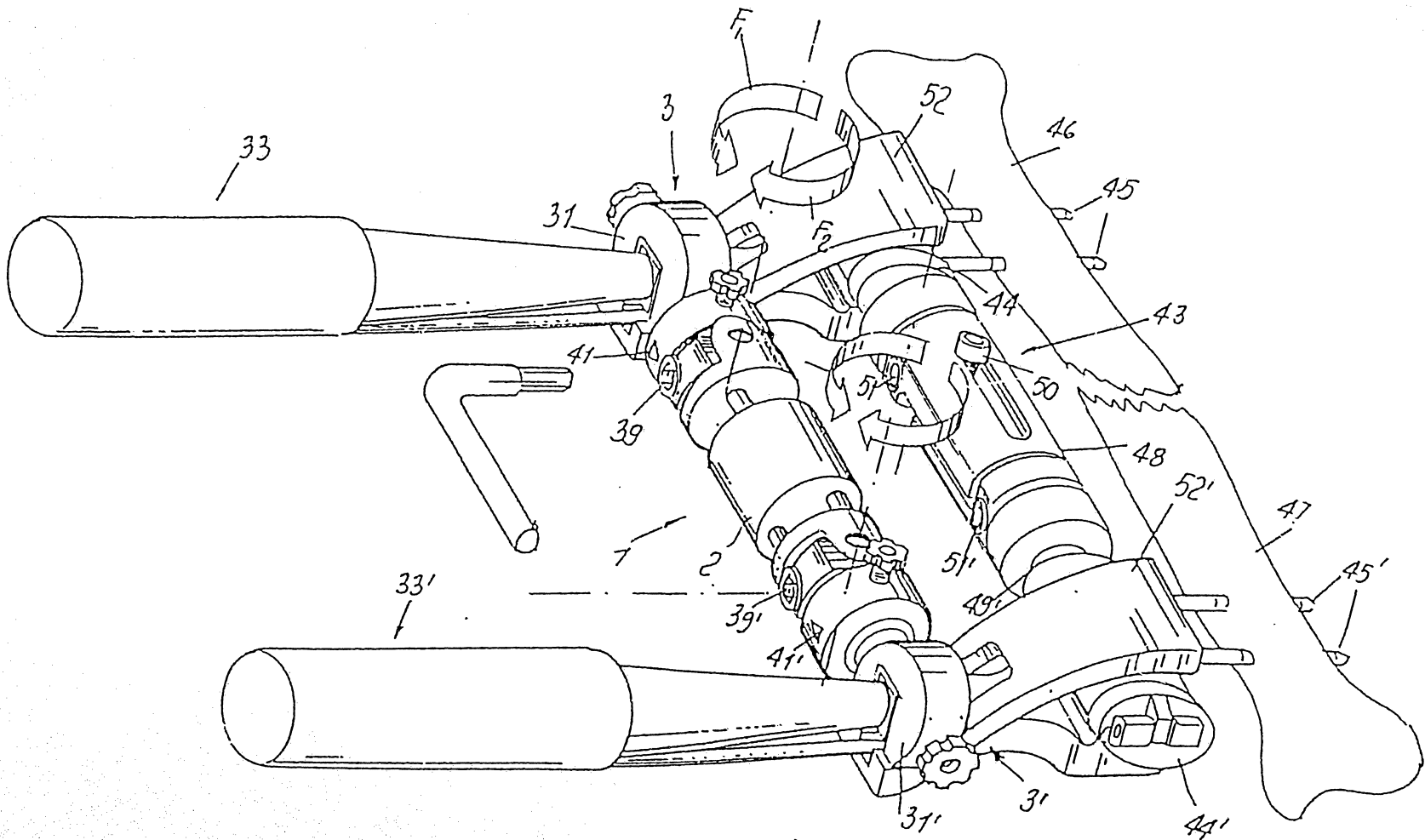
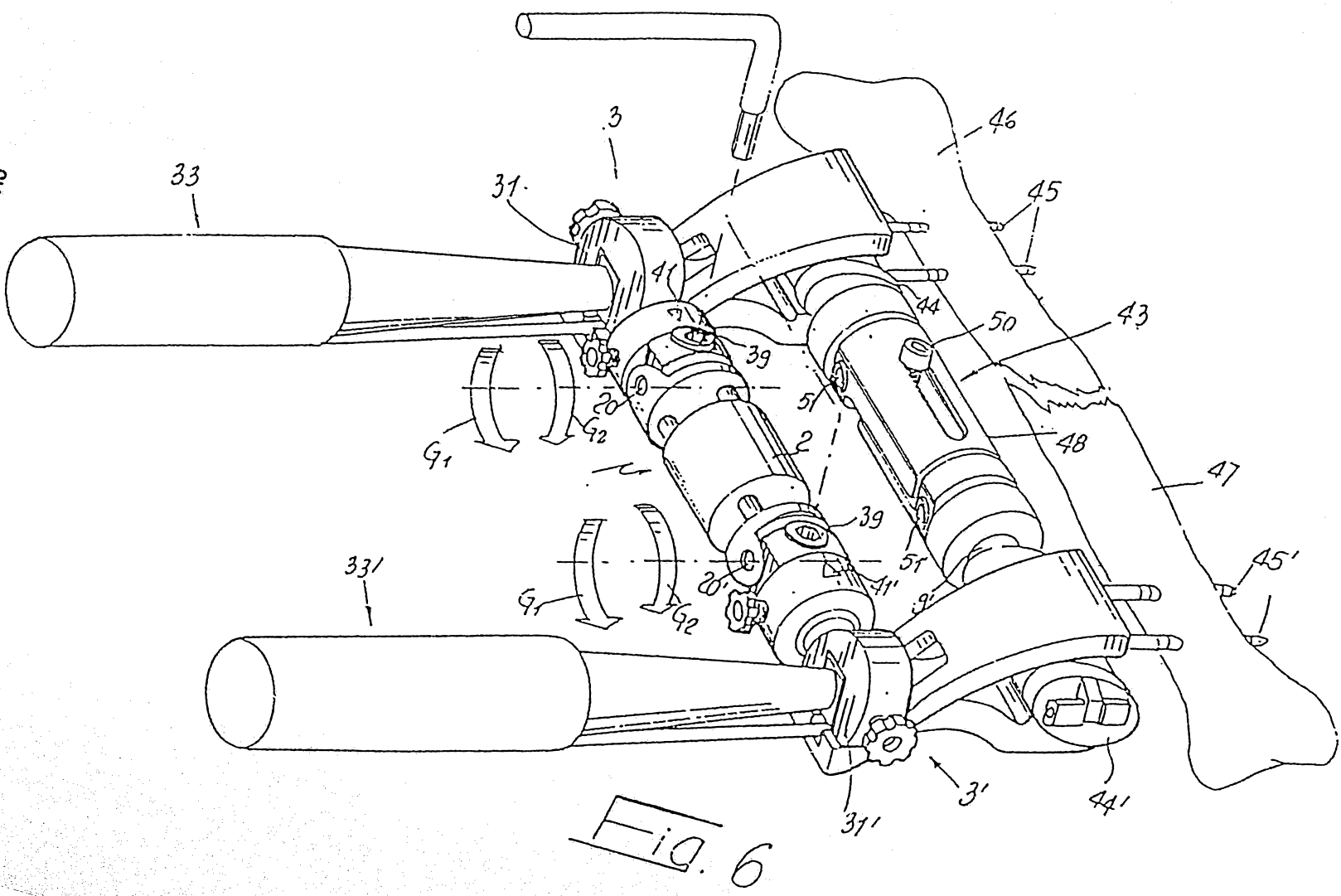


Fig. 5

SUBSTITUTE SHEET (RULE 26)
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP 94/00559

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 A61B17/60

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)

IPC 5 A61B

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 practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO,A,90 11727 (J.-M. HARDY) 18 October 1990 see page 8, line 30 - page 9, line 12; figure 2 -----	1



Further documents are listed in the continuation of box C.



Patent family members are listed in 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 document 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

30 May 1994

Date of mailing of the international search report

08.06.94

Name and mailing address of the ISA

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Authorized officer

Gérard, B

INTERNATIONAL SEARCH REPORT

International application No.

PCT/EP 94/00559

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 11
because they relate to subject matter not required to be searched by this Authority, namely:
Method of treatment of the human body by surgery.
Please see Rule 39.1(iv) PCT.
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest☐ The additional search fees were accompanied by the applicant's protest.☐ No protest accompanied the payment of additional search fees.

Information on patent family members

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A-9011727	18-10-90	FR-A- 2645428	12-10-90
		CA-A- 2031302	12-10-90
		EP-A- 0423299	24-04-91
		JP-T- 3505295	21-11-91
