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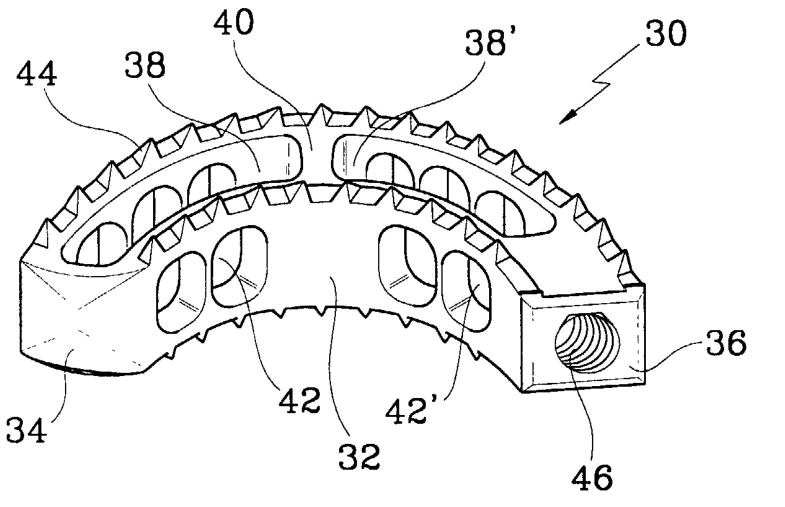
(54) **Title:** A PROSTHETIC IMPLANT FOR SPINAL INTERBODY FUSION AND A INSERTING APPARATUS THEREOF



(57) **Abstract:** A prosthetic implant for vertebral interbody fusion and an apparatus for inserting the implant into a fitting space formed between adjoining vertebrae are disclosed. The prosthetic implant includes an implant body having a curved polygonal column shape, which has an inner passage formed therethough and a plurality of through holes communicated with the inner passage, and which has a plurality of locking protrusions as its outer surface to be in contact with the adjoining vertebrae, a front head connected to the implant body and adapted to be first inserted the fitting space, and a rear tail connected to a rear end of the implant body and adapted to be coupled to an inserting apparatus in a surgical operation. The apparatus includes an outer rod having a longitudinal internally threaded hole formed therein, an inner rod screwed into the internally threaded hole of the outer rod, and a connecting member coupled at its front end to the coupling portion of the prosthetic implant and at its rear end to the inner rod, which is movable by cooperation of the outer and inner rods.

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A PROSTHETIC IMPLANT FOR SPINAL INTERBODY FUSION AND A INSERTING APPARATUS THEREOF

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a prosthetic implant used in vertebral interbody fusion and an apparatus for inserting the prosthetic implant.

Description of the Prior Art

A spine of a human being comprises vertebrae and fibrocartilaginous discs (commonly called "disc") interposed between the vertebrae, and reinforced by ligaments and muscles attached thereto from cranial bones to pelvic bones, thereby supporting a human body and maintaining the body's equilibrium.

Fig. 1 shows a perspective view of a part of a human spine when viewed from the rear (with intervertebral discs being separated therefrom for simplicity), and Fig. 2 shows a plan view of the human spine of Fig. 1. As shown in the drawings, a vertebra comprises a vertebral body 2, a spinous process 4 protruded from a rear side of the vertebral body 2, transverse processes 6 disposed at both sides of the spinous process 4, upper and lower articular processes 8', 8, and a pedicle 10 connecting a front part of the vertebra to a rear part of the vertebra. The intervertebral disc 12 comprises an annulus fibrosus and a nucleus pulposus. The intervertebral disc 12 has a shape and a size changing according to where the disc is positioned. Because an adult intervertebral disc does not contain blood vessels therein, its cells absorb nutriment by diffusion through a central hole of an epiphyseal plate of a vertebral body, in which the diffusion is promoted by movement and weight of the vertebral body.

In general, lower back pain of a lower lumbar part is caused by rupture or degeneration of a lumbar intervertebral disc. Pain in the lower extremities(sciatica) is caused by compression of spinal nerve roots by damaged discs between the vertebrae, and lower back pain is caused by collapse of the disc and adverse effects of bearing the majority of the body weight on a damaged unstable vertebral joint. Surgical treatments for these conditions fall into the following groups: 1) excision of the ruptured soft disc (the procedure removes the portion of the disc compressing the spinal nerve and is generally successful in relieving sciatic leg pain and pain in the sciatica; 2) disc excision with posterior fusion; 3) disc excision with anterior interbody fusion; and 4) disc excision with posterior lumbar intervertebral fusion.

In the above procedures, a solid bony fusion mass is interposed between vertebral bodies in order to relieve the mechanical pain of the traditional unstable degenerative disc and prevent long term disc collapse or further degenerative changes. At this point, because it is difficult to obtain a large enough quantity of autogenous bone with sufficient strength, homologous bank bone is generally used. However, the homologous bank bone requires a much longer time to grow together and is not able to support body weight. In addition, the homologous bank bone requires a long time to achieve complete interbody fusion and has a higher failure rate, estimated at three times higher than the failure rate with the patient's own bone.

U.S. Pat. No. 4,743,256 discloses an improved surgical method comprising preparing a permanent strut spanning a disc space, locating a plug at a predetermined site on a vertebra to fuse the plug to the vertebra, inserting the plug having a porous metal surface allowing ingrowth of bone cells into the plug while maintaining a disc space between the adjoining vertebrae, for preventing back pain due to ruptured or degenerated vertebral discs. The plug has an end surface receiving a tool for facilitating insertion at the predetermined site and is provided with an irregular rough surface to improve ingrowth of bone cells. To form channels at the predetermined sites on the opposing faces of the adjoining vertebrae, posterior sides of the adjoining vertebrae are drilled by a drill surrounded by a guide having protrusions. It is preferable that the channels are not fully extended to the anterior sides of the vertebrae.

Korean Pat. Publication No. 92-3405, which is owned by the same applicant as the above U.S. Pat. No. 4,743,256, discloses a prosthetic implant further improved beyond U.S. Pat.. According to the Korean. Pat., a prosthetic implant traversing a predetermined region between opposing faces of adjoining vertebrae is disclosed. Each of the prosthetic implant has uneven surfaces locked between the opposing faces of the adjoining vertebrae to allow ingrowth of cells. The prosthetic implant has means for receiving a tool, which is extended into the implant, and an end face to facilitate insertion of the prosthetic implant. Also, the prosthetic implant is an inert rigid implant adapted to maintain a required disc space between adjoining vertebrae, and has a predetermined size and shape to provide a transverse strut at the predetermined region. Fig. 3 shows a perspective view of an embodiment of a prior art prosthetic implant.

The prosthetic implant 20 is intended to be directly inserted into an intervertebral space rather than being screwed into a threaded hole of an intervertebral disc. That is, the prosthetic implant is inserted into the fitting space by means of an appropriate tool to support vertebrae, and the tool is removed from the prosthetic implant while maintaining the implant to be immovable, thereby allowing ingrowth of cells of vertebral bones in contact with the implant to be easy. In this case, the prosthetic implant is provided at its outer surfaces with a plurality of protrusions 22 to enable the implant to be firmly held in the intervertebral space.

