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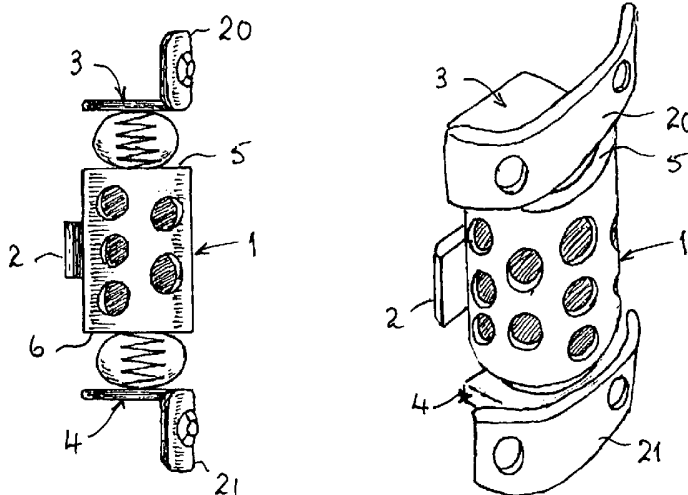
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SPINAL PROSTHESES



(57) Abstract: A spinal prosthesis has a prosthetic vertebral body in the form of a hollow cylinder (1) with perforated wall and attached prosthetic intervertebral discs formed by springs (7, 8) moulded into silicone-rubber beads (9, 10). Anchoring of the cylinder (1) to the damaged vertebra (II) is by means of entrapment of an elongate lug (12) of the cylinder 1 within a slot (16) of a plate (11) retained by screws (12) within a recess (13) of the damaged vertebra (II). The springs (7, 8) of the resilient beads (9, 10) are attached to the natural vertebrae (I, III) superior and inferior to the damaged vertebra (II) by fixing plates (3, 4) which have flanges (20, 21) that are held by screws (22) to those vertebrae (I, III). Where adjoining vertebrae are damaged, two or more prosthetic cylinder (1) for anchoring to the individual vertebra are used with interconnecting resilient beads (9, 10).

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Spinal Prostheses

5 This invention relates to spinal prostheses.

According to the present invention there is provided a spinal prosthesis comprising a prosthetic vertebral body having means for attaching it to a subject vertebra, two
10 resilient elements attached to opposite ends of the prosthetic vertebral body to provide respectively prosthetic intervertebral discs between the subject vertebra and the vertebrae superior and inferior to it, and means for attaching the resilient elements to their
15 respective superior and inferior vertebrae.

The spinal prosthesis of the invention is of a form that is readily applicable to replacement of cervical, lower thoracic and lumbar vertebrae and their discs, that have
20 been damaged by fracture or disease. It is of especial advantage in the context of a damaged cervical vertebra, for which the normal surgical practice is to replace it and its discs by a prosthetic vertebra that becomes fused to the natural vertebrae superior and inferior to it.

25 The result is that in addition to the loss of shock absorption in the affected vertebra, there is loss of rotational freedom too with the consequence that the patient loses in part or altogether, the ability to turn the head. This disadvantage can be entirely or largely
30 overcome using the prosthesis of the invention.

The prosthetic vertebral body of the spinal prosthesis of the present invention may be hollow with a perforated wall, for receiving bone chips or bone substitute. It
35 may be cylindrical or circular or other cross-section.

The resilient elements may involve coiled springs, and may each comprise a compression spring embedded in a resilient material, or a bead solely of resilient material. In either case, the resilient material may be
5 silicone rubber.

The means for attaching the two resilient elements to the respective superior and inferior vertebrae may include two fixing plates for screw attachment to the relevant
10 superior and inferior vertebra respectively. One of the resilient elements may, as an alternative where the superior or inferior vertebra is also damaged, be attached to a further prosthetic vertebral body that is attached to that vertebra.

