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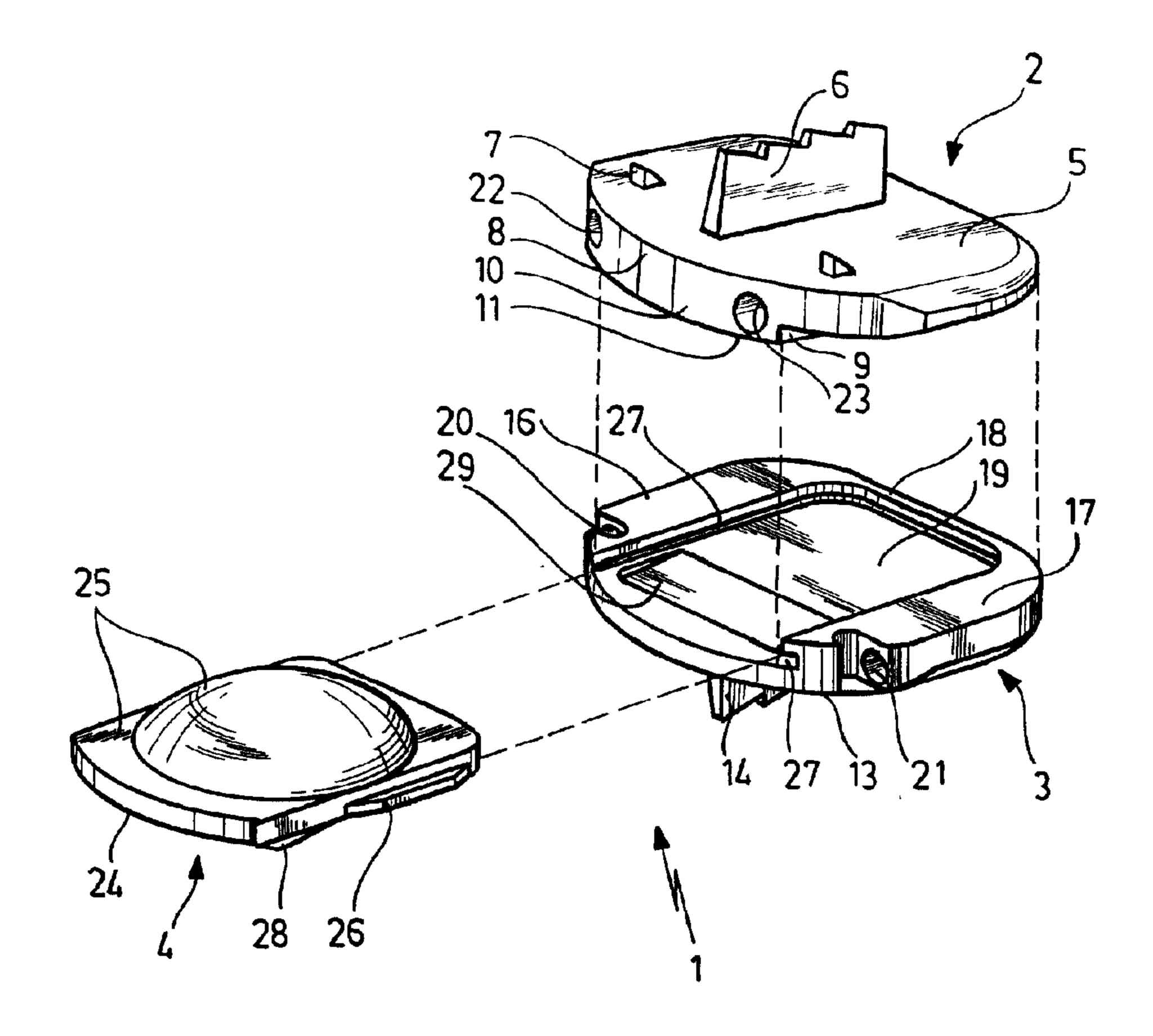
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(54) Titre: IMPLANT INTERVERTEBRAL (54) Title: INTERVERTEBRAL IMPLANT



(57) Abrégé/Abstract:

The invention relates to an intervertebral implant (1), comprising an upper part (2) that has a support surface (5) for a vertebral body, and a lower part (3) that has a support surface (13) for an adjacent vertebral body. Contact elements (20, 21, 22, 23) are positioned on said upper part and said lower part and can be accessed from one side of the implant respectively, with an handling instrument. The aim of the invention is to minimize the structural height of the intervertebral implant (1) for insertion into an intervertebral space. To this end, the upper part (2) and the lower part (3) each have projections or recessed sections (9, 10, 16,





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(57) Abrégé(suite)/Abstract(continued):

17, 19) which are oriented towards the other part and are laterally offset from each other in such a way that they engage in each other as the upper part (2) approaches the lower part (3). The contact elements (20, 21, 22, 23) are arranged on the upper part (2) and on the lower part (3) in projections (10, 16, 17) of these parts respectively, and the contact elements (20, 21, 22, 23) of the upper part (2) and the lower part (3) lie adjacent to one another and at least partially overlap in the direction of the height of the intervertebral implant (1).

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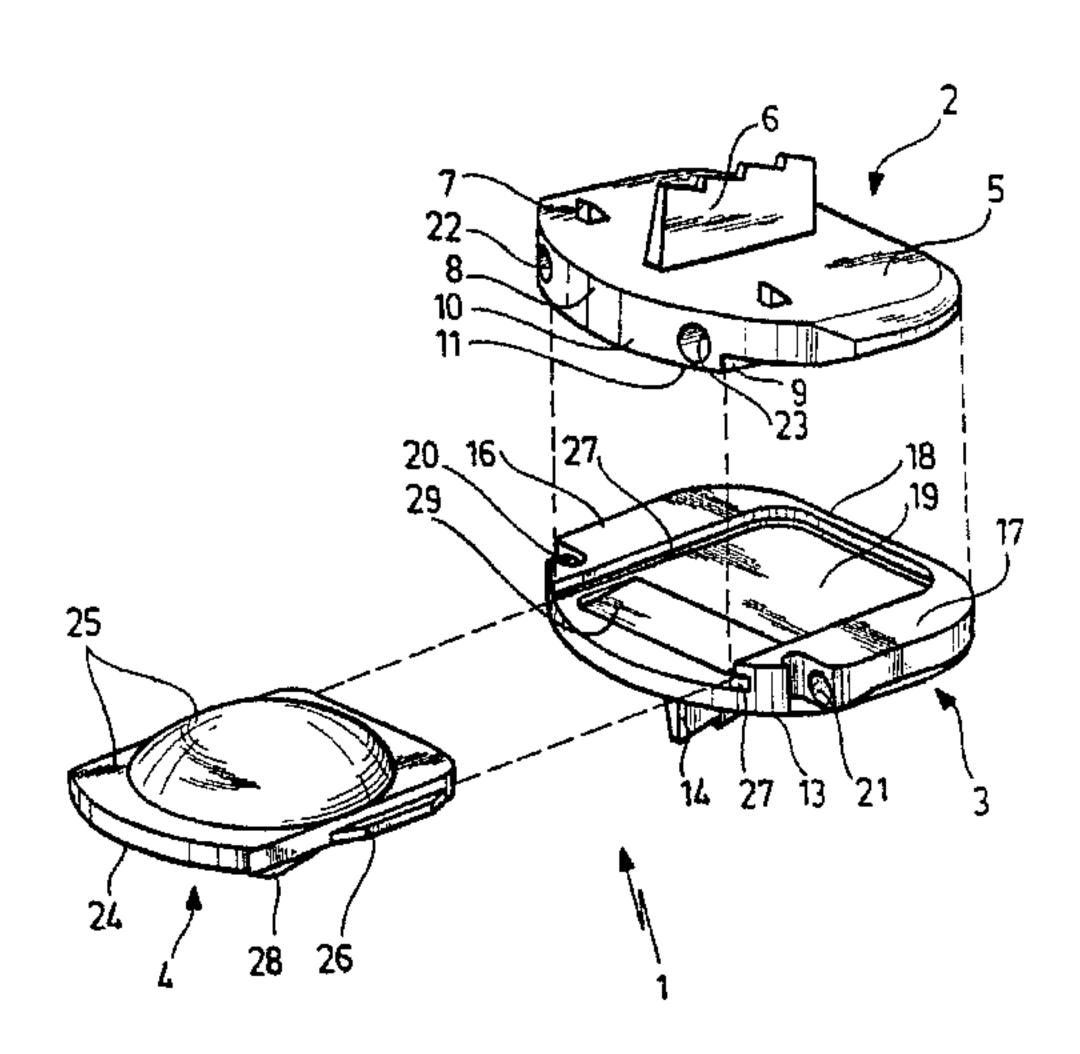
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(54) Title: INTERVERTEBRAL IMPLANT

(54) Bezeichnung: ZWISCHENWIRBELIMPLANTAT



(57) Abstract: The invention relates to an intervertebral implant (1), comprising an upper part (2) that has a support surface (5) for a vertebral body, and a lower part (3) that has a support surface (13) for an adjacent vertebral body. Contact elements (20, 21, 22, 23) are positioned on said upper part and said lower part and can be accessed from one side of the implant respectively, with an handling instrument. The aim of the invention is to minimize the structural height of the intervertebral implant (1) for insertion into an intervertebral space. To this end, the upper part (2) and the lower part (3) each have projections or recessed sections (9, 10, 16, 17, 19) which are oriented towards the other part and are laterally offset from each other in such a way that they engage in each other as the upper part (2) approaches the lower part (3). The contact elements (20, 21, 22, 23) are arranged on the upper part (2) and on the lower part (3) in projections (10, 16, 17) of these parts respectively, and the contact elements (20, 21, 22, 23) of the upper part (2) and the lower part (3) lie adjacent to one another and at least partially overlap in the direction of the height of the intervertebral implant (1).