In a surgical operation for remedying degenerative disc disease by inserting such a prosthetic implant 20 into an intervertebral space, even though there is pain at only one leg, an intervertebral disc 12 is dissected at its both sides, and prosthetic implants 20 are respectively inserted into the both cut portions, as indicated by the arrows A, A' in Fig. 4.

Therefore, since a spinal nerve root, which is related with a body portion that does not feel pain before the surgical operation, must be also displaced to allow the prosthetic implant to be inserted therethrough, a spinal cord 24 and a spinal nerve 26 are affected by the displacement, thereby causing pain.

Furthermore, if an intervertebral space is undesirably destroyed when the prosthetic implant 20 enters the fitting space, or if the inserting operation of the prosthetic implant is not smooth in case of the fitting space being not destroyed, the fixation of the prosthetic implant at a final position may be unstable or the insertion of the implant may not be easy. That is, since the prior art prosthetic implant 20 as shown in Fig. 3 has the same width and height at its front end and rear end, the above problems cannot be avoided.

SUMMARY OF THE INVENTION

Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an object of the present invention is to provide a prosthetic implant for vertebral interbody fusion and an apparatus for inserting the prosthetic implant which are intended to be inserted through dissection at only one side of an intervertebral disc, and to be adequately fixed and corrected, thereby allowing the surgical operation to be easily completed in a short period of time.

It is another object of the present invention to provide a prosthetic implant, which can be easily inserted into a fitting space and stably, fixed in position.

In order to accomplish the above object, the present invention provides a prosthetic implant for vertebral interbody fusion which is inserted into a fitting space formed between adjoining vertebrae to restore an intervertebral space, is free from shifting, and fuses the adjoining vertebrae, comprising: an implant body having a polygonal column shape curved at a predetermined curvature, which has a longitudinal inner passage formed therethrough and a plurality of through holes communicated with the inner passage, and which is provided with a plurality of locking protrusions at its outer surface to be in contact with opposing faces of the adjoining vertebrae; a front head connected to a front end of the implant body and adapted to be first inserted into the fitting space; and a rear tail connected to a rear end of the implant body and adapted to be coupled to an inserting apparatus in a surgical operation.

The front head may be integrally connected at its rear end to the front end of the implant body, and may be pointed forwardly at its front end.

The implant body may be divided into a plurality of sub implant bodies. Preferably, the implant body is divided into two sub bodies.

The implant body may be provided at its lateral face with a slit to give resiliency to the implant body when the implant body is inserted in the fitting space, thereby promoting fusion between the prosthetic implant and the adjoining vertebrae and absorbing shocks.

In order to accomplish the above object, the present invention also provides an apparatus for inserting a prosthetic implant having a rear coupling portion into a fitting space formed between adjoining vertebrae, comprising:

an outer rod having a longitudinal internally threaded hole formed therein; an inner rod screwed into the internally threaded hole of the outer rod; and a connecting member coupled at its front end to the coupling portion of the prosthetic implant and at its rear end to the inner rod, which is movable by cooperation of the outer and inner rods.

The connecting member may comprise a base portion and a threaded protrusion adapted to be coupled to the rear coupling portion of the prosthetic implant, and the base portion may be hingedly connected at its one end to a front end of the outer rod and at its other end to a front end of a connecting rod, the other end of the connecting rod being connected to a front end of a stationary rod coupled to the inner rod.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 shows a perspective view of a part of a human spine when viewed from the rear (with intervertebral discs being separated therefrom);

Fig. 2 shows a plan view of the human spine of Fig. 1;

Fig. 3 shows a perspective view of an embodiment of a prior art prosthetic implant;

Fig. 4 is a schematic view showing a procedure of inserting a prior art prosthetic implant;

Fig. 5 shows a perspective view of a prosthetic implant for vertebral interbody fusion according to the present invention;

Fig. 6 shows a perspective view of another embodiment of a prosthetic implant for vertebral interbody fusion according to the present invention;

Fig. 7 shows a perspective view of still another embodiment of a prosthetic implant for vertebral interbody fusion according to the present invention;

Fig. 8 shows a perspective view of still another embodiment of a prosthetic implant for vertebral interbody fusion according to the present invention;

Fig. 9 shows a perspective view of an embodiment of an apparatus for inserting the prosthetic implant according to the present invention;

Fig. 10 shows a procedure of inserting the prosthetic implant into a fitting space between vertebrae according to the present invention;

Fig. 11 shows a perspective view of another embodiment of an apparatus for inserting the prosthetic implant according to the present invention;

Fig. 12 shows an operation of the apparatus according to the present invention of Fig. 11; and

Fig. 13 shows an operation of the apparatus according to the present invention, in which an outer rod is removed therefrom for clearer understanding

DETAILED DESCRIPTION OF THE INVENTION

The invention will be described in further detail by way of an example with reference to the accompanying drawings.

Fig. 5 shows a prosthetic implant for vertebral interbody fusion according to the present invention. As shown in the drawing, the prosthetic implant 30 comprises a 4-sided column body 32, which is curved at a predetermined curvature, a front ingression head 34 located at a front end of the implant body 32, and a rear tail 36 located at a rear end of the body 32.

The implant body 32 is axially provided with an inner passage. The inner passage is divided into two sub passages 38 and 38' by a partition wall 40 disposed at the middle portion of the implant body. The implant body 32 is provided at its both sides with a plurality of through holes 42 and 42', which are communicated with the inner passages 38 and 38'. The inner passages 38 and 38' function to receive bone growth material together with the through holes 42 and 42' when the prosthetic implant is inserted into a fitting space between vertebrae, thereby promoting growth of intervertebral bone tissue. Though the bone growth material can be somewhat charged into the inner passages after the prosthetic implant is inserted into the intervertebral space, the bone growth material is typically charged into the inner passages and then inserted into the intervertebral space.

The through holes 42 and 42' also serve to facilitate interpretation of a radiation photograph.

The implant body 32 is provided at its upper and lower surfaces with a plurality of locking protrusions 44, which contact with opposing faces of adjoining vertebrae. Each of the locking protrusions 44 includes a front face having a gentle slope and a rear face having an abrupt slope (or a vertical face). Accordingly, the prosthetic implant can be easily inserted into the intervertebral space by contact between opposing faces of vertebrae and the gently inclined faces, but the prosthetic implant is hard to be pulled out of the intervertebral space due to engagement of the abrupt faces of the locking protrusions with the opposing faces of the vertebrae once the prosthetic implant is inserted.

Though it is preferable that the implant body is a 4-sided coulmn, the implant body may be shaped into a polygonal column. Furthermore, positions, numbers, shapes and sizes of the through holes 42 communicating with the inner passages 38 and 38' and the locking protrusions are not limited to those shown in the accompanying drawings, and may have various modifications and variations. That is, though the implant body is shown in the drawings as being opened at its upper and lower faces, the openings may be partly closed or partly changed into shapes of through holes. Also, though the locking protrusions are shown as taking a shape of a quadrangular pyramid, the faces of the protrusions may be inclined in any direction. In addition, the locking protrusions may be provided at lateral faces of the prosthetic implant. However, to accumulate a larger amount of sclerites and blood on the bone growth material charged in the implant body 32, it is preferable to provide the locking protrusions at least at the upper face.