15

A spinal prosthesis in accordance with the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

20 Figures 1 to 4 are, respectively, front, rear, side and perspective views of the spinal prosthesis of the invention;

Figure 5 is a sectional view illustrative of the
25 anchoring of the prosthetic vertebral body of the spinal prosthesis of Figures 1 to 4;

Figures 6 and 7 are illustrative of successive stages in bringing about the anchoring of the prosthetic vertebral
30 body illustrated in Figure 5; and

Figures 8 and 9 are anterior and lateral views respectively of the implanted spinal prosthesis of
Figures 1 to 4.

35

Referring to Figures 1 to 4 the spinal prosthesis, which in this case is for replacement of a fractured or

otherwise damaged cervical vertebra and its discs,
involves a prosthetic vertebral body in the form of a
hollow, metal cylinder 1 of circular cross-section having
a perforated wall. An elongate anchor lug 2 (Figures 2
and 4) is secured to the rear of the cylinder 1 to extend
5 transversely of it, and anchor plates 3 and 4 are
attached to end-caps 5 and 6 respectively of the cylinder
1 via individual, coiled compression-springs 7 and 8.
The springs 7 and 8 are moulded into respective beads 9
10 and 10 of silicone rubber.

Before the prosthetic assembly is implanted, the
cylinder 1 is filled with natural bone chips or bone-
substitute material, and is closed by screwing or bonding
15 the end-caps 5 and 6 to either end. Additionally, an
anterior portion of the damaged vertebra is cut away to
accommodate the cylinder 1, and the superior and inferior
intervertebral discs are removed. After this, as
illustrated in Figure 5, an elongate fixing plate 11 is
20 secured by screws 12 within the cut-away recess 13 of the
damaged vertebra, and the cylinder 1 is anchored to this
plate 11 by means of the lug 2.

More especially in the latter respect, and as illustrated
25 in Figure 6, the lug 2 has a bevelled leading-end 14 and
the cylinder 1 is moved onto the plate 11 to enter the
end 14 into a re-entrant end 15 of a slot 16 in the plate
11. With the leading-end 14 fully engaged in the re-
entrant end 15, the trailing-end 17 of the lug 2 is now
30 brought into the other end 18 of the slot 16 so as to
nest the lug 2 fully within the slot 16. In this
condition, a turn-screw 19 at the end 18 of the slot 16
is turned through half a turn to overlie the lug 2, as
illustrated in Figure 7, trapping it securely, and with
35 it the cylinder 1, to the plate 11.

Referring now also to Figures 8 and 9, the anchor plates 3 and 4 are secured respectively to the vertebrae I and III superior and inferior to the damaged vertebra II, with the beads 9 and 10 eased into the spaces left by the removed intervertebral discs. More particularly, curved flanges 20 and 21 of the plates 3 and 4 respectively abut the anterior faces of the natural vertebrae I and III and are firmly secured to them by screws 22.

After the prosthetic vertebral body formed by the cylinder 1 has been anchored and the prosthetic intervertebral discs formed by the beads 9 and 10 have been secured as described above, there will eventually be fusion of the bone chips or substitute bone within the cylinder 1. This will extend through the perforated wall of the cylinder 1 to the remaining part of the damaged vertebra II, and will be effective to restore to a large extent the original vertebral structure. The fusion can be enhanced by packing further bone chips or bone substitute around the cylinder 1 within the recess 13 as illustrated at 23 in Figure 8.

The form of prosthetic vertebra described above has the advantage that there is no fusion or locking together of vertebrae, and the natural degrees of flexion and extension together with rotation can be to a large extent preserved. The artificial discs formed by the beads 9 and 10 incorporating the springs 7 and 8 allow for relative vertebral movement. The springs 7 and 8 in particular are strong enough for the required load-bearing, and together with the silicone rubber in which they are moulded, provide a substantial degree of resilience for cushioning purposes. The fact that the beads 9 and 10 are attached through the plates 3 and 4 to the superior and inferior vertebrae I and III, as well as to the cylinder 1 ensures that they are securely retained in proper place.

