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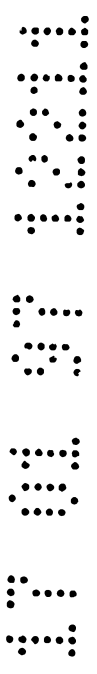
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# Spine Implant

## Abstract

Spine implant which is formed as hollow body (2) with at least one throughgoing opening (14) in a side wall for receiving bone material (26) and the surface of the implant predominantly having a roughness, wherein the hollow body (2) substantially has a round cross section over its entire length.



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**ORIGINAL**

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Invention Title:         Spine Implant

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

## Spine Implant

The invention relates to a spine implant which is formed as hollow body with at least one throughgoing opening in a side wall for receiving bone material and the surface of the implant predominantly having a roughness.

5 Intervertebral discs which are damaged generatively or traumatically or which are affected by disease can cause serious physical trouble. Thus, damaged or by disease affected discs can result in eg. a reduction of the space between two adjacent vertebrae such that a pressure on the nerves extending within the spine is created and thereby great pains are caused. Spine curvatures of large extents can be caused or the movability of  
10 two adjacent vertebrae can be strongly limited by a series of diseases, whereby the discs are affected.

For relief of symptoms which are caused by damaged or non healthy discs or which are related to those, it is known to insert implants between adjacent vertebrae in order to replace the affected discs at least partly whereby the implants have a stabilising  
15 function.

The EP O 307 241 B1 describes an implant for maintaining a desired space between vertebrae which is inserted in prepared grooves and which is roughened on the surface for interlocking with the grooves. Furthermore, the implant has at least one throughgoing slot for receiving bone graft material. The implant, preferably being a square block, is pushed into the grooves by means of a tool which is securely attached to  
20 an end of the implant. This has the disadvantage that at first the grooves have to be formed by taking out disc and bone material, whereby a high precision is necessary with the adaptation of the groove form to the form of the implant in order to achieve an exact and secure positioning of the implant. Especially with a square block implant it is  
25 difficult and takes time to avoid a cant. Corrections during the insertion of the implant are only possible with limitation.

It is an object of the present invention to overcome or ameliorate some of the disadvantages of the prior art, or at least to provide a useful alternative.

Accordingly, the invention provides a spine implant which is formed as a hollow  
30 body, said implant comprising a side wall with at least one throughgoing opening for receiving bone material and said implant having a roughened surface, wherein said hollow body has a substantially round cross section over its entire length, wherein said hollow body has an open end near which is located at least one pair of symmetrically opposed throughgoing cutouts for receiving a rod for connecting several implants,



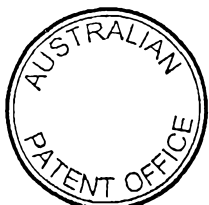
wherein said cutouts are slot-like and are located adjacent to said open end, wherein said cutouts have an inwardly directed end and are semi-circular at said inwardly directed end and wherein said semi-circular ends of said cutouts have a counterbore for receiving nuts having a collar, said nuts fixing a threaded rod.

5           The invention, at least in a preferred embodiment provides an intersomatic spine implant which is insertable easily and within relatively short time.

          The spine implant according to a preferred embodiment of the invention is a hollow body having at least one throughgoing opening in a side wall for receiving bone material. The outer surface of the hollow body has a certain roughness in order to ensure  
10 a better hold and in connection therewith also better conditions for an ingrowth. The hollow body

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is distinguished in that it substantially has a round cross section over its entire length.

It is provided that the implant is dorsally inserted into a defect disc parallel to the surface thereof. Thereby, the diameter of the implant is chosen so that the  
5 implant reaches into both vertebrae adjoining the disc above and below in order to allow fixation of the implant by growing to bone.

Due to the round cross section form of the implant, for the insertion a recess can be created by simple drilling at first which can be done in relatively short time. The bore can be of such extent that the implant only has to be pushed in.  
10 Alternatively, the hollow body can also comprise a self-cutting or self-forming external thread in order that the hollow body can be inserted into the prepared bore (cored hole) by turning-in, whereby the thread provides a sufficient hold in the spine.