The implant body 32 may be curved at different curvatures along its length, rather than at a constant curvature.

The front ingression head 34 is positioned at the front end of the implant body 32 and firstly enters a fitting space, and the rear end of the front head 34 is connected to the implant body 32 and the front end of the front head 34 is pointed forwardly to have a quadrangular pyramidal shape. Edges and the apex of the front head are smoothly rounded.

The tip of the front head may take a rounded form. In this case, though the tip may take a perfect circular form in section, the tip may also take an elliptical form.

The rear tail 36 of the implant body 32 is positioned at the rear end of the body, and has a threaded hole 46 which is adapted to be coupled to an inserting apparatus during a surgical operation.

The prosthetic implant 30 may be made of rigid inert metal such as stainless steel, Co-Cr-Mo alloy and titanium. The locking protrusions 44 may be made of the same material as that of the implant body 32, or may be made of material different from that of the implant body 32, such as copolymer resin. The implant body 30 may be made of polysulfone such as plastic, polycarbonate, polypropylene, polyacetylene and polyethylene, glass, or radiolucent material charged with carbon fiber. The plastic material may be shaped by an injection molding process.

Referring to Figs. 6 and 7, there are shown other embodiments of the implant body according to the present invention. As shown in the drawings, the implant body is provided with slits 48 and 48'. The slits 48 and 48' are formed at the front end and rear end of the implant body.

The slits 48 and 48' are formed to be completely extended between both lateral faces of the implant body, as shown in Fig. 6.

In another embodiment, the slits 48 and 48' are formed to be extended horizontally from the inner curved surface to the respective centers of the front head and rear tail of the implant body, respectively, as shown in Fig. 7. In any embodiment, upper and lower sections of the implant body divided by the slits 48 and 48' must be resiliently spaced from each other after external force acting on them is released. Functions obtained by the above construction having the slits will now be described as follows.

Regeneration of bone tissue can occur by physical force, or minute electrical stimulation. In other words, generation of bone tissue occurs at a region subjected to higher stress (usually measured in force per unit area) and adequate mechanical stimulation such as micromotion, while osteoplysis of bone tissue occurs at a region subjected to lower load. According to such regeneration mechanism of bone tissue, firm fixation of the implant may affect regeneration of bone tissue, and difference of hardness between bone tissue and a metal may induce osteplysis of bone tissue. For example, steel material has a strength 10 times higher than that of bone tissue. Where fixation of vertebrae is achieved by metal having such high strength, osteplysis of bone tissue occurs locally because normal stress is not transferred to bone tissue when being subjected to load. Therefore, since a structure of generated bone tissue become weak, it is at high risk of bone fracture. Such phenomenon is also referred as "stress shielding". Also, large differences of strength between a bone and a prosthetic implant are likely to induce loosening of the contact between the bone tissue and the prosthetic implant (phenomenon in which fixation between bone tissue and a prosthetic implant become weak).

Where the prosthetic implant is provided at its sides with the slits 48 and 48', as shown in Figs. 6 and 7, even though a vertebral column having the prosthetic implant therein is vertically applied with a sudden impact, the implant body can be somewhat deformed to absorb the shock by its resiliency. This allows sufficient load and adequate mechanical stress to be transferred to sclerites filled in the prosthetic implant, thereby providing a condition suitable to regeneration of bone tissue.

Referring to Fig. 8, there is still another embodiment of the prosthetic implant according to the present invention. As shown in the drawing, the prosthetic implant is divided into two sub implant bodies at its partition wall, which are detachably coupled to each other. The sub implant bodies are provided at their opposing faces with a horizontal sliding groove 50 and a mating sliding protrusion 52, respectively. The sub implant bodies are formed at their boundary portion with pin holes 50 into which pin members 54 are inserted, thereby allowing the two sub implant bodies to be detachably coupled to each other. Alternatively, the implant body may be divided into three or more sub implant bodies if required.

Referring to Fig. 9, there is shown an embodiment of an apparatus of the present invention, which is intended to allow insertion of the prosthetic implant into a fitting space previously formed in a space between vertebrae of a patient.

As shown in the drawing, the apparatus for inserting the prosthetic implant according to the present invention is adapted to be coupled to the threaded hole 46 of the prosthetic implant 30. The apparatus of the invention comprises an outer rod 60 having an internally threaded hole 58, a connecting member to be screwed at its end into the threaded hole of the prosthetic implant 30, and an inner rod 64 screwed into the internally threaded hole 58 of the outer rod 60 and coupled to the other end of the connecting member 62. The connecting member 62 is coupled to the inner rod 64 by means of a pin 66.

The outer rod 60 comprises a cylindrical pipe 68 and a flange handle 70 provided at a rear end of the pipe part 68. The flange handle 70 is knurled at its outer surface to enhance its gripping force. The outer rod 60 is also provided with a plain hole 72 at its inner surface before the internal threaded hole 58.

The connecting member 62 includes a threaded protrusion 74 to be screwed into the threaded hole 46, a tongue portion 76 to be coupled to a front end of the inner rod 64, and a middle portion 78 disposed between the threaded protrusion 74 and the tongue portion 76 and to be slid in the plain hole 72 of the outer rod 60. The tongue portion 76 is projected from the meddle portion 78, and provided with a hole into which the pin 66 is inserted. The connection member 62 causes the prosthetic implant 30 to be rotated by cooperation of the outer rod 60 and the inner rod 64.

In this embodiment, though the coupling between the prosthetic implant and the apparatus is shown as being embodied by thread engagement, the coupling may be performed in various other manners.

The inner rod 64 comprises a sliding portion 82 slidably disposed in the plain hole 72, a threaded portion 84 engaged with the internal threaded hole 58, and a flange handle 86 provided at the rear end of the threaded portion 84. The flange handle 86 is also knurled at its outer surface to enhance its gripping force. The sliding portion 82 of the inner rod 64 is provided at its front end with a longitudinal slit 88 into which the tongue portion 76 of the connecting member 62 is inserted, and provided with a pin hole 90 perpendicular to the slit 88 into which the pin 66 is inserted.

Referring to Fig. 10, there is shown a procedure of inserting the prosthetic implant into a fitting space formed by dissecting only one side of intervertebral disc according to the present invention.

As first shown in Fig. 10A, after the inner rod 64 is screwed into the outer rod 60, the connecting member 62 is coupled to the sliding portion 82 projected from the front end of the outer rod 60 by inserting the pin 66 into the pin hole 80 of the connecting member 62 and the pin hole 90 of the inner rod 64. Subsequently, the prosthetic implant 30 is coupled to the threaded protrusion 74. The prosthetic implant 30 is inserted into a fitting space of an intervertebral disc in the direction from a dorsal to ventral side of a patient such that the threaded protrusion of the connecting member 62 is directed upward and rightward. Thereafter, the outer rod 60 is rotated clockwise by rotating the flange handle 70 while the inserting apparatus is pushed forwardly as indicated by the arrow "P", so that the connecting member 62 is pushed by the front end of the outer rod 60. Consequently, the prosthetic implant 30 is pushed into an intervertebral space. This condition is shown in Fig. 10B.