The entire prosthetic complex of vertebral body and intervertebral discs formed by the cylinder 1 and attached beads 9 and 10, may be readily released for removal if this should be required, simply by unscrewing the four screws 22 and turning the screw 19 back from its overlapping position. The screws 12 may also be unscrewed for removal of the plate 11.

Although the prosthetic vertebral body described above is a cylinder 1 of circular cross-section, the cross-section may be different from this and indeed may be more oval so as to be more closely comparable with that of the natural vertebra. Furthermore, although the cylinder 1 is hollow and has a perforated wall, it may instead be a short length of tube with an imperforate wall, or a short length of rod; fusing of the tube or rod into the body of the vertebra may be enhanced in these circumstances by bone chips or bone substrate packed round it.

It is not necessary that the beads 9 and 10 incorporate discrete springs 7 and 8, in that they may instead be provided by solid beads wholly of silicone rubber or other resilient plastics material.

The invention has been described above in the context of cervical-vertebral prosthesis. Essentially the same principles of construction may be used for prosthesis of lower thoracic and lumbar vertebrae. Furthermore, although the prosthesis described is for use in connection with a single damaged vertebra, the same basic form may be extended for use where two or more adjoining vertebrae are damaged.

For example, a chain of two or more cylinders or other prosthetic vertebral bodies corresponding to the cylinder 1, may be used, each being attached to the next via a bead corresponding to the bead 9 (or 10) for use as the

intervening disc. Each of the two end vertebral bodies of such a chain would be attached to a plate corresponding to the plate 3 (or 4), via a bead corresponding to the bead 9 (or 10).

Claims:

1. A spinal prosthesis comprising a prosthetic vertebral body having means for anchoring it to a subject vertebra, two resilient elements attached to opposite ends of the prosthetic vertebral body to provide respectively prosthetic intervertebral discs between the subject vertebra and the vertebrae superior and inferior to it, and means for attaching the resilient elements to their respective superior and inferior vertebrae.

2. A spinal prosthesis according to Claim 1 wherein the prosthetic vertebral body is hollow to receive bone chips or bone substitute and has a perforated wall.

3. A spinal prosthesis according to Claim 1 or Claim 2 wherein the prosthetic vertebral body is cylindrical.

4. A spinal prosthesis according to Claim 1 wherein the prosthetic vertebral body is a rod or a tube.

5. A spinal prosthesis according to any one of Claims 1 to 4 wherein the means for anchoring the prosthetic vertebral body to the subject vertebra comprises a fixing plate for securing to the subject vertebra, an anchor lug secured to the prosthetic vertebral body for engagement with the fixing plate, and a selectively-operable device for retention of the anchor lug anchored to the fixing plate.

6. A spinal prosthesis according to Claim 5 wherein the anchor lug is elongate and the fixing plate has an elongate slot for receiving the anchor lug nested lengthwise within it, and the selectively-operable device is operable to trap the anchor lug within the slot.

7. A spinal prosthesis according to Claim 6 wherein one of the two ends of the slot is re-entrant for trapping one of the ends of the anchor lug within the slot, and the selectively-operable device is operable to trap the other end of the anchor lug within the slot.

8. A spinal prosthesis according to any one of Claims 1 to 7 wherein the resilient elements comprise coiled springs.

9. A spinal prosthesis according to Claim 8 wherein each of the resilient elements comprises a compression spring embedded in a resilient material.

10. A spinal prosthesis according to any one of Claims 1 to 7 wherein the resilient elements comprise beads of resilient material.

11. A spinal prosthesis according to Claim 9 or Claim 10 wherein the resilient material is silicone rubber.

12. A spinal prosthesis according to any one of Claims 1 to 11 wherein the means for attaching the two resilient elements to the respective superior and inferior vertebrae comprises two fixing plates for screw attachment to the superior and inferior vertebrae respectively.

