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US 20180177567 A1 **US 20080311538 A1**

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INT CL **A61B, A61C**
Other: **WPI, EPODOC, Patent Fulltext**

(54) Title of the Invention: **Dental surgery apparatus**
Abstract Title: **Dental Surgery Apparatus with Guide and Depth Stop**

(57) Dental surgery apparatus for use in dental implant surgery comprises at least one sleeve 302-305 releasably securable to a dental handpiece 801 and having a channel for receiving a drill 802 and an external annular abutment surface defined between a first portion having a larger diameter than a second portion of the sleeve. The smaller diameter second portions of the sleeve are insertable into an aperture 203 of a dental surgical guide 201 until the annular abutment surface abuts a shoulder 202 surrounding the aperture 203 to act as a depth stop to limit the depth of the drilled hole. The length of the first portion of each sleeve may be different, to vary the depth of the drilled hole for each sleeve. An irrigation window may be defined in the side wall of each sleeve.

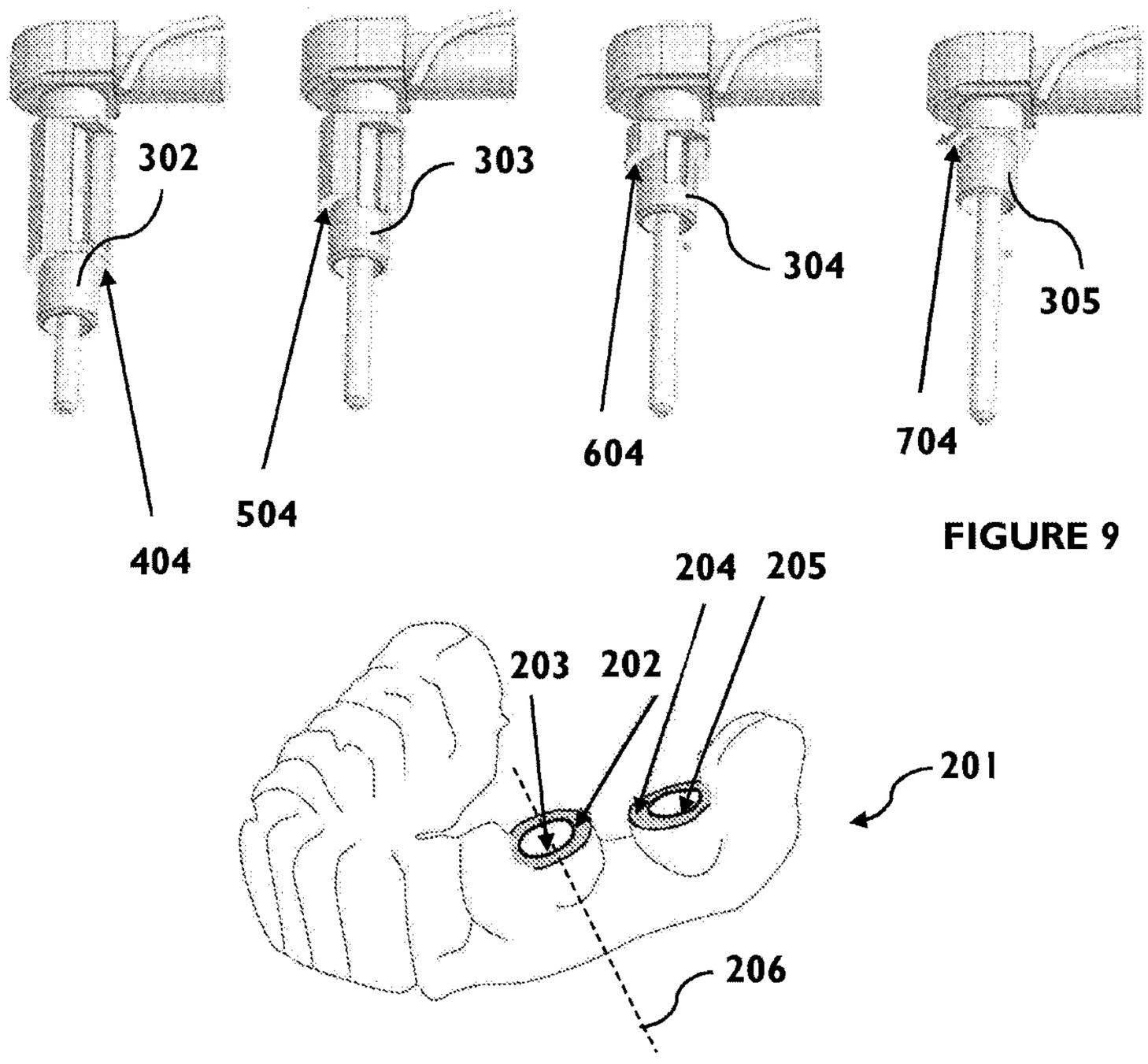

FIGURE 9

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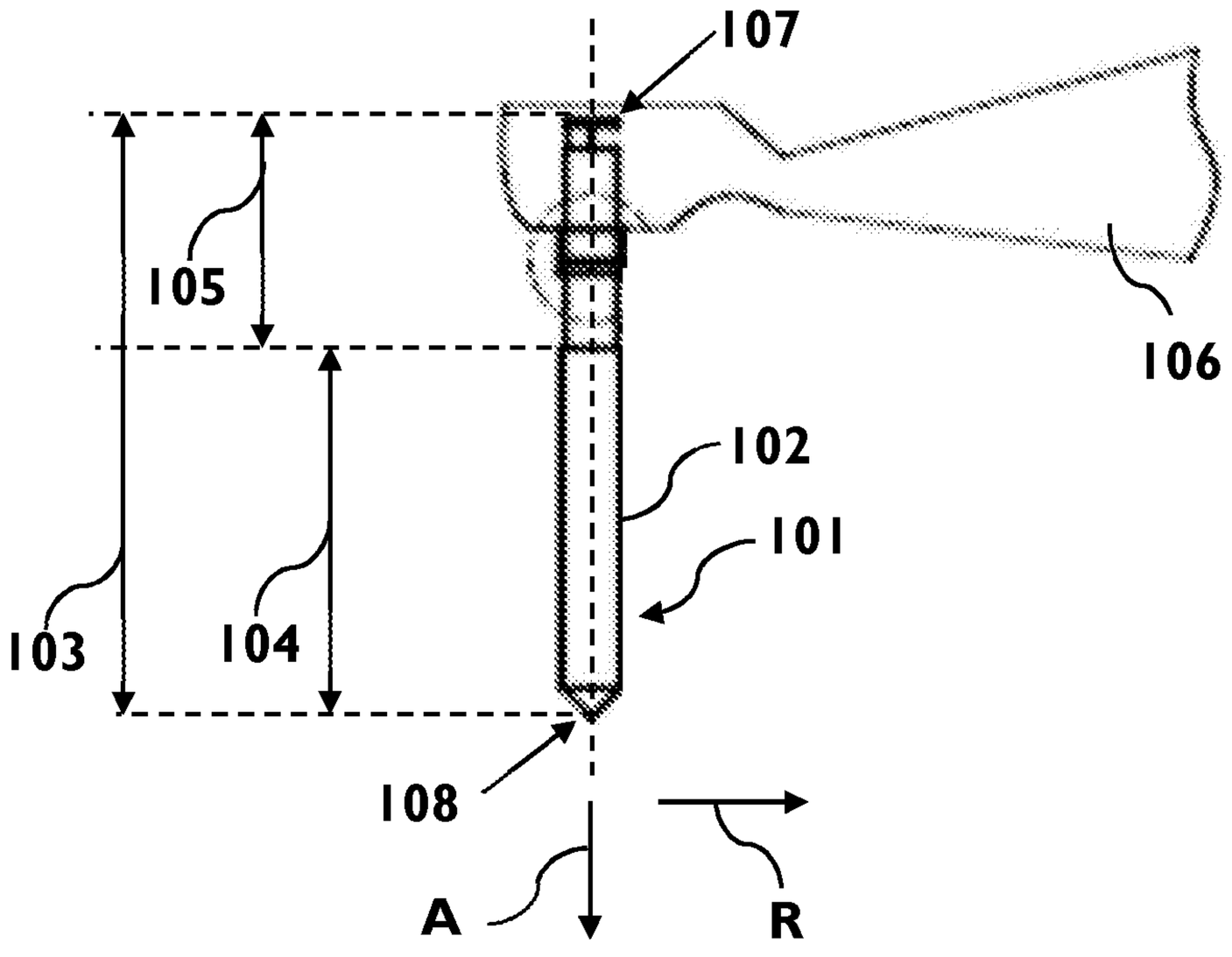