The outer rod 60 is further rotated clockwise by rotation of the flange handle 70 while the inserting apparatus is pushed as indicated by the arrow "P", so that the prosthetic implant 30 is seated in the intervertebral space, as shown in Fig. 10C. During insertion of the prosthetic implant, the inner rod 64 is not rotated.

At this point, since the front ingression head 34 of the prosthetic implant 30 is pointed forward, the prosthetic implant is subjected to little resistance at an initial portion of the fitting space. When the prosthetic implant 30 is completely inserted to its rear end, the implant body 32 is engaged with bone tissue at its outer surface, thereby being subjected to resistance in its ingression. Additionally, since the implant body 32 is provided at its upper and lower surfaces with a plurality of locking protrusions 44, the resistance to displacement of the implant body 32 can be further increased.

As shown in Fig. 10C, after the prosthetic implant 30 is completely seated, the inner rod 64 is rotated counterclockwise while preventing the outer rod 60 from being rotated, so that the threaded protrusions 74 of the connecting member 62 are released from the threaded hole 46 of the prosthetic implant 30. At this point, the connecting member 62 is guided into the plain hole 72 of the outer rod 60. The condition in which the connecting member 62 is completely released from the prosthetic implant 30 is shown in Fig. 10D.

Thereafter, the whole inserting apparatus is pulled out in the direction of the arrow "P" to be removed from the intervertebral space, as shown in Fig. 10E.

By using the inserting apparatus according to the present invention, the prosthetic implant can be accurately positioned and smoothly inserted into an intervertebral space, and can be maintained in a stable seated position. Furthermore, the inserting apparatus can be easily pulled out of an intervertebral space.

Fig. 11 shows an exploded perspective view of another embodiment of an inserting apparatus for vertebral interbody fusion according to the present invention.

As shown in the drawing, the inserting apparatus according to this embodiment comprises an outer rod 160 having an internally threaded hole, an inner rod 164 screwed into the outer rod 160, a connecting member 162 screwed into the threaded hole 46 of the prosthetic implant 30 at its front end and coupled to the outer rod 160 at its other end, and actuated by cooperation of the inner rod 164 and the outer rod 160, a stationary rod 166 fixed to an end of the inner rod 164 at its one end and received in the outer rod 160, and a connecting rod 168 coupled between the other end of the stationary rod 166 and a base portion (described later) of the connecting member 162 and moved in the outer rod 160.

The outer rod 160 comprises a coupling part 170 having an internal thread to be engaged with a threaded portion of the inner rod 164, and a case part 172 having a four-sided column shape and receiving the stationary rod 166 and the connecting rod 168 therein. The case 172 is hingedly coupled at its front end to the base portion of the connecting member 162 by a pin 173.

The connecting member 162 comprises the base portion 176, and a threaded protrusion 174 screwed into the threaded hole 46 of the prosthetic implant 30. The base portion 176 is hingedly coupled at its one end to an end of the case 172 of the outer rod 160 by means of a pin 173, and hingedly coupled at its other end to the connecting rod 168 by means of a pin 178.

The cylindrical inner rod 164 comprises an externally threaded part 180 to be engaged with the internal thread of the coupling part 170 of the outer rod 160, and a handle part 182 having a knurled surface. The externally threaded part 180 is provided at its one end with a circular groove 186 of a predetermined depth such that the stationary rod 166 is inserted in the circular groove 186 and fixed thereto by fastening screws 184. The fastening screws

184 radially pass through the externally threaded part 180 and reach the circular groove 186.

The stationary rod 166 is provided at its rear end with an annular groove 188 in which the fastening screws 184 are disposed. The stationary rod 166 is hingedly coupled at the front end to the other end of the connecting rod 168 by means of a pin 190.

Figs. 12 and 13 show an inserting operation of the apparatus according to the present invention.

From the condition as shown in Fig. 12a, as the inner rod 164 is rotated by rotation of the handle 182, the inner rod 164 is retracted rearwardly with respect to the outer rod 160, thereby causing the connecting member 162 to be turned counterclockwise about the pin 173. Therefore, the connecting rod 168 is pulled and inclined, and then finally positioned in the state shown in Fig. 12c via the state shown in Fig. 12b. At this point, the whole apparatus is pushed to insert the prosthetic implant while the handle 182 of the inner rod 164 is gripped by a hand.

Since procedures of coupling and inserting the prosthetic implant are substantially the same as those described with reference to Fig. 10, the detailed description thereof will be omitted. Figs. 13a to 13c show a procedure in which the connecting rod 168 is gradually inclined by rotation of the inner rod 164.

As described above, the present invention provides a prosthetic implant for vertebral interbody fusion and an apparatus for inserting the prosthetic implant, which allow only one side of an intervertebral disc to be dissected, and enhance fixing and correcting ability of a prosthetic implant. Accordingly, it is possible to simplify a surgical operation by minimization of a treatment area and time for insertion of a prosthetic implant, and allow a prosthetic implant to be maintained in stable fixed position.

Although preferred embodiments of the present invention have been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

WHAT IS CLAIMED IS:

1. A prosthetic implant for vertebral interbody fusion which is inserted into a fitting space formed between adjoining vertebrae to restore an intervertebral space, is free from shifting, and fuses the adjoining vertebrae, comprising:

an implant body having a polygonal column shape curved at a predetermined curvature, which has a longitudinal inner passage formed therethrough and a plurality of through holes communicated with the inner passage, and which is provided with a plurality of locking protrusions at its outer surface to be in contact with opposing faces of the adjoining vertebrae;

a front head connected to a front end of the implant body and adapted to be first inserted into the fitting space; and

a rear tail connected to a rear end of the implant body and adapted to be coupled to an inserting apparatus in a surgical operation.

2. The prosthetic implant as set forth in claim 1, in which the front head is integrally connected at its rear end to the front end of the implant body such that a circumference of the rear end of the front head coincides with a circumference of the implant body, and is pointed forwardly at its front end.

3. The prosthetic implant as set forth in claim 1, in which the implant body is provided at its lateral face with a slit to give resiliency to the implant body when the implant body is inserted in the fitting space, thereby promoting fusion between the prosthetic implant and the adjoining vertebrae and absorbing shocks.

4. The prosthetic implant as set forth in claim 1, in which the implant body is adapted to be divided into a plurality of sub bodies.

5. An apparatus for inserting a prosthetic implant having a rear coupling portion into a fitting space formed between adjoining vertebrae, comprising:

an outer rod having a longitudinal internally threaded hole formed therein;

an inner rod screwed into the internally threaded hole of the outer rod; and

a connecting member coupled at its front end to the coupling portion of the prosthetic implant and at its rear end to the inner rod, which is movable by cooperation of the outer and inner rods.

6. The apparatus as set forth in claim 1, in which the connecting member comprises a base portion and a threaded protrusion adapted to be coupled to the rear coupling portion of the prosthetic implant, and the base portion is hingedly connected at its one end to a front end of the outer rod and at its other end to a front end of a connecting rod, the other end of the connecting rod being connected to a front end of a stationary rod coupled to the inner rod.