(57) Zusammenfassung: Um bei einem Zwischenwirbelimplantat (1) mit einem eine Stützfläche (5) für einen Wirbelkörper aufweisenden Oberteil (2) und einem eine Stützfläche (13) für einen benachbarten Wirbelkörper aufweisenden Unterteil (3), an denen jeweils von einer Seite des Zwischenwirbelimplantats her zugängliche Angriffselemente (20, 21, 22, 23) für ein Handhabungsinstrument angeordnet sind, die Bauhöhe des Zwischenwirbelimplantats (1) beim

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INTERVERTEBRAL IMPLANT

The invention relates to an intervertebral implant, having an upper part that has a support face for a vertebra and a lower part that has a support face for an adjacent vertebra.

One such intervertebral implant is known for instance from U.S. Patent 5,314,477. This intervertebral implant is used to replace a disk removed from the intervertebral space, and accordingly the intervertebral implant must have a relatively low structural height, since it has to fit into the gap between vertebrae. This is particularly difficult if an additional pivot insert is also embedded between the upper part and the lower part, as is the case in the known intervertebral implant of U.S. Patent 5,314,477.

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But even in two-piece intervertebral implants, difficulties also arise, especially if the implants also have pins and other protrusions on their support faces that are intended for anchoring the intervertebral implant in the bone. Often, these parts can be inserted only by widening the intervertebral space greatly. Not only is this difficult, but it also presents the risk of injuries.

25 Since the intervertebral space has a relatively low height, it is also difficult for engagement elements that a manipulation instrument can engage to be secured to both parts of the intervertebral implant. It is conventional to

have such manipulation instruments engage the upper part and the lower part separately, for instance by means of pins that are inserted into bores on the upper part and lower part, so that with the manipulation instrument, the two parts of the intervertebral implant can be inserted into the intervertebral space and can optionally also be varied in terms of their spacing from one another, thereby allowing a certain spreading open of the intervertebral space. In this respect, reference is made to the pincerlike manipulation instrument of U.S. Patent 5,314,477.

Because of the strong forces, it is necessary to provide a certain structural height for the engagement elements; for instance, the receiving bores must have a certain diameter.

15 This dictates a minimum structural height for the upper part and for the lower part, and in conventional intervertebral implants, the structural heights' of the upper part and lower part are thus added together, so that even if the upper and lower parts rest directly on one another, a relatively great structural height of the intervertebral implant is still unavoidable.

In one embodiment of the invention an intervertebral implant of this generic type is modified in such a way that the minimum structural height is reduced, to make it easier to insert the intervertebral implant into the intervertebral space.

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In such an embodiment the upper part and lower part each have protrusions and recesses aimed at the respectively other part, which are offset laterally from one another in such a way that when the upper part has been

brought close to the lower part they mesh with one another. The engagement elements on the upper part and on the lower part are each disposed in protrusions of these parts in such a way that the engagement elements of the upper part and lower part are located side by side and at least partly overlap in the direction of the height of the intervertebral implant.

In this embodiment, a minimal structural height of the two intervertebral implant parts resting on one another can be attained, since the engagement elements, which cannot fall 10 below a minimal structural height, are each disposed in protrusions of the upper part and lower part, or in other words in the parts of the upper part and lower part that have the greatest structural height. These regions of great 15 structural height are embodied as protrusions, next to which are respective recesses, into which the protrusions of the respectively other part can dip. As a result, on the one hand, the engagement elements for the manipulation instruments are located side by side, and on the other, they can at least 20 partly overlap, so that the total structural height of the parts resting on one another of the intervertebral implant can be reduced markedly compared to conventional intervertebral implants. The result is accordingly an internested arrangement of the upper and lower parts, with maximal exploitation of the available material height. 25

It is favorable if the engagement elements are insertion openings for pinlike retaining elements of a manipulation instrument; because of the described construction, these insertion-openings can have a relatively large diameter and can thus receive strong retaining pins, and nevertheless a relatively low structural height of the

intervertebral implant with parts resting directly on one another is obtained.

It is advantageous if the insertion openings extend substantially parallel to the support faces; once again, this prevents an increase in the structural height of the intervertebral implant parts.

In one embodiment, it is provided that the lower part has a central indentation, opposite the lower support face, which indentation is surrounded by a U-shaped edge. Thus with the lower part and upper part resting directly on one another, the indentation serves to receive a protrusion on the upper part.

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It is advantageous if the upper part has a central protrusion that fits substantially in complimentary fashion into the indentation; that is, the total volume of the indentation is utilized for the protrusion.

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It is also advantageous if the engagement elements of the lower part are disposed on the two ends of the U-shaped edge, or in other words are located on the outside.

- Conversely, the engagement elements of the upper part can be disposed on the central protrusion of the upper part, or in other words are located farther inward than the engagement elements of the lower part.
- In particular, the engagement elements of the upper part can be disposed near the lateral edges of the central protrusion, so that for the upper part as well, the spacing of the engagement elements can be selected to be relatively great; as a result, both: the upper part and the lower part

can be reliably secured against skewing.

It should already be noted here that the words "lower part" and "upper part" do not necessarily say anything about the installed position of the intervertebral implant in the spinal column; the part called the "lower part" could in fact be above in the spinal column. What is essential is merely that the upper part and lower part define the intervertebral implant on opposite sides of the implant.

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attainable as well.

It is especially advantageous if the upper part and/or the lower part is embodied in substantially platelike fashion; these parts naturally, in accordance with the design of the invention, have protrusions and recesses that are oriented toward the respectively other part. The platelike embodiment, however, leads as a whole to a very low structural height of the intervertebral implant.

In one embodiment, the lower part and the upper part each

20 have a respective receptacle for a pivot insert. This pivot
insert, which is placed between the upper part and lower
part after the insertion of the intervertebral implant,
supports the upper part and lower part against one another;
it takes on a resilient function, for instance, and

25 furthermore leads to a certain pivotability of the two
parts of an intervertebral implant relative to one another,
so that a pivotability of the adjacent vertebra is thus

In particular, it is advantageous if the pivot insert has at least one spherical support face, which engages the correspondingly spherically shaped receptacle.

It is favorable if the spherical receptacle is disposed

in the central protrusion of the upper part.

It is also advantageous if the central indentation of the lower part forms the receptacle for the pivot insert.

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According to one embodiment of the invention, it is provided that the pivot insert can be inserted from the side into the receptacle, which has the engagement elements for a manipulation instrument. This is the side from which the upper part and lower part are introduced into the intervertebral space, and it is also from this side that the pivot insert can then be thrust between the already-inserted parts of the intervertebral implant.

15 It is favorable if the pivot insert is insertable into the receptacle along a guide.

In that the insert as well is preferably embodied substantially in platelike fashion.

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An especially favorable design is obtained if the insert substantially completely fills up the central receptacle and with its spherical support face protrudes from the receptacle.

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Another problem with the design of the implant described in US patent no. 5,314,477 is that it employs a pair of anchors or keels on each face of the upper and lower parts. Such a construction was always considered necessary to provide adequate stability. Such a double anchor arrangement, however, is highly invasive, and a surprising aspect of the present invention is that the inventors have found that contrary to expectations a single anchor will in fact provide the necessary degree of stability. Such an arrangement is much less invasive that that of the prior art.

Accordingly, in one aspect the invention provides a intervertebral implant comprising a first part having an outer surface for engaging a first vertebrae, a second part having an outer surface for engaging a second vertebrae, the first and second parts being in operative engagement with each other for movement of one part relative to the other part, said first and second parts being configured for insertion along a path into an intevertebral space between said first and second vertebrae, and a single anchor extending outwardly from one of said parts, said single anchor being constructed to enter a groove cut into a corresponding first or second vertebrae as said first and second parts move along said path into said intevertebral space during insertion of said implant, and wherein after said insertion said single anchor engages said groove to anchor said one part to said corresponding first or second vertebrae.

In another aspect, the invention provides an intervertebral implant insertable between adjacent vertebrae, comprising an upper part having an upper surface for engaging a vertebrae 20 and a lower surface which includes a rounded portion, a lower part having a lower surface for engaging a vertebrae and an upper surface portion in operative engagement with the rounded portion of the upper part, said implant being constructed to be the sole implant in its intervertebral 25 space, the implant having a lead end which leads as the implant is inserted along a path into the intervertebral space and a trailing end opposite the lead end, and lateral planes which pass through the outermost boundaries of the implant and parallel to the said path, and a single anchor on 30 each of the upper surface of the upper part and the lower. surface of the lower part, each said anchor being elongated, having a height greater than its width, and located along a line parallel to said path, the two anchors lying essentially in the same vertical plane, which plane is essentially midway 35 between said lateral planes, each said anchor being adapted to enter a groove in the adjacent vertebrae as the implant moves along said path into the intervertebral space, to anchor its respective part to the vertebrae which its surface 40 engages.

In another aspect, the invention provides an intervertebral implant insertable between adjacent vertebrae, comprising a

generally rectangular upper part having an upper surface for engaging a vertebrae and a lower surface which includes a rounded portion, a generally rectangular lower part having a lower surface for engaging a vertebrae and having an upper surface portion in operative engagement with the rounded portion of the upper part, said implant being constructed to be the sole implant in its intervertebral space, one of the longer sides of the generally rectangular upper and lower parts comprising a leading end and the other of the longer sides of the generally rectangular upper and lower parts being a trailing end as the implant is moved in an insertion direction to be inserted into the intervertebral space, and a single anchor on each of the upper surface of the upper part and the lower surface of the lower part, the two single anchors being elongated, each having a height greater than its width, and the two single anchors lying in essentially the same vertical plane, which plane is located essentially midway between the short sides of the generally rectangular upper and lower parts and thus parallel to the insertion direction, and each anchor being adapted to enter a groove in the adjacent vertebrae as the implant moves in said insertion direction into the intervertebral space, to anchor its respective part to the vertebrae which its surface engages.

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In another aspect, the invention provides an intervertebral implant comprising a first part which has an outer surface for engaging a vertebrae and an inner surface which has a rounded portion, a second part which has an outer surface for engaging a vertebrae and an inner surface having a recess with an opening on one side, and an insert having a base portion which is shaped to enter the said opening to be engaged in said recess, and a raised portion which is smaller in area, transversely, than the base portion and which extends from the base portion to a rounded portion which 35 mates with the rounded portion of the first part to allow relative movement of the first part and the second part.