FIGURE 1 ***(PRIOR ART)***

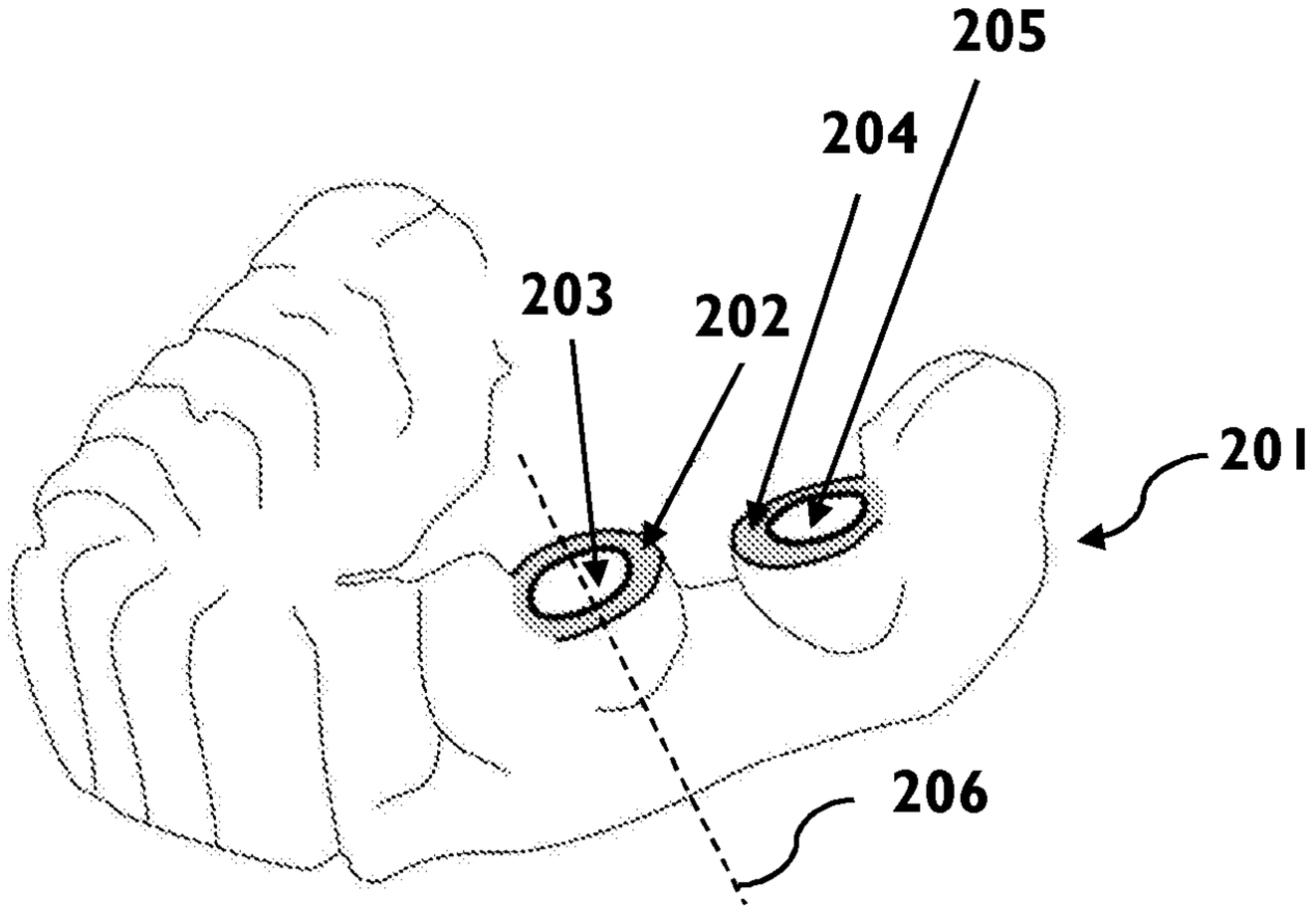