13. A spinal prosthesis according to any one of Claims 1 to 11 wherein attachment of at least one of the resilient elements to its respective superior or inferior vertebra is to a further prosthetic vertebral body for anchoring to that respective vertebra.

14. A spinal prosthesis according to any one of Claims 1 to 11 wherein attachment of one of the resilient elements to its respective superior or inferior vertebra is to a

fixing plate for screw attachment to that vertebra, and attachment of the other of the resilient elements to its respective superior or inferior vertebra is to a further prosthetic vertebral body for anchoring to that respective vertebra.

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Fig. 1

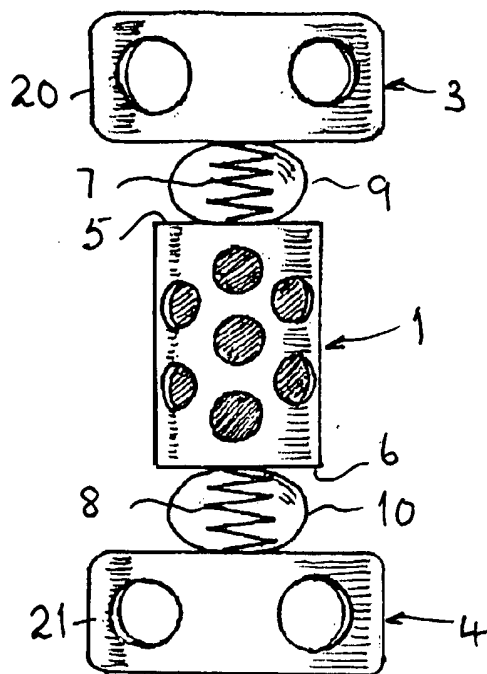


Fig. 2

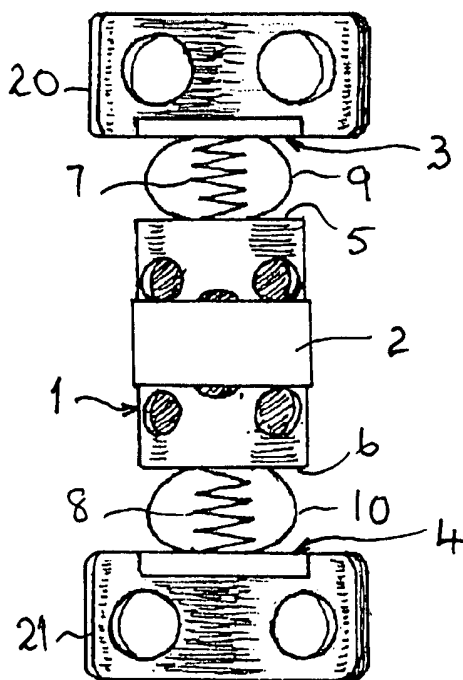


Fig. 3

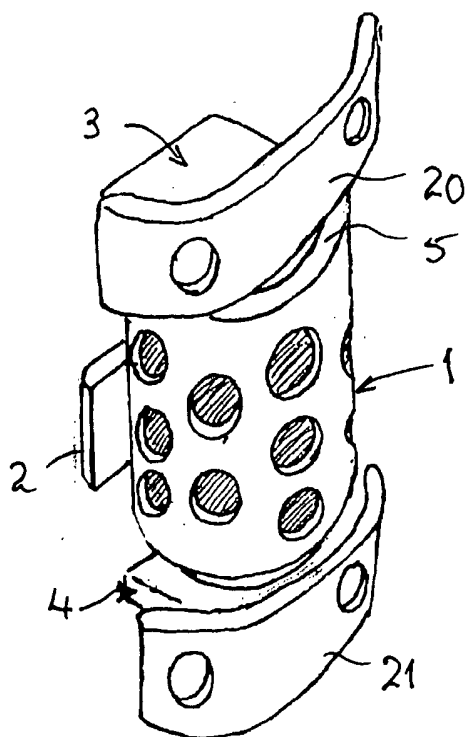
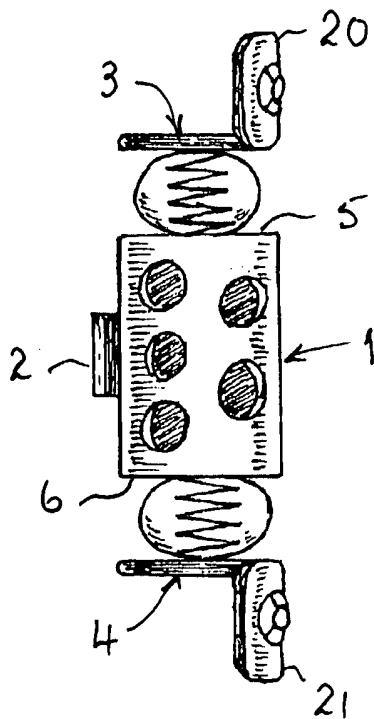