Especially if the external thread is self-cutting, several throughgoing openings  
15 are provided in the side wall of the hollow body, the openings being formed as longitudinal nuts. With the nuts cutting edges are formed, which pass bone chips created during screwing-in into the inside of the hollow body. For screwing-in, at an end the hollow body can comprise means for turning using a tool.

An especially favourable shape of the hollow body is circular-cylindrical  
20 shape. At an end being opposed to the end inserted first, the hollow body can be open and closable with a cover. An advantage of such a closable end is that the hollow body can be filled with spongiose bone material and can subsequently be closed. The cover can be screwable onto the open end and can be formed, eg. as hexsocket head screw or as slotted or cross-slotted screw. The hexsocket and the  
25 slots in the cover, respectively, can simultaneously be the means for turning the hollow body upon screwing-in the hollow body into the spine.

At the dorsally located end, possibly being open as described above, the hollow body can be provided with one or several pairs of symmetrically opposed cutouts through transversely relative to the longitudinal axis in order to receive a  
30 rod which connects several implants inserted along the spine. Thereby, the inventive implant can also be employed as part of a device for bringing into line and stabilising, respectively, a damaged section of the spine. Thus, for instance the rod can be employed as distraction or compression rod.

The cutouts can be holes so that the rod is pushed subsequently through the  
35 implants from the side. If the hollow body is open at the dorsally located end, the cutouts can also be formed like slots extending from the edge of the open end in longitudinal direction of the hollow body. In this embodiment, the rod can be

simultaneously put into all provided implants. At its ventrally located end, the slot-like cutouts can be semi-circular for adaptation to the shape of the round rod.

For fixation of the rod a screwable cover as described above can be provided with a portion, preferably a portion of the thread shank, pressing against the rod which is put into the cutouts. It can also be provided that the rod has a thread for fixation at the implants. Nuts which engage at both sides by means of correspondingly formed portions with the holes or the slot-like cutout fix the implants at the rod. For that, the holes or the semi-circular portions of the slot-like cutouts can be provided with a counterbore, with which collars of the fixing nuts engage.

The hollow body can be closed at the end with which it is inserted and can be hemisphere-like curved in order to facilitate the inserting.

As material for production of the implant, metal is especially suitable, preferably titanium.

In the following some indications are listed, with the invention can be employed.

In case of intersomatic fusions, the implant can be used without fixation at a rod, whereby it preferably is closable with the described hexsocket head screw. In case of fusions after discitides, also of multi-segmental extension, the implant can be employed in connection with a rod in order to provide sufficient stabilisation and above all in order to avoid too strong movements. Such a multisegmental fixation is also provided for anterior distraction in case of juvenile kyphoses in order to form so called distraction instruments. Furthermore, the invention can be helpfully applied in case of anterior epiphyseodeses in connection with juvenile scolioses. Also in case of tumours or other lesions, the device according to the invention can be employed at the anterior spine.

In the following the invention will be illustrated in more detail with reference to drawings.

Fig. 1 shows an implant in elevational view and a screwable cover in elevational view and in top plan view.

Fig. 2 shows a rod with associated nuts for fixation the implant of Fig. 1.

Fig. 3 shows the components of Figs. 1 and 2 in perspective view as they are assembled as a device for bringing in line a damaged section of the spine.

Fig. 1a shows an implant 2 according to the invention which is formed as hollow body having an open end 4 which is closable with a cover in form of a hexsocket head screw 6 (shown in Figs. 1c and 1d). The hollow body of the implant

2 is circular-cylindrical and comprises a self cutting external thread 8 which extends over the major part of the surface of the implant 2 between the open end 4 and an opposed end 10. Longitudinal throughgoing grooves 14 which are aligned parallel to the longitudinal axis 12 extend in the side wall of the hollow body over the area of the thread 8, whereby the longitudinal grooves form cutting edges for the thread 8. The closed end 10 is formed like a hemisphere.