In yet another aspect, the invention provides an intervertebral implant comprising: a first part having an outer surface for engaging a vertebrae and a curved inner surface, a second part having an outer surface for engaging a vertebrae and an insert receiving inner surface, an insert having a curved surface which engages the curved inner surface of the upper part for movement relative thereto and engaged with the inner surface of the lower part, the lower part having an opening to receive the insert by transverse movement of the insert into engagement with the inner surface of the lower part, and wherein at least one of the first part and second part have, at the end thereof where said opening is located, engagement means for engaging an instrument for inserting the first and second parts into an intervertebral space between adjacent vertebrae.

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In yet another aspect, the invention provides an intervertebral implant comprising a generally rectangular first part having an outer surface for engaging a vertebrae and a curved inner surface for engaging an insert for movement relative thereto, a generally rectangular second part having an outer surface for engaging a vertebrae and an inner surface for engaging an insert, the inner surface of the lower part having a recess which includes an opening for receiving an insert transversely therein, the insert having a curved surface and being insertable transversely through said opening into the recess for engagement with the second part and for operative engagement of its curved surface with the curved inner surface of the first part for movement relative thereto.

In yet another aspect, the invention provides an intervertebral implant comprising: a first part having an outer surface for engaging a vertebrae and having an inner surface having an inwardly extending protrusion, a second part having a lower surface for engaging a vertebrae and an

inner surface formed as a recess which is constructed to receive an insert which, in use, operatively engages the first part, and wherein the protrusion of the first part is nestable in the recess of the second part for insertion of the two parts together into an intervertebral space.

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In a further aspect, the invention provides an intervertebral implant comprising, a first part having an outer surface for engaging a vertebrae and an inner surface for operatively engaging an insert, second part having an outer surface for engaging a vertebrae and an inner surface constructed to hold an insert, and at least one of the first part and second part having engaging means for engaging instruments for insertion of the first part and second part together into an intervertebral space between two adjacent vertebrae, the first part and second part each having a lead end which leads as the implant is inserted in an insert direction into an intervertebral space and a trailing end opposite the lead end, and said engaging means being located on the trailing end of the at least one first and second parts such that said instruments are located in a working space between parallel planes passing through opposed sides of the implant and parallel to the direction of insertion, and the implant having an opening located in the trailing end of the implant and within the working space for allowing insertion of an insert into the space between the first and second parts.

In a further aspect, the invention provides an intervertebral implant comprising: a first part having an outer surface for engaging a vertebrae and having an inner surface, a second part having an outer surface for engaging a vertebrae and an inner surface, an insert having a first surface engaging the inner surface of the first part and a second surface engaging the inner surface of the second part, the inner surface of the second part being constructed to receive said insert, one of

the inner surface of the second part and the second surface of the insert including an elongated detent recess extending thereacross, and the other of the inner surface of the second part and the first surface of the insert having an elongated detent, which detent is resiliently engagable in the detent recess as the insert is inserted onto the inner surface of the lower part.

The ensuing description of preferred embodiments of the invention serves in conjunction with the drawing to provide further explanation. Shown are:

Fig. 1: a perspective exploded view of an intervertebral implant with an upper part, a lower part, and a pivot insert that can be inserted between them;

15 Fig. 2: a perspective exploded view of the upper part

and the lower part of the intervertebral implant, without an inserted pivot insert;

- Fig. 3: a view similar to Fig. 2 with the pivot insert insert inserted into the lower part;
 - Fig. 4: a perspective view of the upper part and the lower part of the intervertebral implant with maximum mutual proximity;

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- Fig. 5: a front view of the intervertebral implant of Fig. 4;
- Fig. 6: a perspective view of the intervertebral implant with the pivot insert inserted; and

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- Fig. 7: a cross-sectional view of the intervertebral implant of Fig. 6.
- The intervertebral implant 1 shown in the drawing includes three parts, namely a platelike upper part 2, a platelike lower part 3, and a substantially platelike pivot insert 4.

The upper part 2 is embodied flat on its top, thus creating a support face 5, on which various kinds of protrusions 6, 7

25 are disposed which serve the purpose of anchoring the upper part 2 in a vertebra that rests, with its end face toward an intervertebral space, on the support face 5. The central protrusion 6, longitudinally extending relative to the insertion direction is referred to as an anchor or keel. The anchor is designed to slide into a corresponding slot cut into the vertebrae.

The upper part 2 is substantially rectangular in cross section; in the exemplary embodiment shown, a longitudinal edge 8 curves outward.

On the two short sides of this rectangle, the thickness of the platelike upper part 2 is less than in the central region, so that along the short sides of the upper part 2, downward-pointing recesses 9 each extending parallel to these edges are formed that are open toward the outside. The central region of the upper part 2 is located between the two recesses 9 and thus has a greater thickness or height and thus forms a downward-pointing protrusion 10 embodied between the two recesses 9. This protrusion is defined by an underside 11, which extends substantially parallel to the support face 5 and in which there is a spherical indentation 12, which forms a bearing plate for the pivot insert 4.

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The lower part 3 of the intervertebral implant 1 is also 15 platelike in embodiment and on its underside has a flat support face 13 with protrusions 14 and 15, which correspond to the protrusions 6 and 7 of the support face 5. Like the protrusion 6, the central protrusion 14, longitudinally extending relative to the insertion direction is referred to as an anchor or keel. The anchor is designed to slide into a 20 corresponding slot cut into the vertebrae. On the side remote from the support face 13, the thickness of the lower part 3 is less in the central region than in an outer region. This outer region of greater thickness has the form of a U, with two parallel legs 16, 17, which extend parallel to the short 25 edges of the lower part 3, which in cross section is embodied similarly to the upper part 2, and with a crosspiece 18 that connects the two legs 16 and 17 on one end. The region enclosed by the legs 16 and 17 and the crosspiece 18 forms a central indentation 19, whose area is substantially 30 equivalent to the area of the central protrusion 10 of the upper part 2, while the disposition and length of the legs 16 and 17 correspond essentially to the disposition and length of the recesses 9 on the upper part 2. As a result, it is possible to place the upper 2 and lower part 3 on one another in such a way that the central protrusion 10 of the upper 2 dips into the central indentation 19, while the legs 16 and 17 of the lower part 3

dip into the recesses 9 of the upper part 2 (Fig. 4); in this position, the upper part 2 and lower part 3 have maximum proximity to one another and a minimal structural height.

The dimensions are selected such that the various recesses are essentially filled completely by the protrusions dipping into them.

Blind bores 20 and 21 are machined into the two legs 16 and 17 of the lower part 3, extending parallel to these legs 16, 17 from their free ends; the diameter of these bores is relatively great in proportion to the height of the legs 16, 17, and this diameter is in fact greater than the thickness or height of the lower part 3 in the region of the central indentation 19.

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Blind bores 22 and 23, which extend parallel to the
blind bores 20 and 21 in the lower part 3, are machined into
the central protrusion 10 of the upper part 2, in the
vicinity of its side edges. These blind bores 22 and 23
again have a relatively great diameter, which corresponds to
a substantial portion of the height of the protrusion 10 and
is greater than the thickness of the upper part 2 in the
region of the recesses 9.

When the upper part 2 and lower part 3 rest tightly against one another in the manner described, the blind bores 20 and 21 of the lower part 3 and the blind bores 22 and 23 of the upper part 2 overlap at least partly in the direction of the height of the intervertebral implant 1, as is clearly shown in Figs. 4 and 5.

The blind bores 20, 21, 22 and 23 serve as receptacles for pinlike extensions of a manipulation instrument, not

shown in the drawing, and thus form engagement elements for this manipulation instrument, which in this way separately engages the upper part 2 and the lower part 3. With this manipulation instrument, it is possible to introduce the upper part 2 and the lower part 3 of the intervertebral implant 1 into an intervertebral space; the very low structural height of the intervertebral implant 1 facilitates this introduction, which can be done essentially without major widening of the intervertebral space.

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part 3 in this way, the two parts of the intervertebral implant 1 can be spread apart; that is, their spacing is increased, for instance with the aid of the manipulation instrument that is holding the upper 2 and the lower part 3.

In this spread-open position of the upper part 2 and lower part 3, it is possible to thrust the pivot insert 4 between the upper part 2 and the lower part 3.

This pivot insert is constructed essentially in the shape of a plate, which has a flat underside 24 and a spherically upward-curved top side 25. The outer dimensions of the platelike pivot insert correspond to those of the central indentation 19 in the lower part 3, so that the pivot insert 4 can be thrust into this indentation, filling it up, specifically from the side toward which the blind bores 20, 21, 22, 23 open. Guide strips 26 on the side edges of the pivot insert 4 engage corresponding guide grooves 27 in the legs 16, 17, so that an insertion guide for the pivot insert 4 is formed that fixes it in the lower part 3 after its insertion. The inserted pivot insert 4, after insertion, fills up the indentation 19 and protrudes with its spherically curved top side 25 upward past the top side of

the lower part 3; the spherical top side 25 dips in complimentary fashion into the spherically curved indentation 12 on the underside of the protrusion 10, where with the upper part 2 it forms a ball joint, which enables a certain pivotability of the upper part 2 relative to the lower part 3 (Fig. 7).

The pivot insert 4 can have a detent protrusion 28 on its flat underside 24; when the pivot insert 4 is inserted into the lower part 3, this protrusion locks elastically into a detent recess 29 that is located on the bottom of the indentation 19; as a result, the pivot insert 4 is also fixed in the insertion direction in the indentation 19.

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The upper part 2 and lower part 3 are preferably made of physiologically safe metal, such as titanium, while the pivot insert 4 preferably comprises a likewise physiologically safe plastic material, such as polyethylene. These support faces 5 and 13 can be embodied in an especially bone-compatible way; for instance, this surface can be roughened by a coating, so that optimal anchoring to the adjacent bone material is obtained.