Fig. 4

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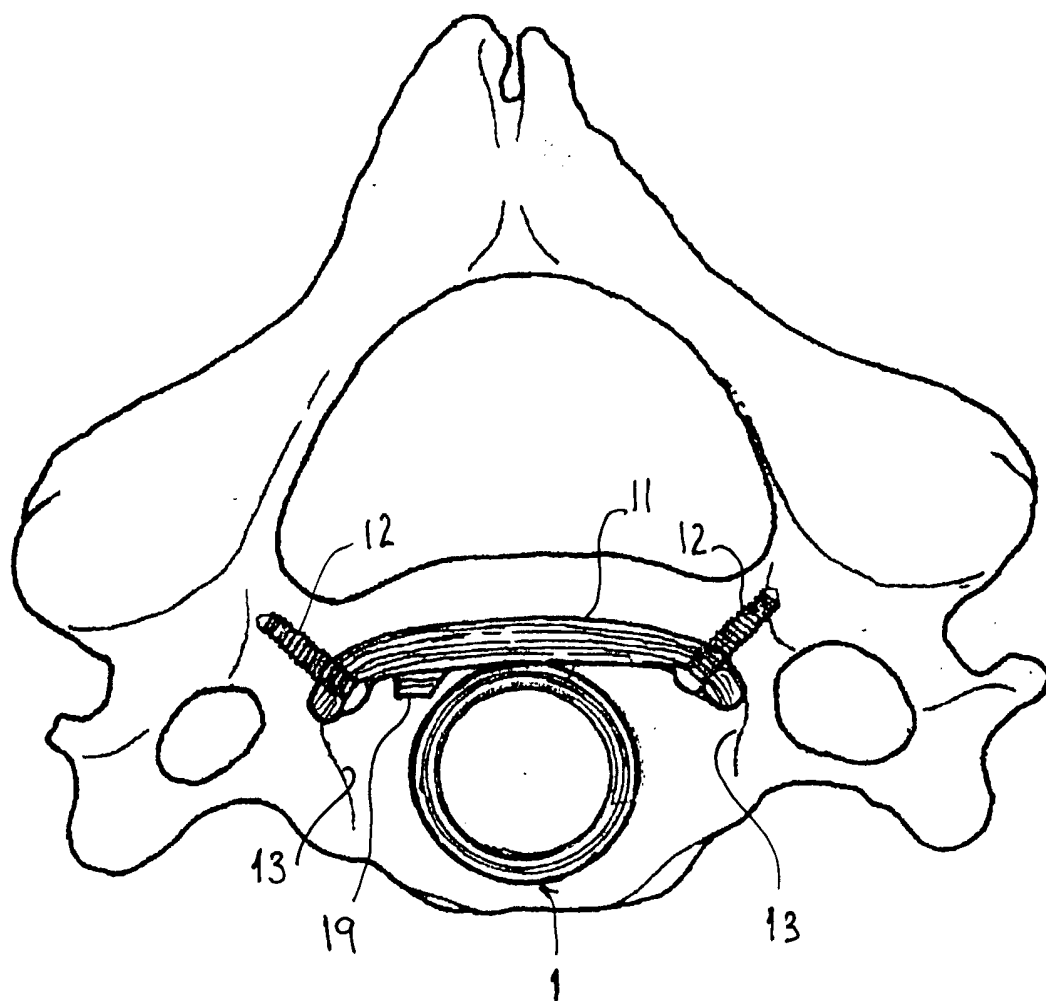