Fig. 1b shows the implant 2 (also without the hexsocket head screw 6) turned by 90° relative to the representation in Fig. 1a. In this elevational view of the implant 2, two diametrically opposite slot-like cutouts 16 can be seen which extend within an area having no thread from the edge of the open end 4 parallel to the longitudinal axis 12 of the implant. The cutouts 16 are semi-circular at their inwardly directed end 18. The semi-circular portion of the cutouts is radially outside provided with a counterbore 20 for engagement with a nut 22 (comp. Fig. 2) which is used for fixation of a rod 23 put into the cutout 16 as is illustrated below in more detail.

In Fig. 1c a hexsocket head screw 6 is shown, in the upper part of the Figure in elevational view and in the lower part in top plan view. The screw comprises a thread 24 (shown in Fig. 1d) and a hexsocket 26.

Fig. 1d shows the implant 2 filled with spongy bone material 26 and with the hexsocket head screw 6 screwed on.

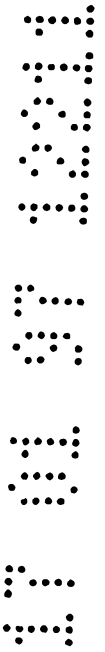
The implant 2 is dorsally and in pairs inserted into a defect disc such that both implants lie side-by-side symmetrically with a certain space in the plane of the disc. For that purpose, at first a hole can be bored which has approximately the core diameter of the implant 2, in order to screw this in subsequently. The diameter of the implant is chosen so that the implant upwardly and downwardly extends over the disc into bone material of the adjacent vertebrae in order to achieve a firm anchorage of the implant.

The implant can be screwed-in using a screwdriver-like tool, the blade of which is inserted into the cutout 16. Alternatively, the implant can also be screwed-in using a hexagonal screwdriver inserted into the hexsocket 26.

Fig. 2 shows an above mentioned rod 23 which is insertable into the cutout 16 and with which several implants 2 can be connected with each other in order to constitute a device for bringing into line a damaged spine section. The rod 23 has a thread (not shown) for screwing-on nuts 22 of which one is shown in elevational view and in top plan view in Fig. 2. The nuts 22 have a collar 28 the form of which is adapted to the counterbore 20 to engage with the inwardly directed cutout end 18 of the implant 2.

Fig. 3 shows a device for bringing into line a damaged spine section, the device being composed of components as shown in Fig. 1 and 2, whereby same parts are denoted by the same reference numbers.

The device comprises two implants 2 connected by a thread rod 23 which is  
 5 put into the cutout 16 of the two implants. A pair of nuts 22 is provided for each implant for fixation of the rod 23, the nuts being screwed onto the rod 23 and engaging with the inwardly directed ends 18 of the cutouts 16. By means of the hexsocket head screws 6 the open ends 4 of the implants and thus the cutouts can be closed. Therefore, the rod is more or less loosely held on the implants 2. A pre-  
 10 fixation can be carried out using the hexsocket head screws 6. The final fixation can be done using the nuts 22. By turning only one nut, the implants can also be put under stress towards each other or away from each other (compressing - distracting).



The claims defining the invention are as follows:

1. A spine implant which is formed as a hollow body, said implant comprising a side wall with at least one throughgoing opening for receiving bone material and said implant having a roughened surface, wherein said hollow body has a substantially round cross section over its entire length, wherein said hollow body has an open end near which is located at least one pair of symmetrically opposed throughgoing cutouts for receiving a rod for connecting several implants, wherein said cutouts are slot-like and are located adjacent to said open end, wherein said cutouts have an inwardly directed end and are semi-circular at said inwardly directed end and wherein said semi-circular ends of said cutouts have a counterbore for receiving nuts having a collar, said nuts fixing a threaded rod.
2. Implant according to claim 1, wherein the hollow body substantially has a circular-cylindrical shape.
3. Implant according to claim 1 or claim 2, wherein the hollow body comprises a self-cutting or self forming external thread.
4. Implant according to claim 3, wherein at an end the hollow body comprises means for turning the body using a tool.
5. Implant according to any one of claims 1 to 4, wherein said open end can be closed with a cover.
6. Implant according to claim 5, wherein the cover is a hexsocket head screw.
7. Implant according to claim 5, wherein the cover is a slotted or cross-slotted screw.
8. Implant according to any one of claims 1 to 7, wherein the cutouts are holes.
9. Implant according to any one of claims 5 to 8, wherein the cover can be screwed so far that it presses against the rod in the cutout.
10. Implant according to any one of the preceding claims, wherein the hollow body has a closed end being hemisphere-like curved.
11. Implant according to any one of the preceding claims, wherein the throughgoing openings in the side wall are formed as longitudinal grooves.
12. Implant according to any one of the preceding claims, wherein said implant is made of metal.
13. Implant according to claim 12, wherein said implant is made of titanium.