By way of further explanation, as will be apparent from the
drawings, the invention may also be described in the
following manner, which is equivalent to the preceding
description. The upper part 2 has an upper surface 5 for
engaging a vertebrae and a lower surface which comprises a
downward pointing protrusion 10 between side recesses 9 and a
rounded portion, preferably in the form of a concave
spherical indentation 12. A lower part 3 has a lower surface
13 for engaging a vertebrae. A pivot insert 4, when joined to
the lower part 3, as shown for example in Figure 3, provides
a convex upper surface portion 25, preferably spherical, in
operational engagement with the rounded portion 12 of the
upper part.

The lower part 3 and pivot insert 4 may, taken together, be described as a lower part formed in two pieces, namely the elements 3 and 4, wherein the element 3 may be referred to as a lower piece and the element 4 may be referred to as an upper piece.

The upper and lower parts include on their upper surface and lower surface, respectively, protrusions 6 and 14 which may also be referred to as anchors, which anchor the upper and lower parts, respectively, into the adjacent vertebrae that form the intervertebral space and rest against the respective upper and lower surfaces.

As shown in the figures, the anchors 6 and 14 each have a zigzag edge which comprise teeth. As best shown in Figure 7, anchor 6 is greater in height than the remainder of the upper part 2, i.e., from surface 5 to the bottom of protrusion 10. Similarly, anchor 14 is greater in height than the remainder of the lower part 3, i.e., from lower surface 13 to the top 20 of walls 16, 17 and 18. As also shown in the figures, in the preferred embodiment, the length of the anchors 6 and 14, i.e., in the direction from the anterior to the posterior thereof, is greater than one half of the overall dimension of its respective part from its anterior to its posterior, 25 passing through that anchor. As also illustrated in the drawings, the vertical height of each anchor 6 and 14 is greater than its width with the dimension taken horizontally in Figures 5 or 7.

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The lower part comprises three walls including parallel side walls 16 and 17 and a rear wall 18. These walls form between them a central indentation 19 which comprises a recess with a generally flat surface. The fourth side of the recess is open. The pivot insert 4 has a detent 28 that snap-fits into a detent recess 29 formed in the generally flat surface of

recess 19.

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As best shown in Figures 2, 4 and 5, in the absence of pivot insert 4, the protrusion 10 of upper part 2 can fit down

5 between walls 16, 17 and 18-of the lower part 2. This fitting of protrusion 10 within the recess 19, surrounded by-walls 16,17 and 18 may be referred to as "nesting" since the protrusion 10 essentially "nests" within recess 19. With the upper and lower parts in this nested condition, as shown in Figures 4 and 5, the combined height of the upper and lower parts 2 and 3, i.e., the height from surface 13 to surface 5, is less than the total additive height of the upper and lower parts, taken separately, i.e., less than the total of the height from surface 13 to the top of walls 16, 17 and 18 plus the height from surface 5 to the bottom of protrusion 10.

To reach its final destination within an intervertebral space, the implant must of course be moved along a path from outside of the patient, into the patient, and then into the intervertebral space. In the illustrated embodiment, as described above, instruments would engage apertures 20, 21, 22 and 23 to move the implant along a path. The anchors 6 and 14 are parallel to this path. As a point of reference, lateral planes parallel to the direction of this path pass through opposed side surfaces of the parts. Thus, in the illustrated embodiment, the path would be parallel to the front to rear (anterior to posterior) direction, wherein, during insertion, the rear (posterior) of the implant would constitute the lead end and the front (anterior) thereof would constitute the trailing end.

Although the invention has been described in detail with respect to preferred embodiments thereof, it will be apparent that the invention is capable of numerous modifications and variations, apparent to those skilled in the art, without departing from the spirit and scope of the invention.

Claims

- 1. An intervertebral implant comprising:
- a first part having an outer surface for engaging a first vertebrae,
- a second part having an outer surface for engaging a second vertebrae,

the first and second parts being in operative engagement with each other for movement of one part relative to the other part,

said first and second parts being configured for insertion along a path into an intevertebral space between said first and second vertebrae, and a single anchor extending outwardly from one of said parts, said single anchor being constructed to enter a groove cut into a corresponding first or second vertebrae as said first and second parts move along said path into said intevertebral space during insertion of said implant, and wherein after said insertion said single anchor engages said groove to anchor said one part to said corresponding first or second vertebrae.

- 2. An intervertebral implant according to claim 1, wherein the height of the single anchor is greater than its width.
- 3. An intervertebral implant according to claim 2, wherein the single anchor is perpendicular to the outer surface of its respective part.
- 4. An intervertebral implant according to claim 2, wherein the operative engagement of the first and second parts is a universal engagement.
- 5. An intervertebral implant according to claim 4, wherein the universal engagement includes a convex surface on one of the parts operatively engaged with a mating concave surface on the other part.
- 6. An intervertebral implant according to claim 5, wherein one of said parts comprises two pieces, a first piece which engages the adjacent vertebrae and a second piece which engages the other part.
- 7. An intervertebral implant according to claim 2, wherein the

single anchor passes through a center line of the implant.

- 8. An intervertebral implant according to claim 7, wherein the single anchor is located in a central anterior to posterior plane of the implant.
- 9. An intervertebral implant according to claim 2, wherein both of said parts have a said single anchor, each having a height greater than its width.

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- 10. An intervertebral implant according to claim 9, wherein the two single anchors lie in a common plane.
- 11. An intervertebral implant according to claim 10, wherein the common plane is a central anterior to posterior plane of the implant.
- 12. An intervertebral implant according to claim 9, wherein both of the single anchors are perpendicular to their respective first or second part outer surfaces.
 - 13. An intervertebral implant according to claim 9, wherein one of the parts comprises two pieces, a first piece which includes a single anchor and a second piece operatively connected to the first piece and engaging the other part.
 - 14. An intervertebral implant according to claim 13, wherein the operative engagement is a universal engagement which includes a convex surface on one part and a mating concave surface on the other part, and wherein the part with the two pieces is the part which includes the convex surface.
- 15. An intervertebral implant according to claim 9, wherein the two single anchors are coplanar and vertically aligned with each other.

16. An intervertebral implant according to claim 2, the single anchor positioned on the implant such that the single anchor engages the groove in its respective vertebrae as the implant is moved into the intervertebral space.

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17. An intervertebral implant according to claim 16, wherein both parts have a single anchor.

18. An intervertebral implant according to claim 17, wherein one of the parts comprises two pieces, a first piece which includes a single anchor and a second piece operatively connected to the first piece and engaging the other part.

- 19. An intervertebral implant according to claim 18, wherein the operative engagement is a universal engagement which includes a convex surface on one part and a mating concave surface on the other part, and wherein the part with the two pieces is the part which includes the convex surface.
- 20. An intervertebral implant according to claim 17, wherein the operative engagement of the first and second parts is a universal engagement.
- 21. An intervertebral implant according to claim 17, wherein both of the parts are generally rectangular.
 - 22. An intervertebral implant according to claim 21, wherein the single anchors are substantially parallel to the shorter sides of the generally rectangular shape.

- 23. An intervertebral implant according to claim 2, wherein both parts include apertures in one end thereof for receiving an insertion instrument.
- 35 24. An intervertebral implant according to claim 2, wherein the height of the single anchor is greater than the height of the

remainder of its part.

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- 25. An intervertebral implant according to claim 2, wherein the operative engagement of the two parts is a concave portion in one of the parts and a convex portion in the other of the parts.
- 26. An intervertebral implant according to claim 25, wherein one of the two parts comprises two pieces, a first piece which includes the single anchor and a second piece operatively connected to the first piece and engaging the other part.
- 27. An intervertebral implant according to claim 26, wherein, in the absence of the second piece, the concave portion nests into the first piece.
 - 28. An intervertebral implant according to claim 26, wherein the second piece snap fits into the first piece.
- 29. An intervertebral implant according to claim 2, wherein both parts have midlines on their respective outer surfaces, passing essentially through the center of the outer surface of its respective outer part and both parts having single anchors extending outwardly from the midline of its respective part.

30. An intervertebral implant according to claim 29, wherein the two single anchors lie essentially along a common plane passing through each of the respective midlines.

- 30 31. An intervertebral implant according to claim 29, wherein the two parts of the implant are adapted for implantation together along a path of insertion into an intervertebral space.
- 32. An intervertebral implant according to claim 31, wherein the single anchors are essentially coplanar and aligned with each other, such that the single anchors of the first and second

parts of the implant can be inserted along a path of insertion into respective essentially aligned grooves in the first and second vertebrae.

33. An intervertebral implant according to claim 31, wherein the overall length of at least one single anchor in the direction of a path of insertion of the implant is greater than one half of the overall dimension of its respective part in the direction of insertion.

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- 34. An intervertebral implant according to claim 2, wherein the single anchor is a single uninterrupted solid piece extending outwardly from the outer surface of its respective part.
- 35. An intervertebral implant according to claim 2, wherein the single anchor is a single piece elongated in a plane parallel to a path of insertion of the implant.
- 36. An intervertebral implant according to claim 2, wherein the single anchor comprises a series of teeth.
 - 37. An intervertebral implant according to claim 2, wherein the single anchor extends outwardly from the outer surface of its respective part to an outward edge, wherein said outward edge lies essentially in a straight line.
 - 38. An intervertebral implant according to claim 2, wherein the single anchor extends outwardly essentially from a midline of the outer surface of the first part and wherein said single anchor is elongated and straddles said midline.
 - 39. An intervertebral implant according to claim 38, wherein the single anchor is adapted to enter a groove in the vertebrae which it is adjacent as the implant moves into the
- 35 intervertebral space.

- 40. An intervertebral implant according to claim 2, wherein the first and second parts are generally rectangular.
- 41. An intervertebral implant according to claim 40, wherein the single anchor is generally parallel to the short sides of the generally rectangular shape.
 - 42. An intervertebral implant according to claim 1, including a single anchor on both of the first and second parts.
- 43. An intervertebral implant according to claim 42, wherein the two single anchors lie in a common plane.