FIG.1

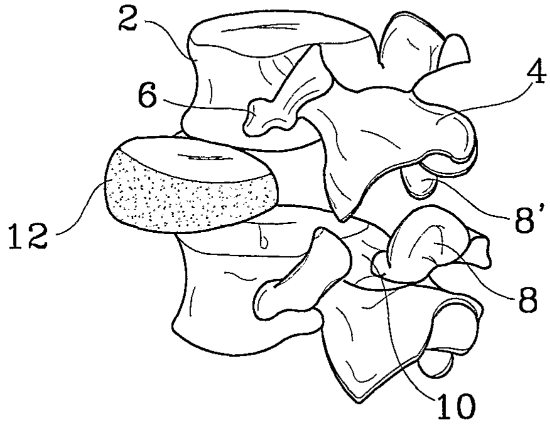


FIG.2

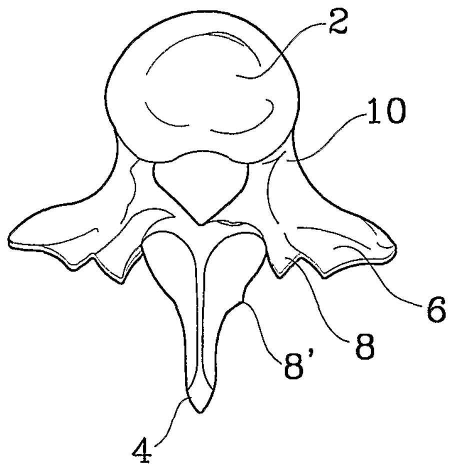


FIG.3

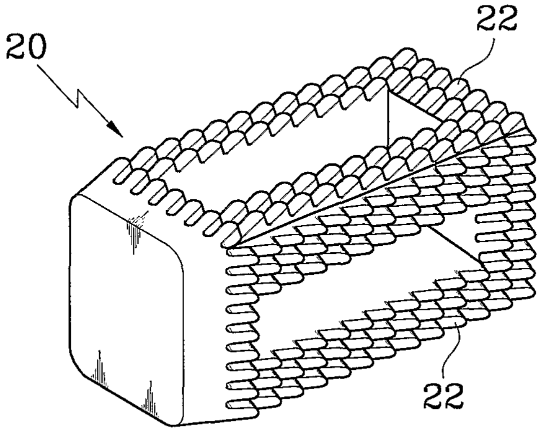


FIG.4

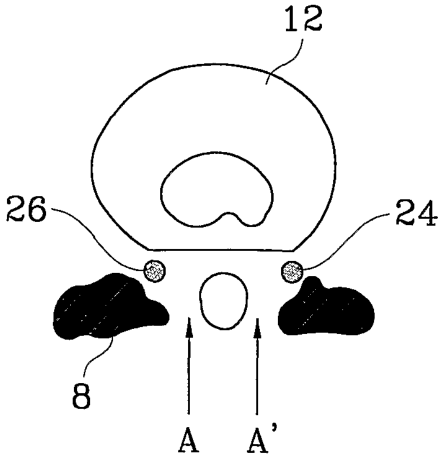


FIG.5

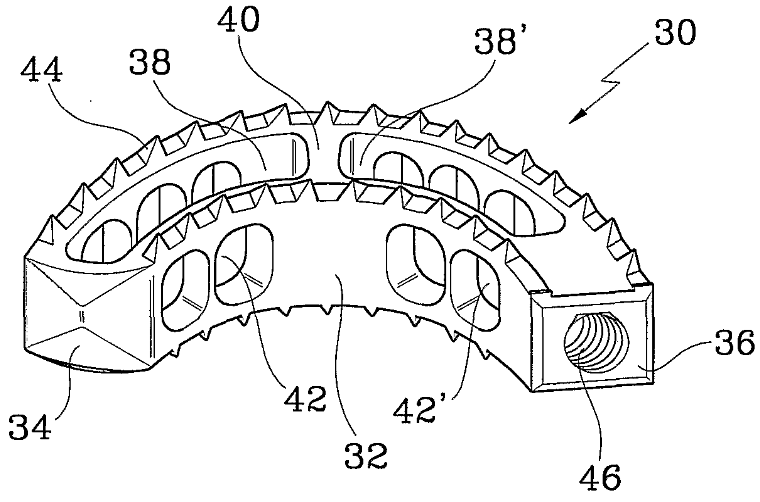


FIG.6

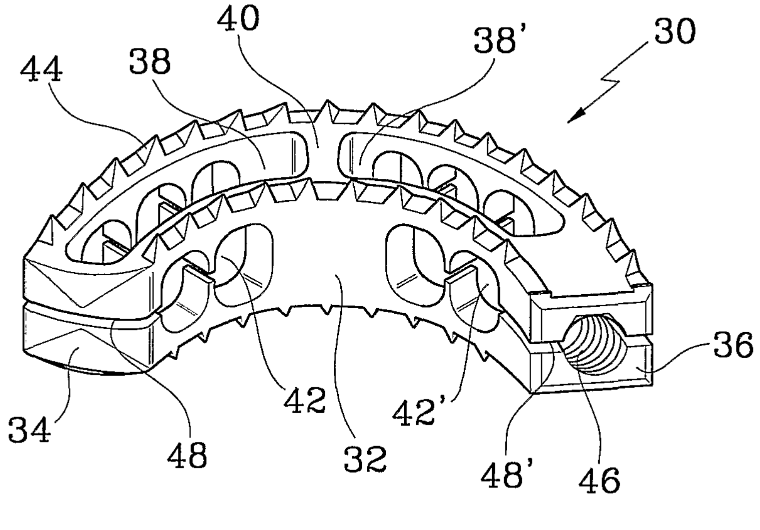
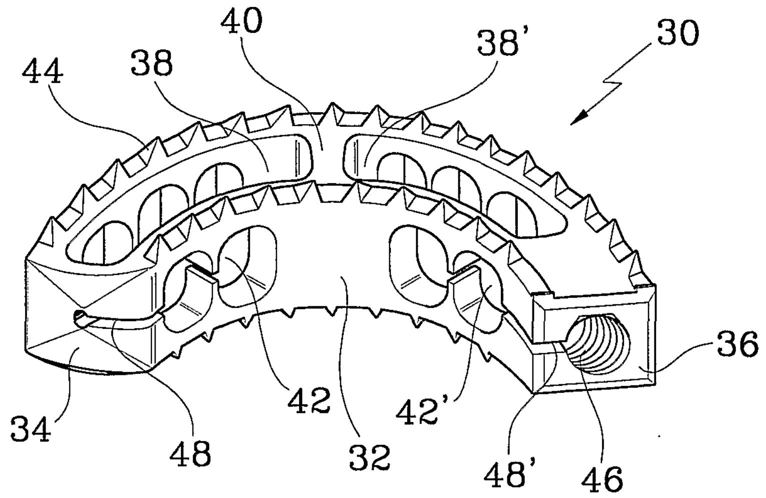