14. A spine implant, substantially as hereinbefore described with reference to any one of the embodiments of the invention shown in the accompanying drawings.

**Dated 2 December, 1999**

**Howmedica GmbH**

**Patent Attorneys for the Applicant/Nominated Person**

**SPRUSON & FERGUSON**

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Fig. 1

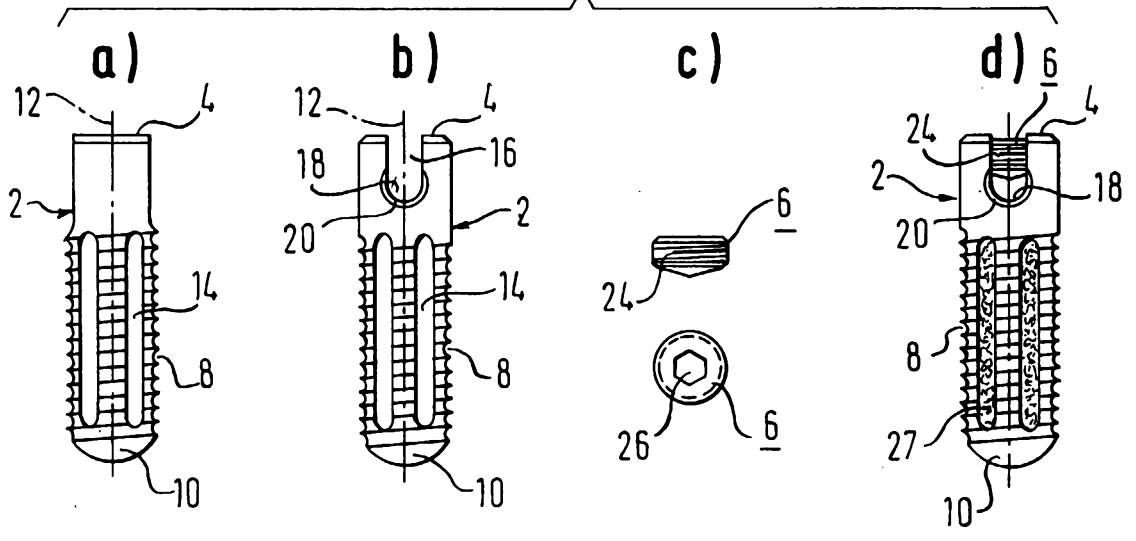


Fig. 2

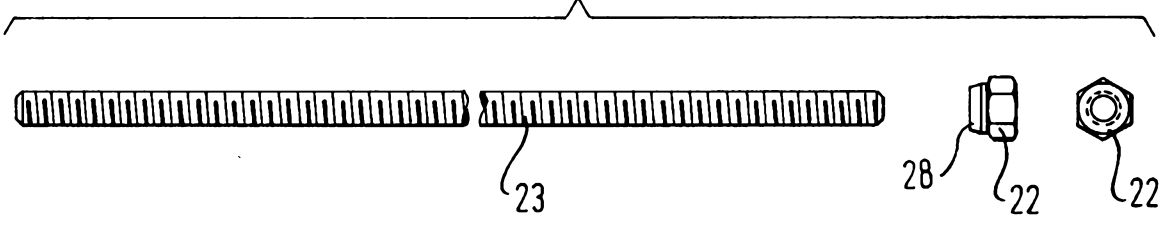


Fig. 3