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- 44. An intervertebral implant according to claim 43, wherein the common plane is a central anterior to posterior plane of the implant.
- 45. An intervertebral implant according to claim 42, wherein both of the single anchors are perpendicular to their respective first or second part outer surfaces.
 - 46. An intervertebral implant according to claim 42, wherein one of the parts comprises two pieces, a first piece which includes a single anchor and a second piece operatively connected to the first piece and engaging the other part.
 - 47. An intervertebral implant according to claim 46, wherein the operative engagement is a universal engagement which includes a convex surface on one part and a mating concave surface on the other part, and wherein the part with the two pieces is the part which includes the convex surface.
- 48. An intervertebral implant according to claim 42, wherein the two single anchors are coplanar and vertically aligned with each other.

- 49. An intervertebral implant according to claim 42, wherein the operative engagement of the first and second parts is a universal engagement.
- 5 50. An intervertebral implant according to claim 42, wherein both of the parts are generally rectangular.
 - 51. An intervertebral implant according to claim 50, wherein the single anchors are substantially parallel to the shorter sides of the generally rectangular shape.

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52. An intervertebral implant according to claim 42, wherein both parts include apertures in one end thereof for receiving an insertion instrument.

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- 53. An intervertebral implant according to claim 42, wherein the height of the single anchor is greater than the height of the remainder of its part.
- 54. An intervertebral implant according to claim 42, wherein the operative engagement of the two parts is a concave portion in one of the parts and a convex portion in the other of the parts.
- of the two parts comprises two pieces, a first piece which includes the single anchor and a second piece operatively connected to the first piece and engaging the other part, and wherein, in the absence of the second piece, the concave portion nests into the first piece.

- 56. An intervertebral implant according to claim 55, wherein the second piece snap fits into the first piece.
- 57. An intervertebral implant according to claim 42, wherein both parts have midlines on their respective outer surfaces, passing essentially through the center of the outer surface of

its respective outer part and both parts having single anchors extending outwardly from the midline of its respective part.

- 58. An intervertebral implant according to claim 57, wherein the two single anchors lie essentially along a common plane passing through each of the respective midlines.
 - 59. An intervertebral implant according to claim 57, wherein the two parts of the implant are adapted for implantation together along a path of insertion into an intervertebral space.

- 60. An intervertebral implant according to claim 59, wherein the single anchors are essentially coplanar and aligned with each other, such that the single anchors of the first and second parts of the implant can be inserted along a path of insertion into respective essentially aligned grooves in the first and second vertebrae.
- overall length of at least one single anchor in the direction of a path of insertion of the implant is greater than one half of the overall dimension of its respective part in the direction of insertion.
- 25 62. An intervertebral implant according to claim 42, wherein the single anchor is a single uninterrupted solid piece extending outwardly from the outer surface of its respective part.
- 63. An intervertebral implant according to claim 42, wherein the single anchor is a single piece elongated in a plane parallel to a path of insertion of the implant.
 - 64. An intervertebral implant according to claim 42, wherein the single anchor is adapted to enter a groove in the vertebrae which it is adjacent as the implant moves into the intervertebral space.

- 65. An intervertebral implant according to claim 1, wherein the single anchor is located along a midline extending essentially midway between sides of its part, which sides are in planes essentially parallel to the single anchor.
- 66. An intervertebral implant according to claim 65, wherein both parts have said single anchors, and wherein both parts have midlines on their respective outer surfaces passing essentially through the center of the outer surface of its respective outer part, and both single anchors extending outwardly from the midline of its respective part.

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- 67. An intervertebral implant according to claim 66, wherein the two single anchors lie essentially along a common plane passing through each of the respective midlines.
- 68. An intervertebral implant according to claim 66, wherein the two parts of the implant are adapted for implantation together along a path of insertion into an intervertebral space.
 - 69. An intervertebral implant according to claim 68, wherein the single anchors are essentially coplanar and aligned with each other, such that the single anchors of the first

and second parts of the implant can be inserted along a path of insertion into respective essentially aligned grooves in the first and second vertebrae.

- 70. An intervertebral implant according to claim 68, wherein the overall length of at least one single anchor in the direction of a path of insertion of the implant is greater than one half of the overall dimension of its respective part in the direction of insertion.
 - 71. An intervertebral implant according to claim 65, wherein the

part with the single anchor is adapted for implantation along a path of insertion into an intervertebral space.

- 72. An intervertebral implant according to claim 71, wherein the overall length of the single anchor in the direction of a path of insertion of the implant is greater than one half of the overall dimension of its respective part in the direction of insertion.
- 73. An intervertebral implant according to claim 71, wherein the single anchor is a single uninterrupted solid piece extending outwardly from the outer surface of its respective part.
- 74. An intervertebral implant according to claim 71, wherein the single anchor is a single piece elongated in a plane parallel to a path of insertion of the implant.

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- 75. An intervertebral implant according to claim 65, wherein the single anchor comprises a series of teeth.
- 76. An intervertebral implant according to claim 65, wherein the single anchor extends outwardly from the outer surface of its respective part to an outward edge, wherein said outward edge lies essentially in a straight line.
- 77. An intervertebral implant according to claim 65, wherein the single anchor extends outwardly essentially from a midline of the outer surface of the first part and wherein said single anchor is elongated and straddles said midline.
- 78. An intervertebral implant according to claim 65, wherein the single anchor is adapted to enter a groove in the vertebrae which it is adjacent as the implant moves into the intervertebral space.
- 79. An intervertebral implant according to claim 65, wherein the

first and second parts are generally rectangular.

- 80. An intervertebral implant according to claim 65, wherein the height of the single anchor is greater than its width.
- 81. An intervertebral implant according to claim 65, wherein the operative engagement of the first and second parts is a universal engagement.
- 10 82. An intervertebral implant according to claim 81, wherein the universal engagement includes a convex surface on one of the parts operatively engaged with a mating concave surface on the other part.
- of said parts comprises two pieces, a first piece which engages the adjacent vertebrae and a second piece which engages the other part.
- 20 84. An intervertebral implant according to claim 65, wherein the single anchor passes through a center line of the implant.
- 85. An intervertebral implant according to claim 65, wherein both of said parts have a single anchor, both of said single anchors having a height greater than its width.
 - 86. An intervertebral implant according to claim 85, wherein the two single anchors lie in a common plane.
- 30 87. An intervertebral implant according to claim 86, wherein both of the single anchors are perpendicular to their respective first or second part outer surfaces.
- 88. An intervertebral implant according to claim 85, wherein one of the parts comprises two pieces, a first piece which includes a single anchor and a second piece operatively connected to the

first piece and engaging the other part.

- 89. An intervertebral implant according to claim 88, wherein the operative engagement is a universal engagement which includes a convex surface on one part and a mating concave surface on the other part, and wherein the part with the two pieces is the part which includes the convex surface.
- 90. An intervertebral implant according to claim 65, the single anchor positioned on the implant such that the single anchor engages the groove in its respective vertebrae as the implant is moved into the intervertebral space.
- 91. An intervertebral implant according to claim 65, wherein both parts include apertures in one end thereof for receiving an insertion instrument.
- 92. An intervertebral implant according to claim 65, wherein the height of the single anchor is greater than the height of the remainder of its part.
 - 93. An intervertebral implant according to claim 65, wherein the operative engagement of the two parts is a concave portion in one of the parts and a convex portion in the other of the parts, one of the two parts comprising two pieces, a first piece which includes the single anchor and a second piece operatively connected to the first piece and engaging the other part, and wherein, in the absence of the second piece, the

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- 94. An intervertebral implant according to claim 93, wherein the second piece snap fits into the first piece.
- 35 95. An intervertebral implant according to claim 1, wherein the single anchor passes through the center of the outer

concave portion nests into the first piece.

surface of its respective part.

- 96. An intervertebral implant according to claim 95, wherein the single anchor is located in a central anterior to posterior plane of the implant.
- 97. An intervertebral implant according to claim 95, wherein the height of the single anchor is greater than its width.
- 10 98. An intervertebral implant according to claim 95, wherein the single anchor is perpendicular to the outer surface of its respective part.
- 99. An intervertebral implant according to claim 95, the single anchor positioned on the implant such that the single anchor engages the groove in its respective vertebrae as the implant is moved into the intervertebral space.
- 100. An intervertebral implant according to claim 95, wherein both parts include apertures in one end thereof for receiving an insertion instrument.
- 101. An intervertebral implant according to claim 95, wherein the operative engagement of the two parts is a concave portion in one of the parts and a convex portion in the other of the parts.
- 102. An intervertebral implant according to claim 101, wherein one of the two parts comprises two pieces, a first piece which includes the single anchor and a second piece operatively connected to the first piece and engaging the other part.
 - 103. An intervertebral implant according to claim 102, wherein, in the absence of the second piece, the concave portion nests into the first piece.

- 104. An intervertebral implant according to claim 103, wherein the second piece snap fits into the first piece.
- 105. An intervertebral implant according to claim 95, wherein the overall length of at least one single anchor in the direction of a path of insertion of the implant is greater than one half of the overall dimension of its respective part in the direction of insertion.
- 10 106. An intervertebral implant according to claim 95, wherein the single anchor is a single uninterrupted solid piece extending outwardly from the outer surface of its respective part.
- 107. An intervertebral implant according to claim 95, wherein the single anchor is a single piece elongated in a plane parallel to a path of insertion of the implant.

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- 108. An intervertebral implant according to claim 95, wherein the single anchor comprises a series of teeth.
- 109. An intervertebral implant according to claim 95, wherein the single anchor extends outwardly from the outer surface of its respective part to an outward edge, wherein said outward edge lies essentially in a straight line.
- 110. An intervertebral implant according to claim 95, wherein the single anchor extends outwardly essentially from a midline of the outer surface of the first part and wherein said single anchor is elongated and straddles said midline.
- 111. An intervertebral implant according to claim 95, wherein the first and second parts are generally rectangular.
- 112. An intervertebral implant according to claim 111, wherein the single anchor is generally parallel to the short sides of the generally rectangular shape.

113. An intervertebral implant according to claim 95, wherein both parts have a said single anchor passing through the center of the outer surface of its respective part.

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- 114. An intervertebral implant according to claim 113, wherein the two single anchors are coplanar and vertically aligned with each other.
- 10 115. An intervertebral implant according to claim 113, wherein both parts have midlines on their respective outer surfaces, passing essentially through the center of the outer surface of its respective outer part and both parts having single anchors extending outwardly from the midline of its respective part.