FIGURE 2 ***(PRIOR ART)***

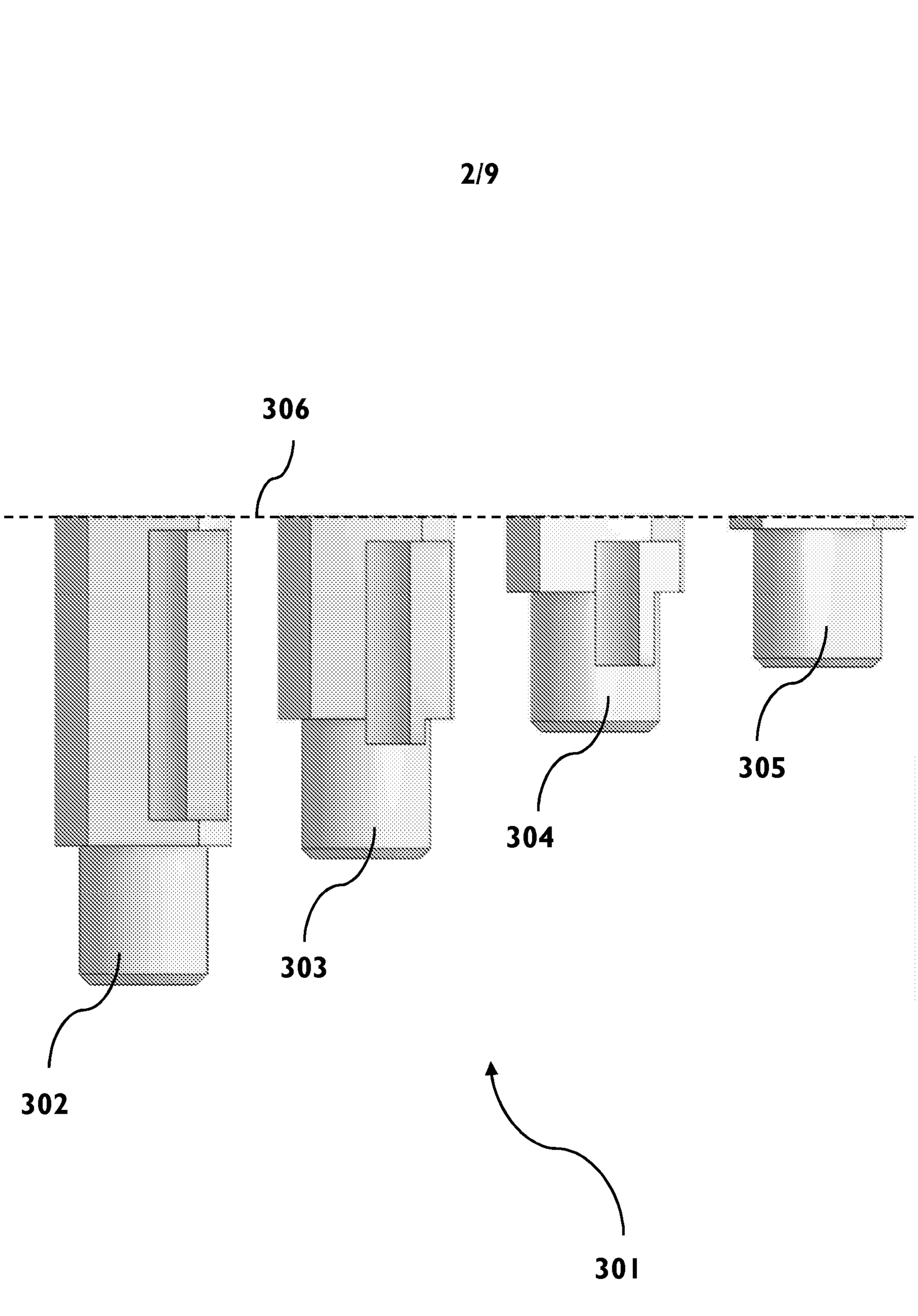