Fig. 5

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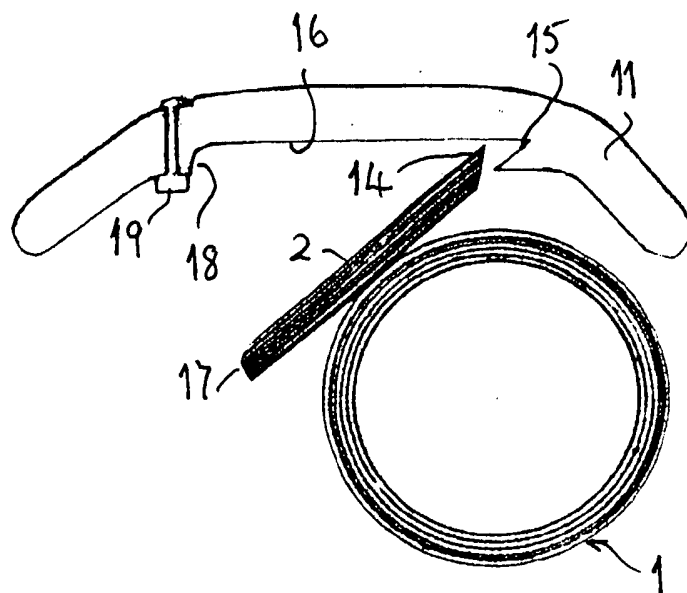