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- 116. An intervertebral implant according to claim 115, wherein the two single anchors lie essentially along a common plane passing through each of the respective midlines.
- 20 117. An intervertebral implant according to claim 115, wherein the two parts of the implant are adapted for implantation together along a path of insertion into an intervertebral space.
- 25 118. An intervertebral implant according to claim 117, wherein the single anchors are essentially coplanar and aligned with each other, such that the single anchors of the first and second parts of the implant can be inserted along a path of insertion into respective essentially aligned grooves in the
- 30 first and second vertebrae.
 - 119. An intervertebral implant according to claim 95, wherein both of said single anchors have a height greater than their width.

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120. An intervertebral implant insertable between adjacent

vertebrae, comprising, an upper part having an upper surface for engaging a vertebrae and a lower surface which includes a rounded portion, a lower part having a lower surface for engaging a vertebrae and an upper surface portion in operative engagement with the rounded portion of the upper part, said implant being constructed to be the sole implant in its intervertebral space, the implant having a lead end which leads as the implant is inserted along a path into the intervertebral space and a trailing end opposite the lead end, and lateral planes which pass through the outermost 10 boundaries of the implant and parallel to the said path, and a single anchor on each of the upper surface of the upper part and the lower surface of the lower part, each said anchor being elongated, having a height greater than its 15 width, and located along a line parallel to said path, the two anchors lying essentially in the same vertical plane, which plane is essentially midway between said lateral planes, each said anchor being adapted to enter a groove in the adjacent vertebrae as the implant moves along said path into the intervertebral space, to anchor its respective part 20 to the vertebrae which its surface engages.

- 121. An intervertebral implant according to claim 120, wherein the rounded portion of the upper part is concave and the upper surface portion of the lower part is convex.
- 122. An intervertebral implant according to claim 121, wherein the lower part is formed in two pieces including a lower piece which has the said lower surface and an upper piece which has the upper surface portion.
 - 123. An intervertebral implant according to claim 120, wherein the height of at least one anchor is greater than the height of the remainder of its respective part.
 - 124. An intervertebral implant according to claim 123,

wherein each anchor is greater in height than the remainder of its respective part.

- 125. An intervertebral implant according to claim 120, the length of at least one anchor in the direction along the midline being greater than one half of the entire front to rear dimension of its respective part.
- 126. An intervertebral implant according to claim 125,

 wherein the length of both anchors in the direction along the midline are greater than one half of the entire front to rear dimension of their respective upper or lower part.
- 127. An intervertebral implant according to claim 120, wherein the rounded portion of the upper part and the upper surface portion of the lower part are spherical.
- 128. An intervertebral implant according to claim 120, the upper and lower parts, in plan view, being generally rectangular.
 - 129. An intervertebral implant according to claim 128, wherein the single anchors are substantially parallel to the shorter sides of the generally rectangular shape of the upper and lower parts.
 - 130. An intervertebral implant according to claim 120, including apertures in the trailing ends of the upper and lower parts for receiving inserting instruments.

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- 131. An intervertebral implant according to claim 120, said anchors having teeth to prevent removal from their respective grooves.
- 35 132. An intervertebral implant according to claim 120, wherein the rounded portion of the upper part is partially

spherical and concave, and the upper surface portion of the lower part is partially spherical and convex.

- 133. An intervertebral implant according to claim 132, wherein the lower part is formed in two pieces, including a lower piece which has the lower surface thereon and an upper piece which fits into a recess in the lower piece and has the said partially spherical and convex portion.
- 134. An intervertebral implant according to claim 133, wherein, in the absence of the upper piece of the lower part, the rounded portion of the upper part can nest into the recess in the lower piece.
- 15 135. An intervertebral implant according to claim 134, wherein, in the nested condition, the overall height of the upper and lower parts is less than the additive total height of the upper and lower parts, taken separately.
- 20 136. An intervertebral implant according to claim 133, wherein the recess in the lower part is a generally flat surface with three walls including two opposite side walls and an end wall and including an opening opposite the end wall.

- 137. An intervertebral implant according to claim 136, wherein the upper piece of the lower part includes a means for snap fitting into the lower piece of the lower part.
- 30 138. An intervertebral implant insertable between adjacent vertebrae, comprising, a generally rectangular upper part having an upper surface for engaging a vertebrae and a lower surface which includes a rounded portion, a generally rectangular lower part having a lower surface for engaging a vertebrae and having an upper surface portion in operative engagement with the rounded portion of the upper part, said

implant being constructed to be the sole implant in its intervertebral space, one of the longer sides of the generally rectangular upper and lower parts comprising a leading end and the other of the longer sides of the generally rectangular upper and lower parts being a trailing end as the implant is moved in an insertion direction to be inserted into the intervertebral space, and a single anchor on each of the upper surface of the upper part and the lower surface of the lower part, the two single anchors being elongated, each having a height greater than its width, and 10 the two single anchors lying in essentially the same vertical plane, which plane is located essentially midway between the short sides of the generally rectangular upper and lower parts and thus parallel to the insertion direction, and each anchor being adapted to enter a groove in the adjacent 15 vertebrae as the implant moves in said insertion direction into the intervertebral space, to anchor its respective part to the vertebrae which its surface engages.

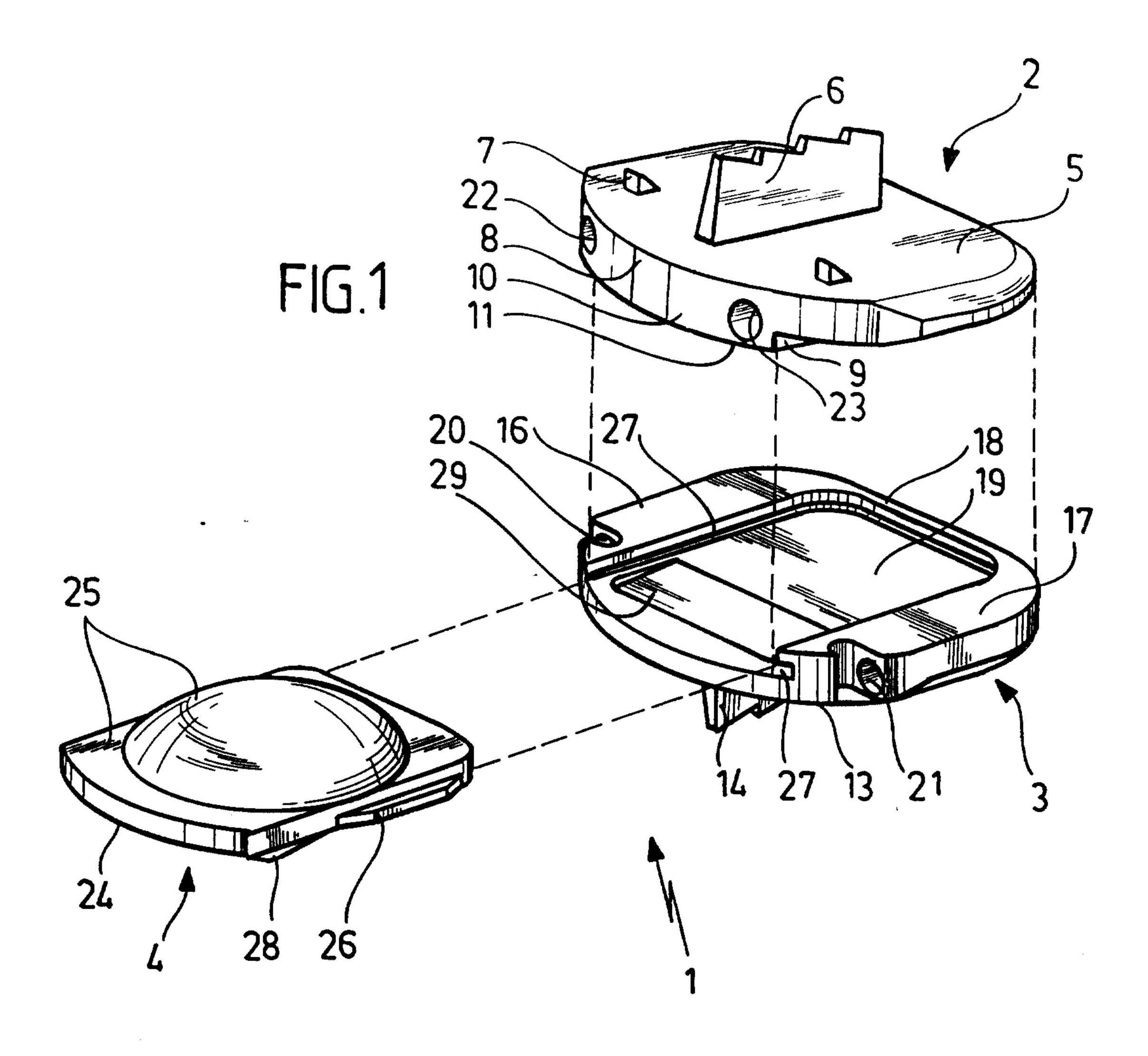
- 20 139. An intervertebral implant according to claim 138, wherein the rounded portion of the upper part is concave and the upper surface portion of the lower part is convex.
- 140. An intervertebral implant according to claim 139, wherein the lower part is formed in two pieces including a lower piece which has the said lower surface and an upper piece which has the upper surface portion.
- 141. An intervertebral implant according to claim 138, wherein the height of at least one anchor is greater than the height of the remainder of its respective part.
- 142. An intervertebral implant according to claim 141, wherein each anchor is greater in height than the remainder of its respective part.

- 143. An intervertebral implant according to claim 138, the length of at least one anchor in the insertion direction being greater than one half of the entire dimension of its respective part in the insertion direction from said leading end to said trailing end.
- 144. An intervertebral implant according to claim 143, wherein the length of both anchors in the insertion direction are greater than one half of the entire dimension of their respective upper or lower part in the insertion direction from said leading end to said trailing end.
- 145. An intervertebral implant according to claim 138, wherein the rounded portion of the upper part and the upper surface portion of the lower part are spherical.