FIGURE 3

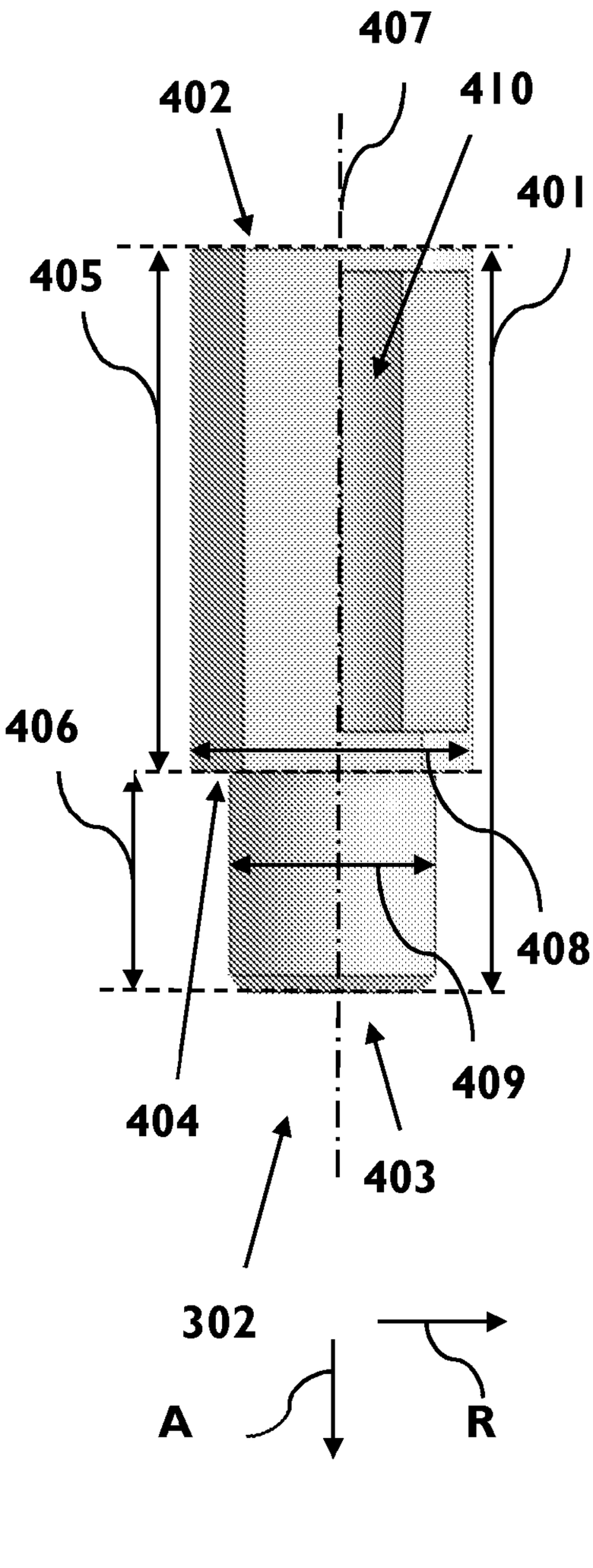

FIGURE 4