Fig. 6

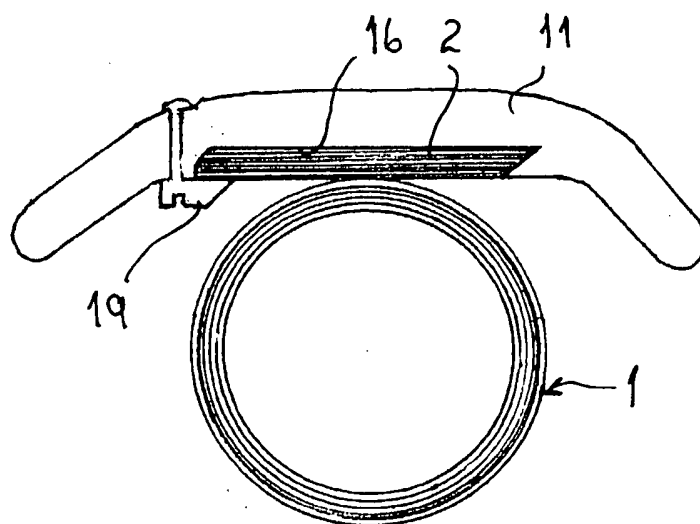


Fig. 7

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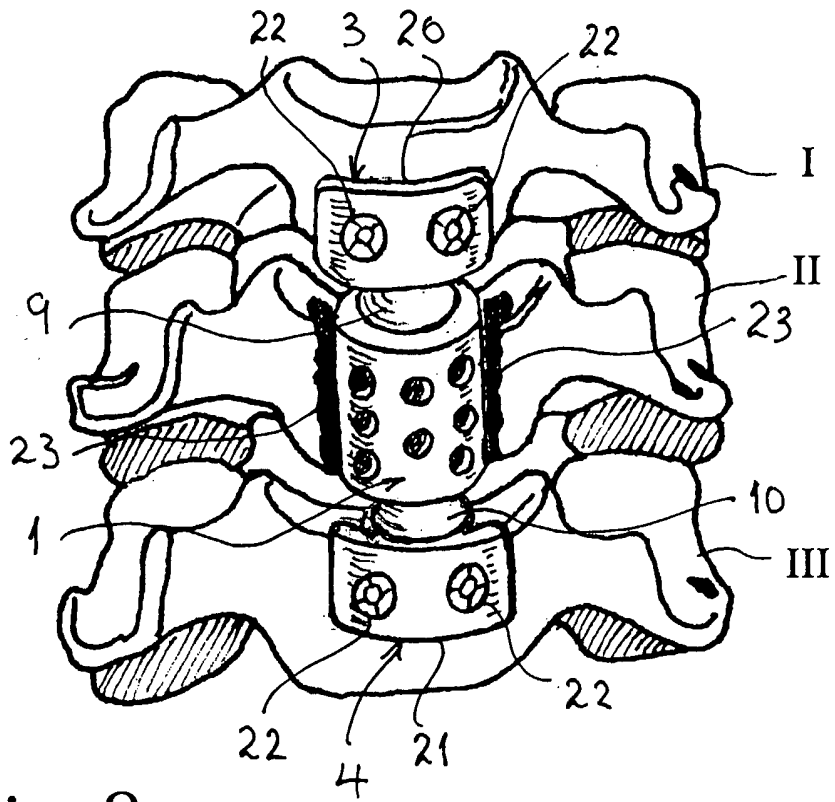
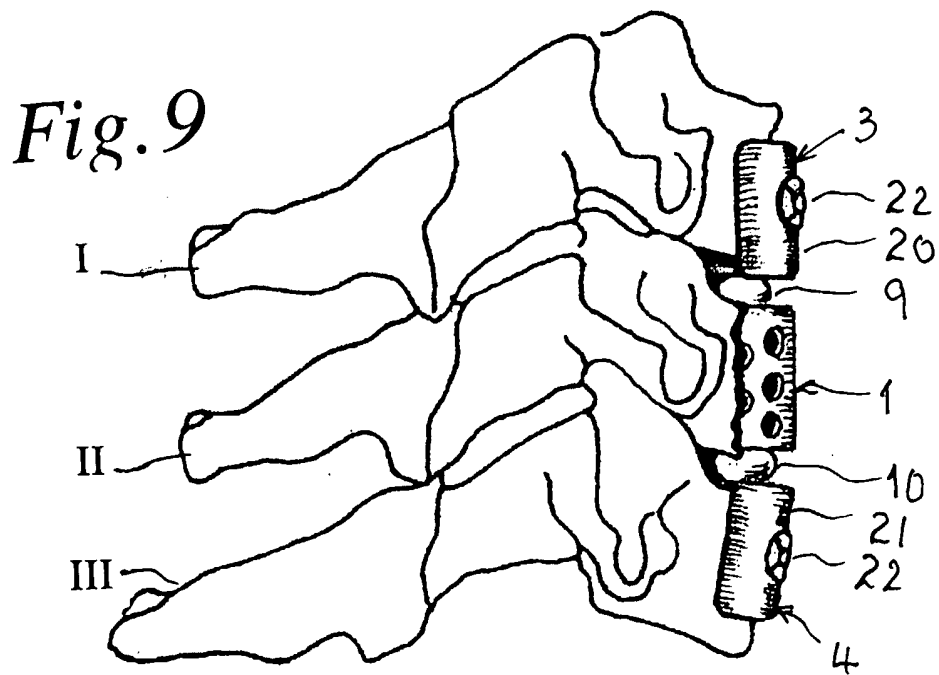


Fig. 8



INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
A61F2/44

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)
A61F

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)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	paragraph '0049! - paragraph '0055! -----	8-14
Y	DE 101 30 825 A1 (STEFFEN, HELGE) 7 March 2002 (2002-03-07) the whole document	8,9
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Date of the actual completion of the international search 15 February 2006	Date of mailing of the international search report 07/03/2006
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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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