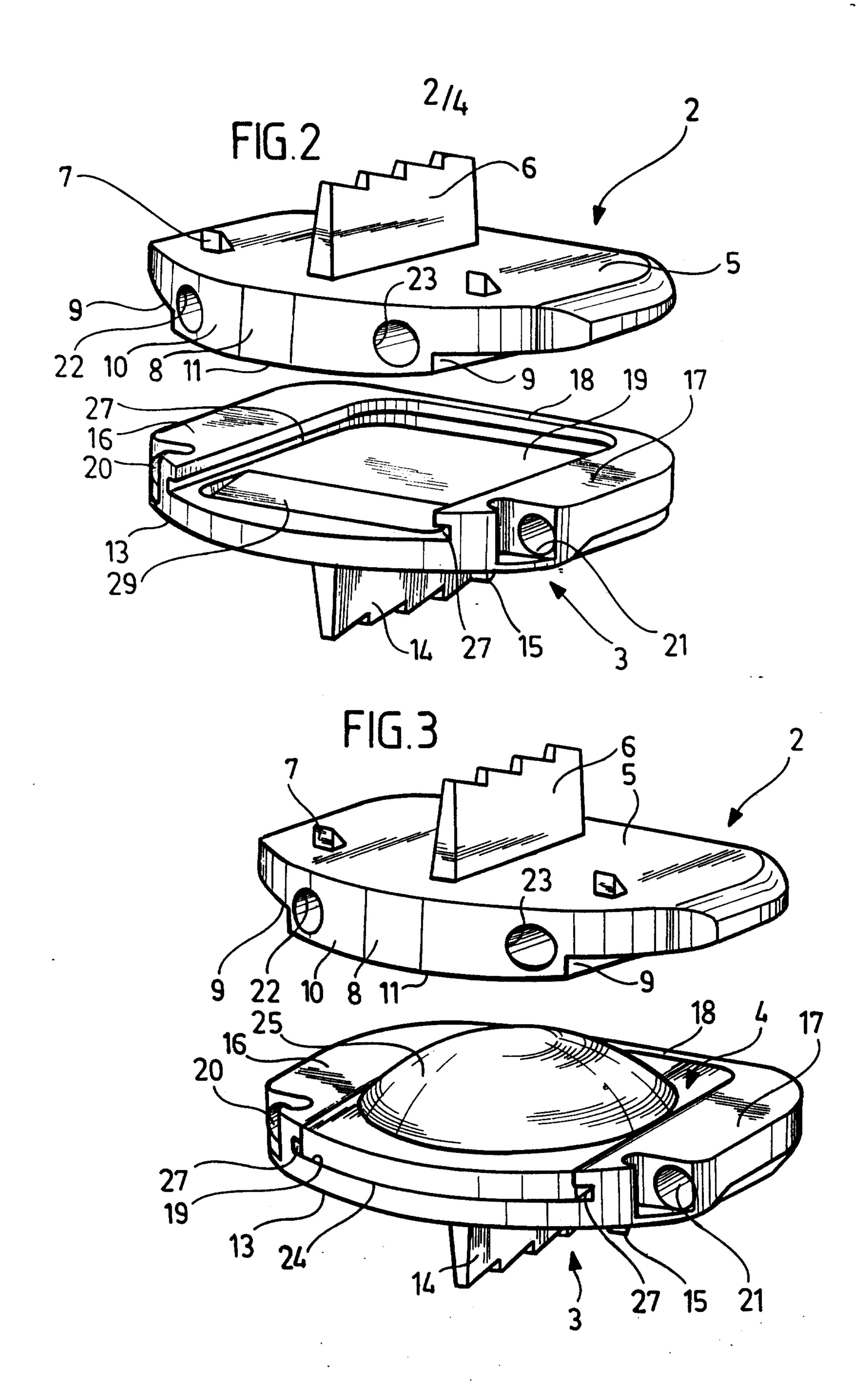
- 146. An intervertebral implant according to claim 138, wherein the rounded portion of the upper part is partially spherical and concave, and the upper surface portion of the lower part is partially spherical and convex.
- 147. An intervertebral implant according to claim 146, wherein the lower part is formed in two pieces, including a lower piece which has the lower surface thereon and an upper piece which fits into a recess in the lower piece and has the said partially spherical convex portion.
- 148. An intervertebral implant according to claim 147, wherein, in the absence of the upper piece of the lower part, the rounded portion of the upper part can nest into the recess in the lower part.
- 149. An intervertebral implant according to claim 148, wherein, in the nested condition, the overall height of the upper and lower parts is less than the additive total height of the upper and lower parts, taken separately.

- 150. An intervertebral implant according to claim 147, wherein the recess in the lower part is a generally flat surface with three walls including two opposite side walls and an end wall and including an opening opposite the end wall.
- 151. An intervertebral implant according to claim 150, wherein the second upper piece of the lower part includes a means for snap fitting into the first lower piece of the lower part.

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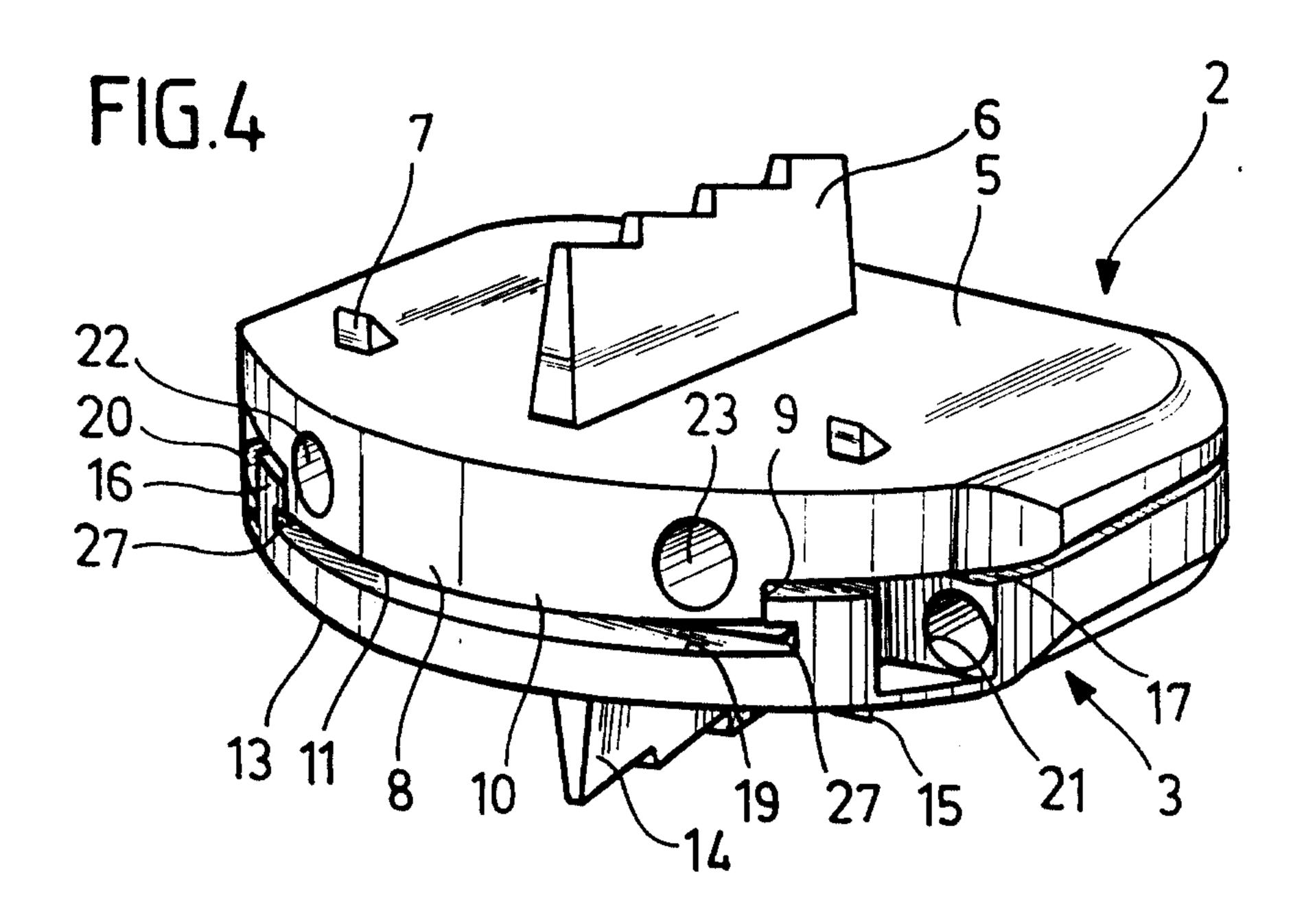
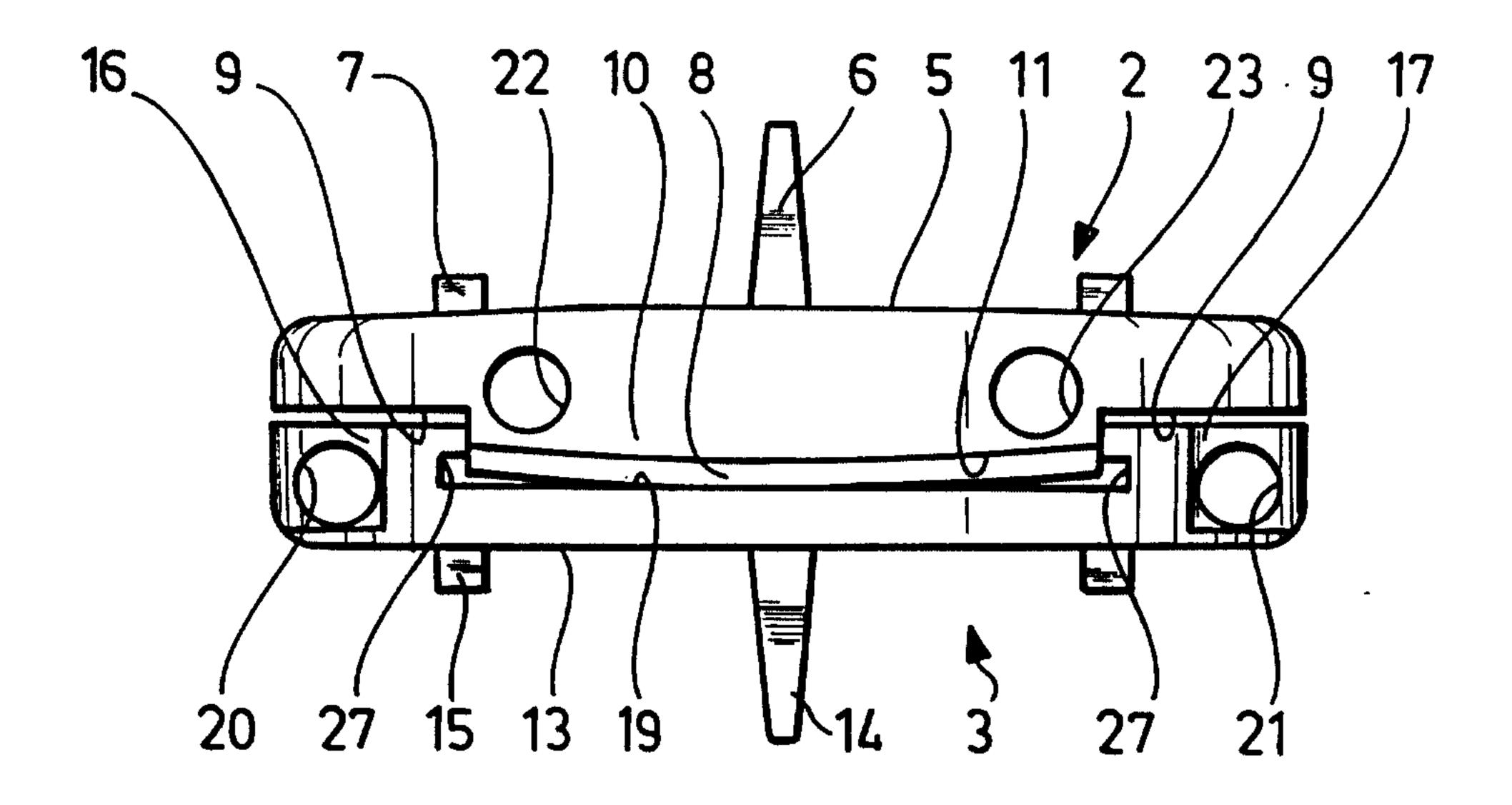