FIG.7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42'
48
32
48'
46

FIG.8

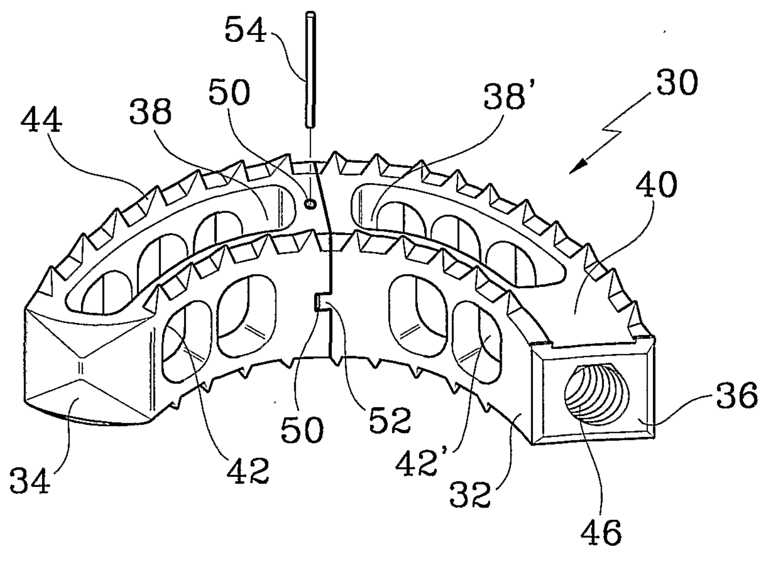
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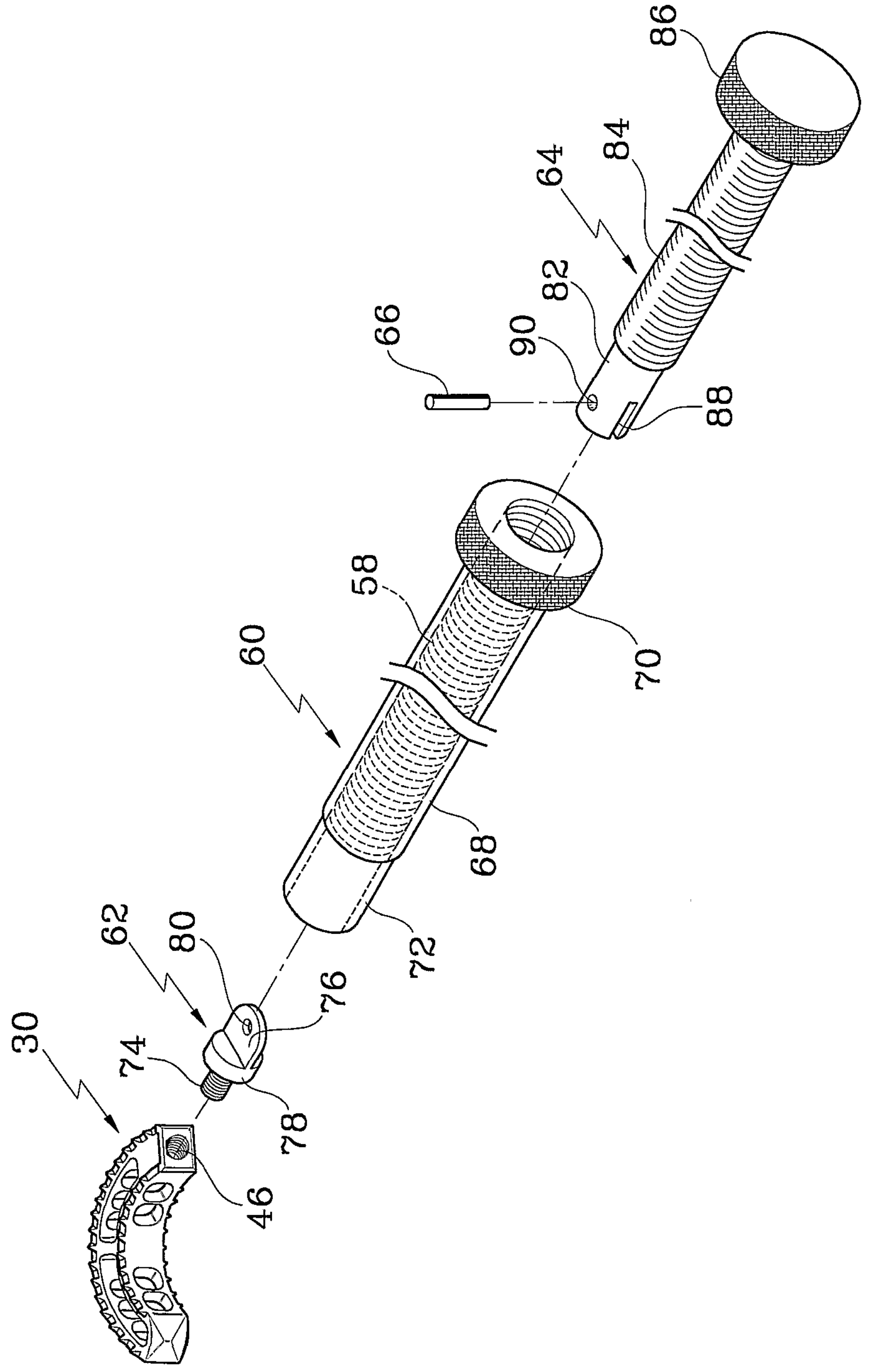
FIG.9