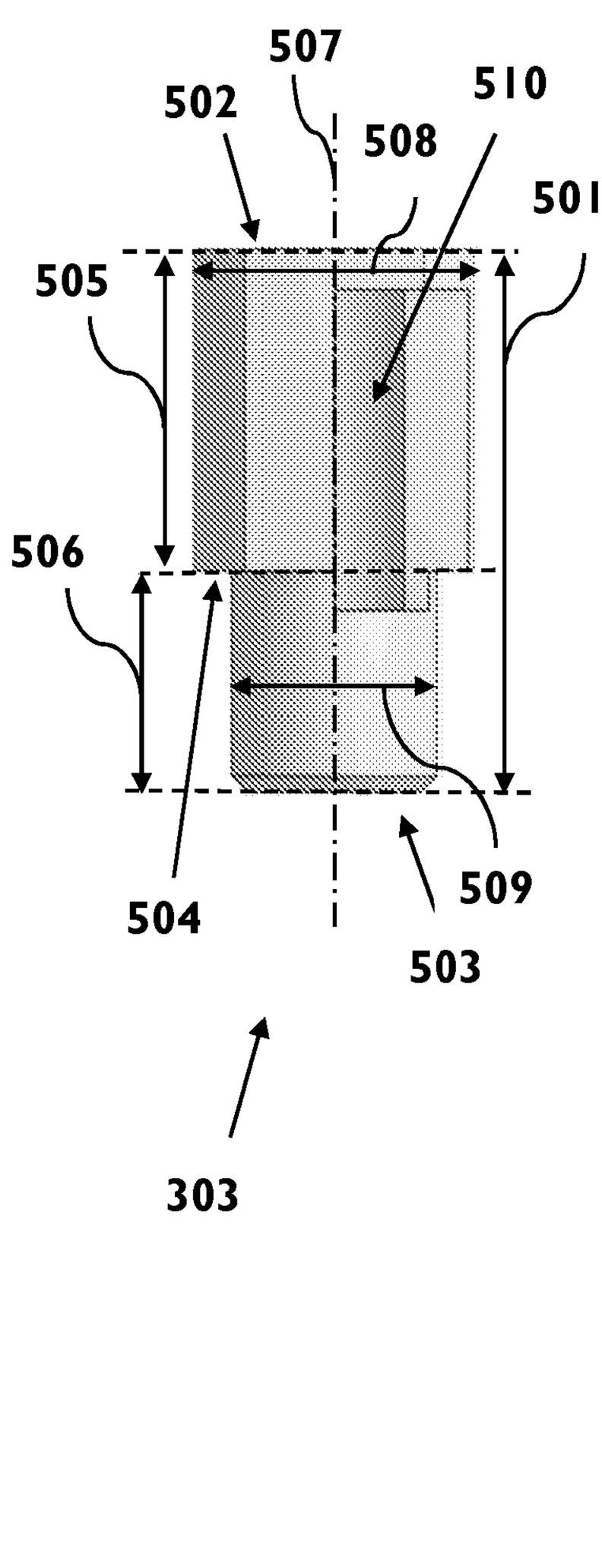

FIGURE 5

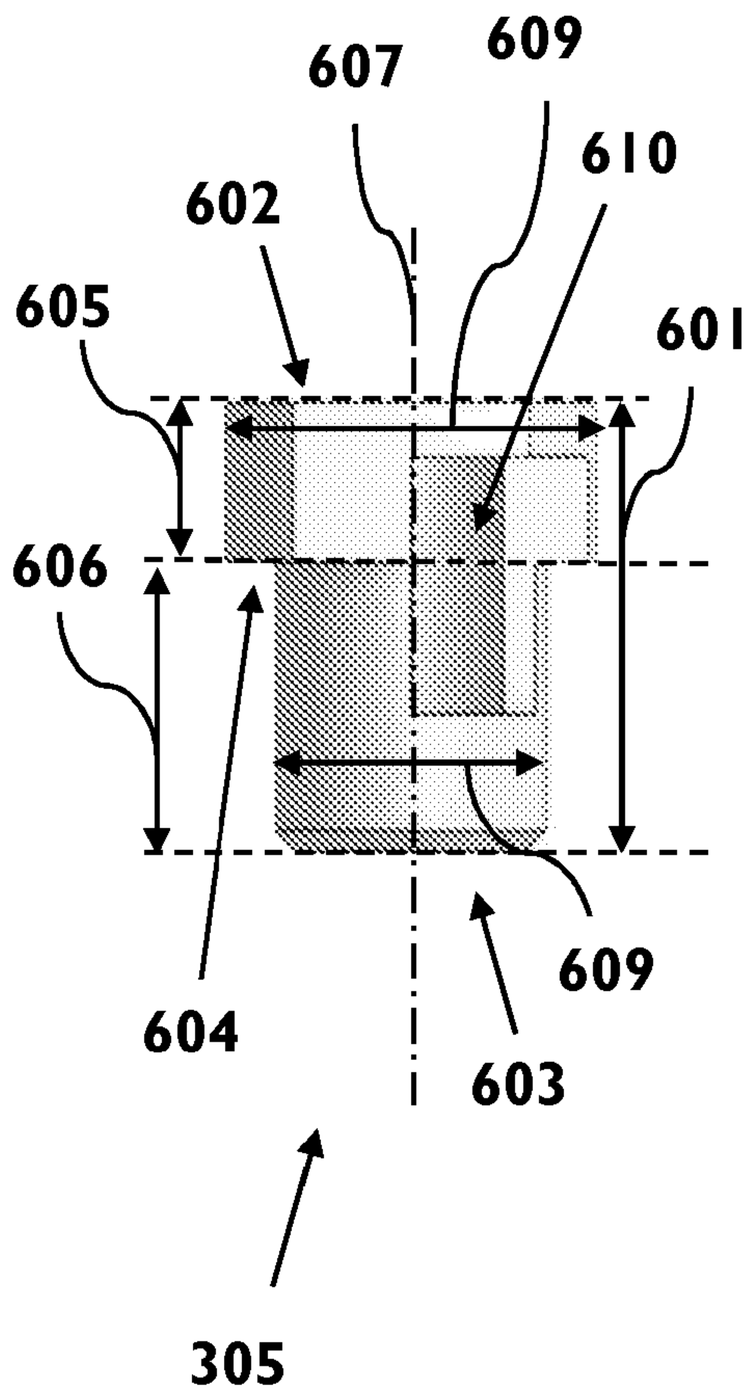