FIG.5



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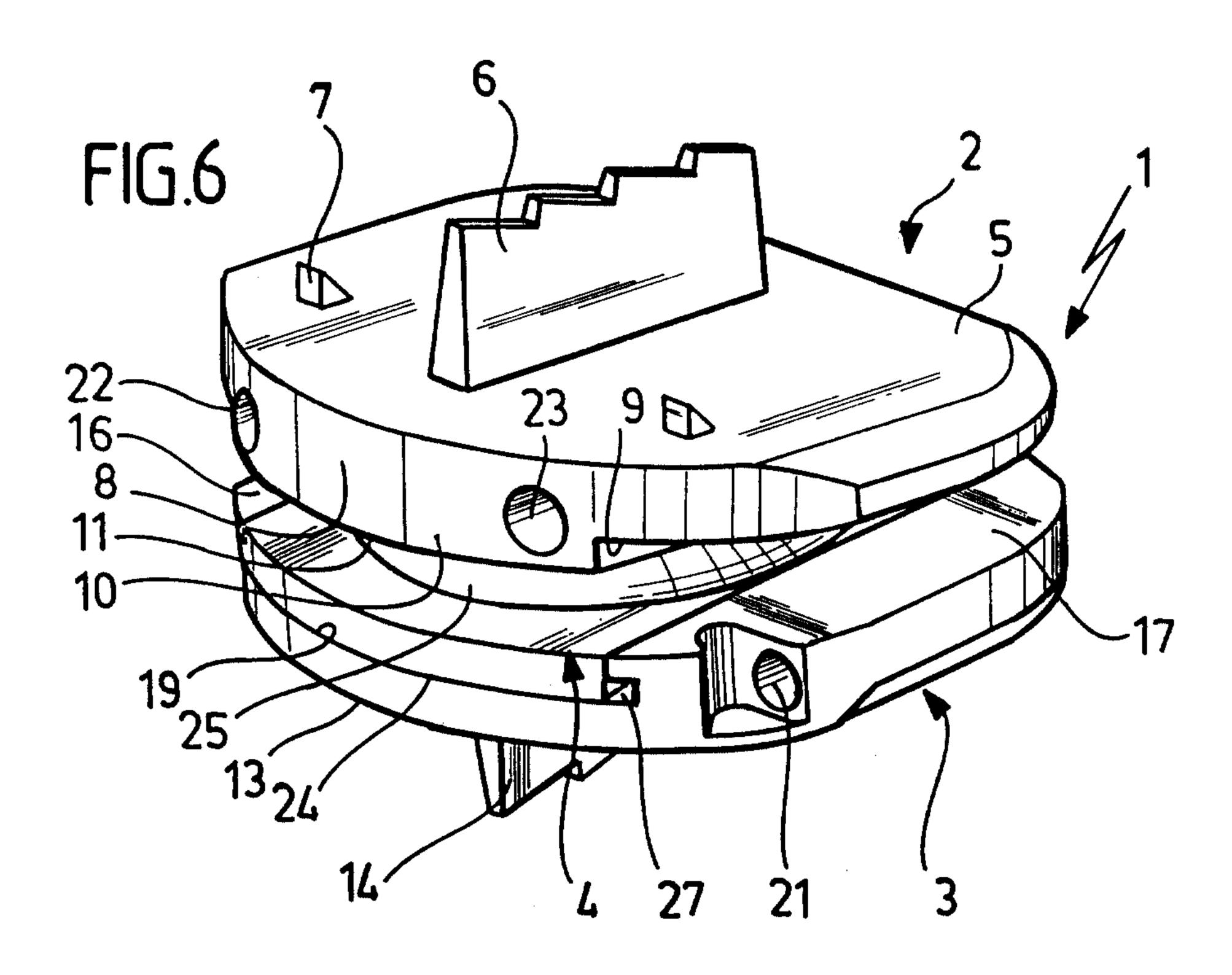
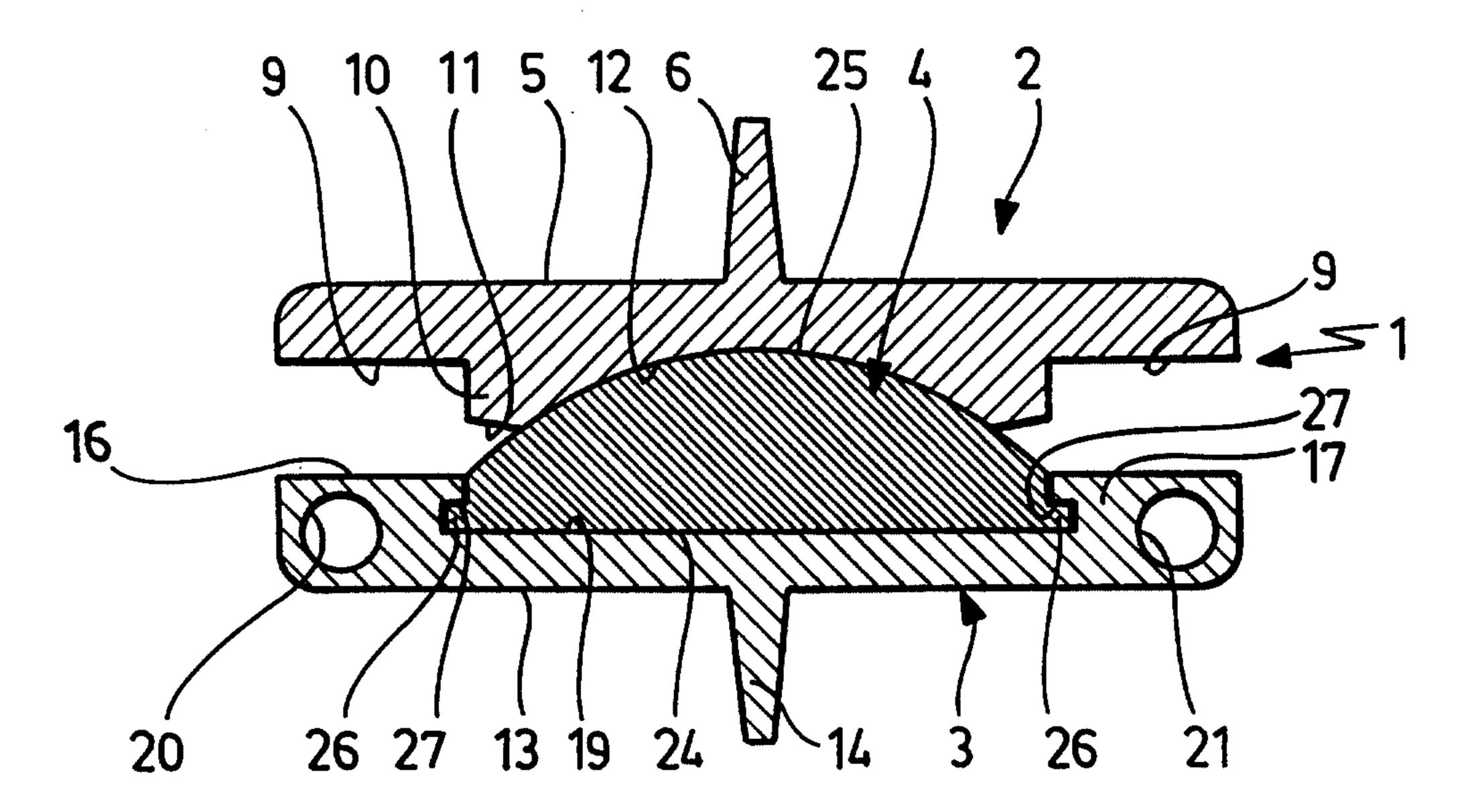


FIG.7



Hurke V. Clark