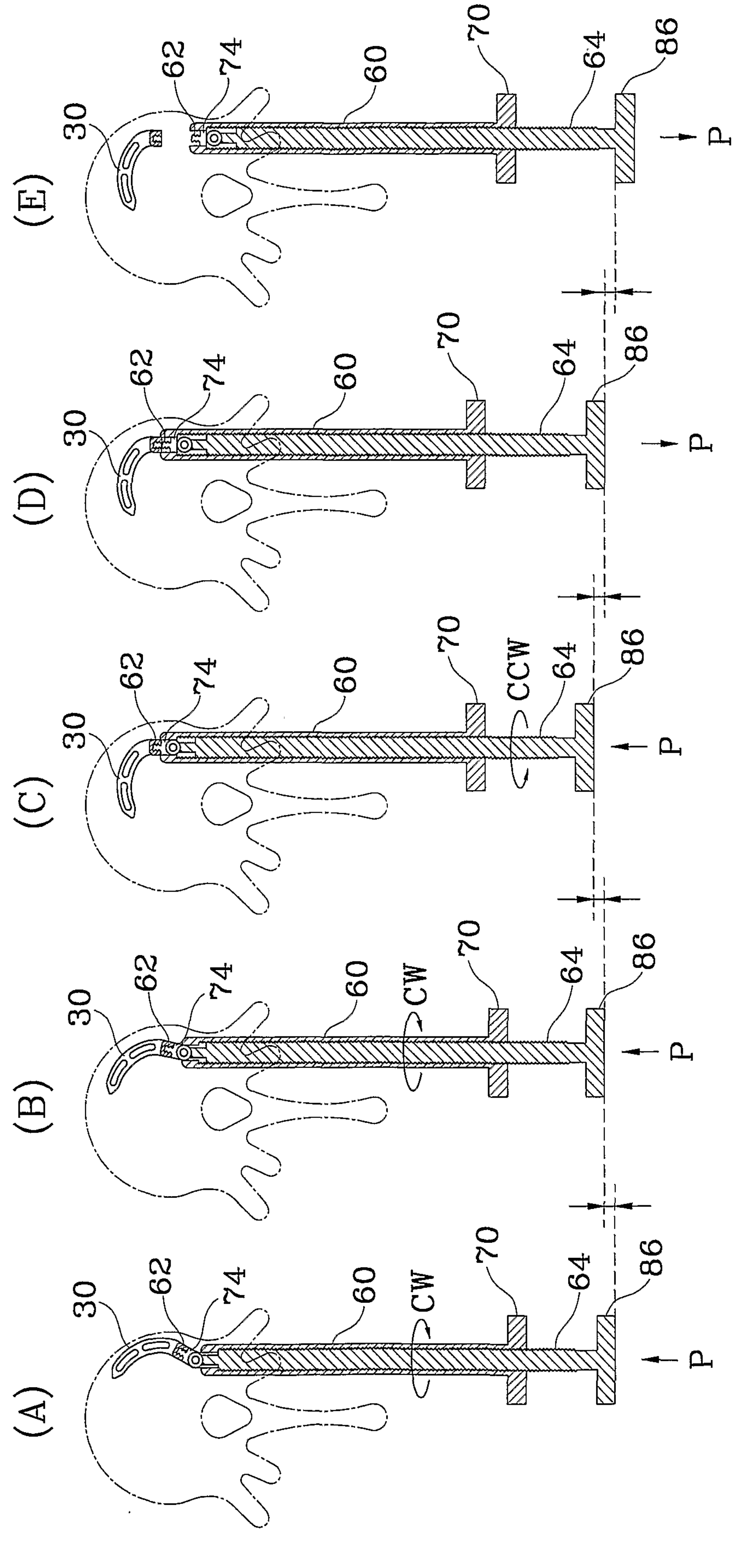


FIG.10

FIG.11

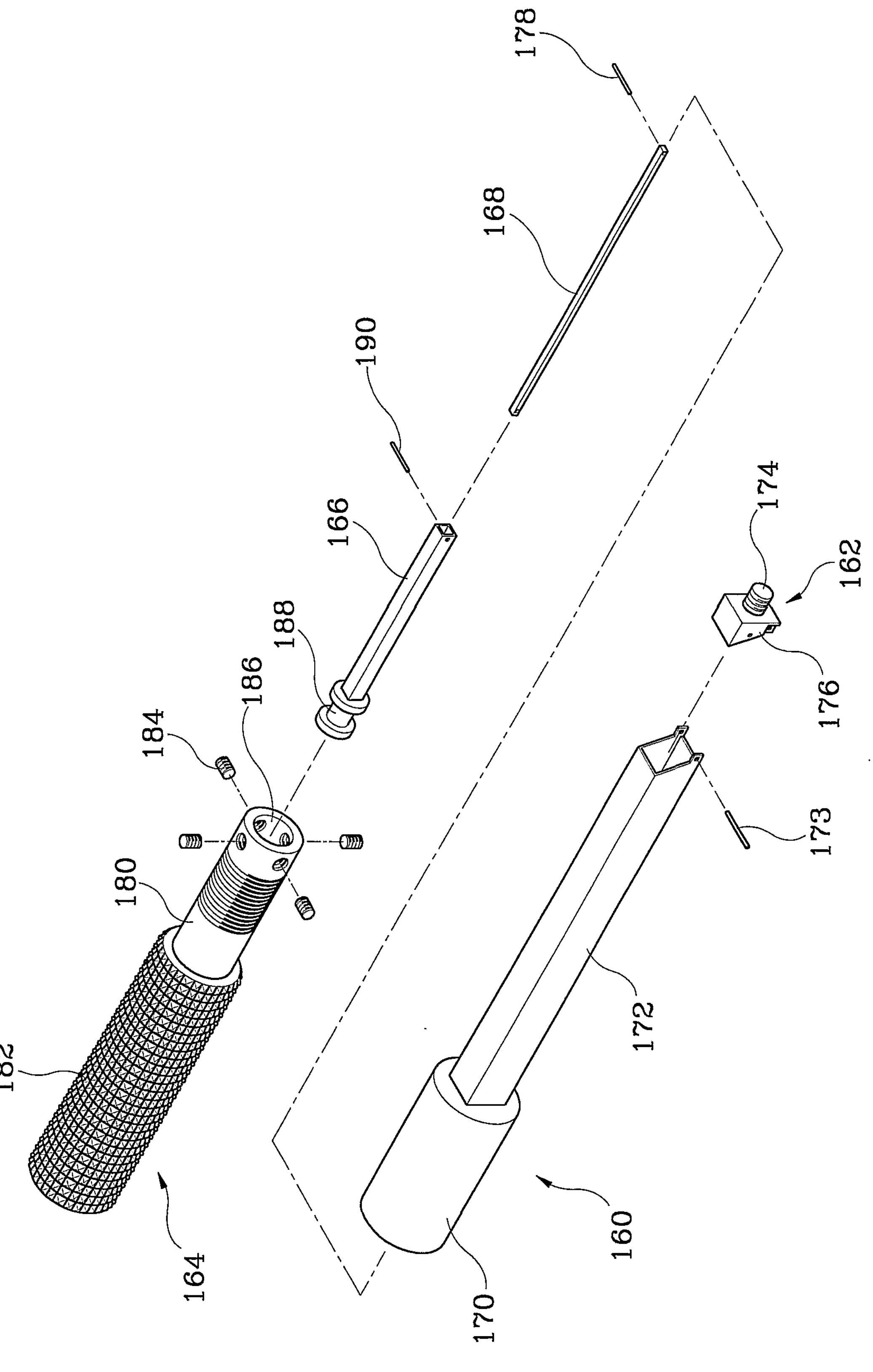

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FIG.12

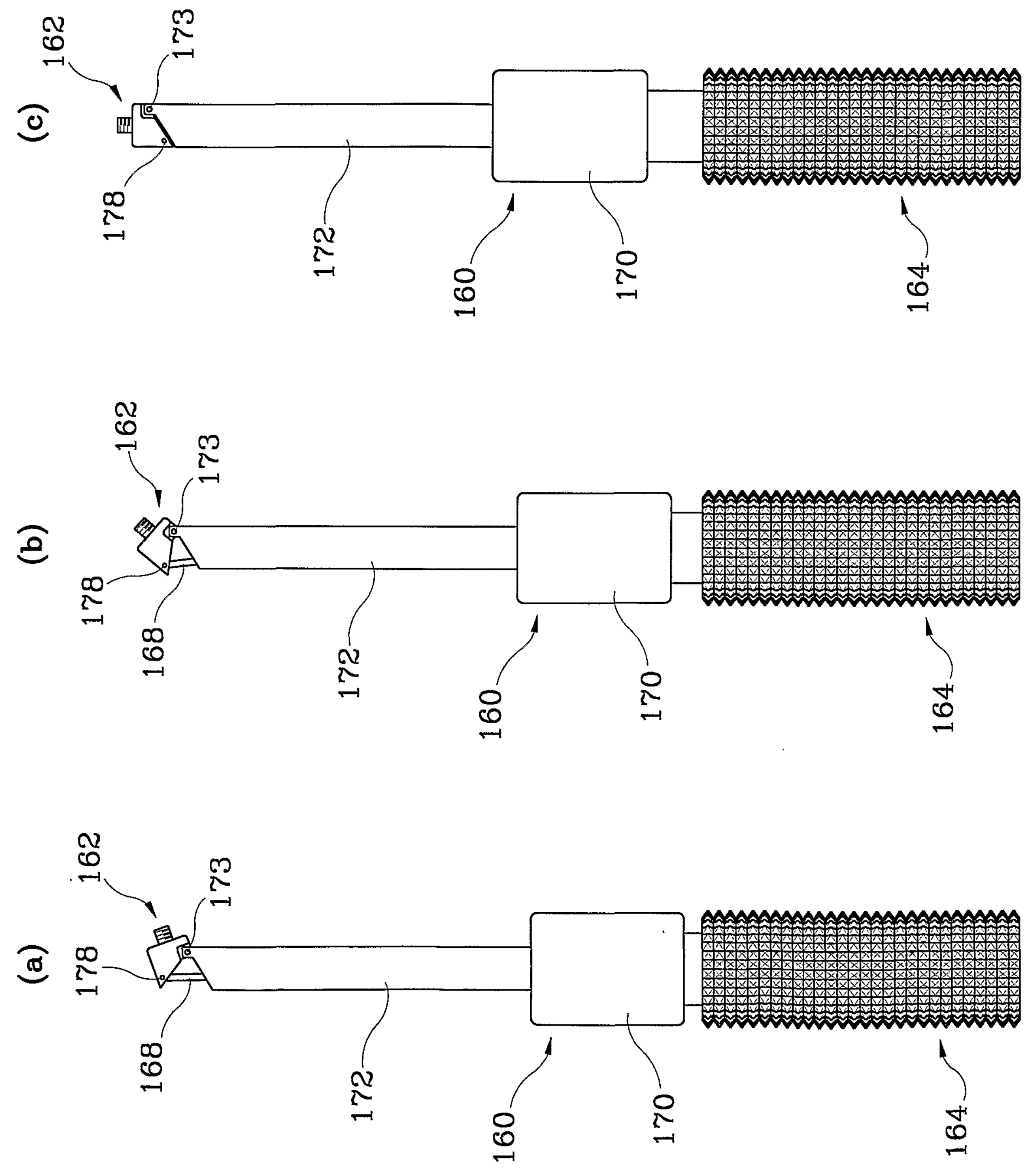
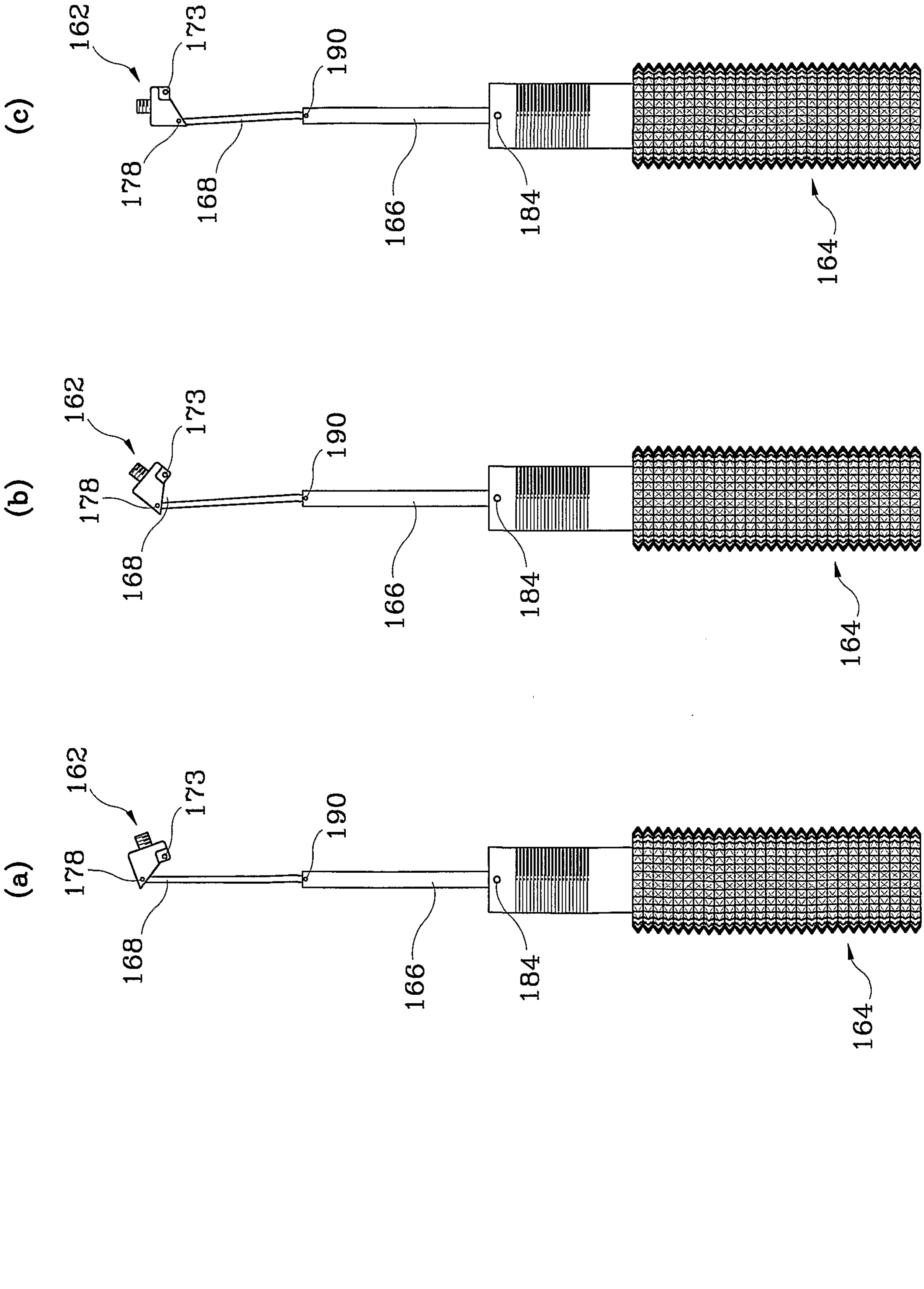


FIG.13



INTERNATIONAL SEARCH REPORT

:ernational application No.
PCT/KR01/01446

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 A61F 2/44

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

B. FIELDS SEARCHED

Minimun documentation searched (classification system followed by classification symbols)

IPC A16B 17/58, 17/70, A61F 2/44, 2/46

Documentation searched other than minimun documentation to the extent that such documents are included in the fileds searched

Korean Utility models and applications for Utility models since 1975

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

NPS, WIPS, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 188509 Y1 (KOO, JA-KYO ET AL.) 15 JULY 2000 See claims 1-4, in particular figures 4-8	1
Y	WO 97-15246 A (SYNTHES AG CHUR) 1 MAY 1997 See abstract, in particular figure 1	1
A	US 5609636 A (SPINE-TECH, INC) 3 NOVEMBER 1997 See the whole document	1-4

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

☒ See patent family annex.

* Special categories of cited documents:

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"&" 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 DECEMBER 2001 (13.12.2001)	13 DECEMBER 2001 (13.12.2001)

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Telephone No. 82-42-481-5581

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR01/01446

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