FIGURE 6

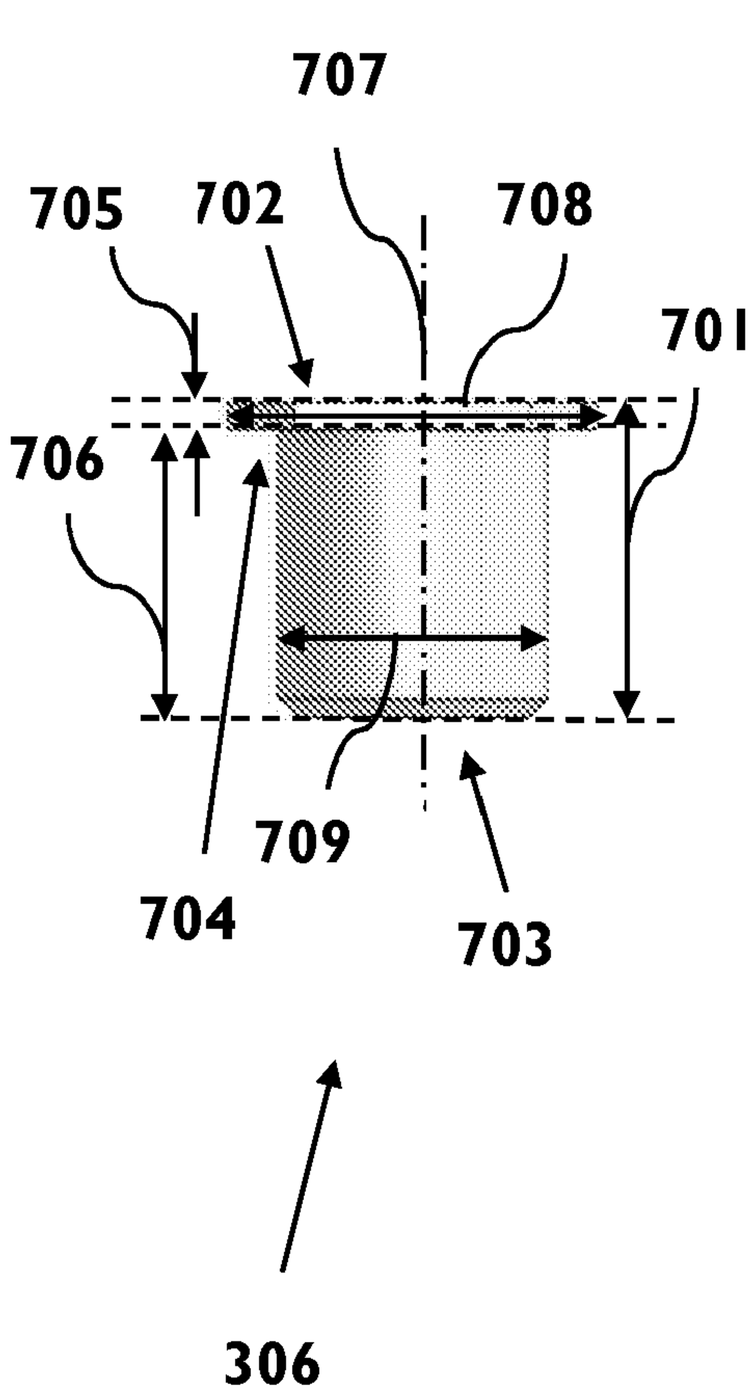

FIGURE 7

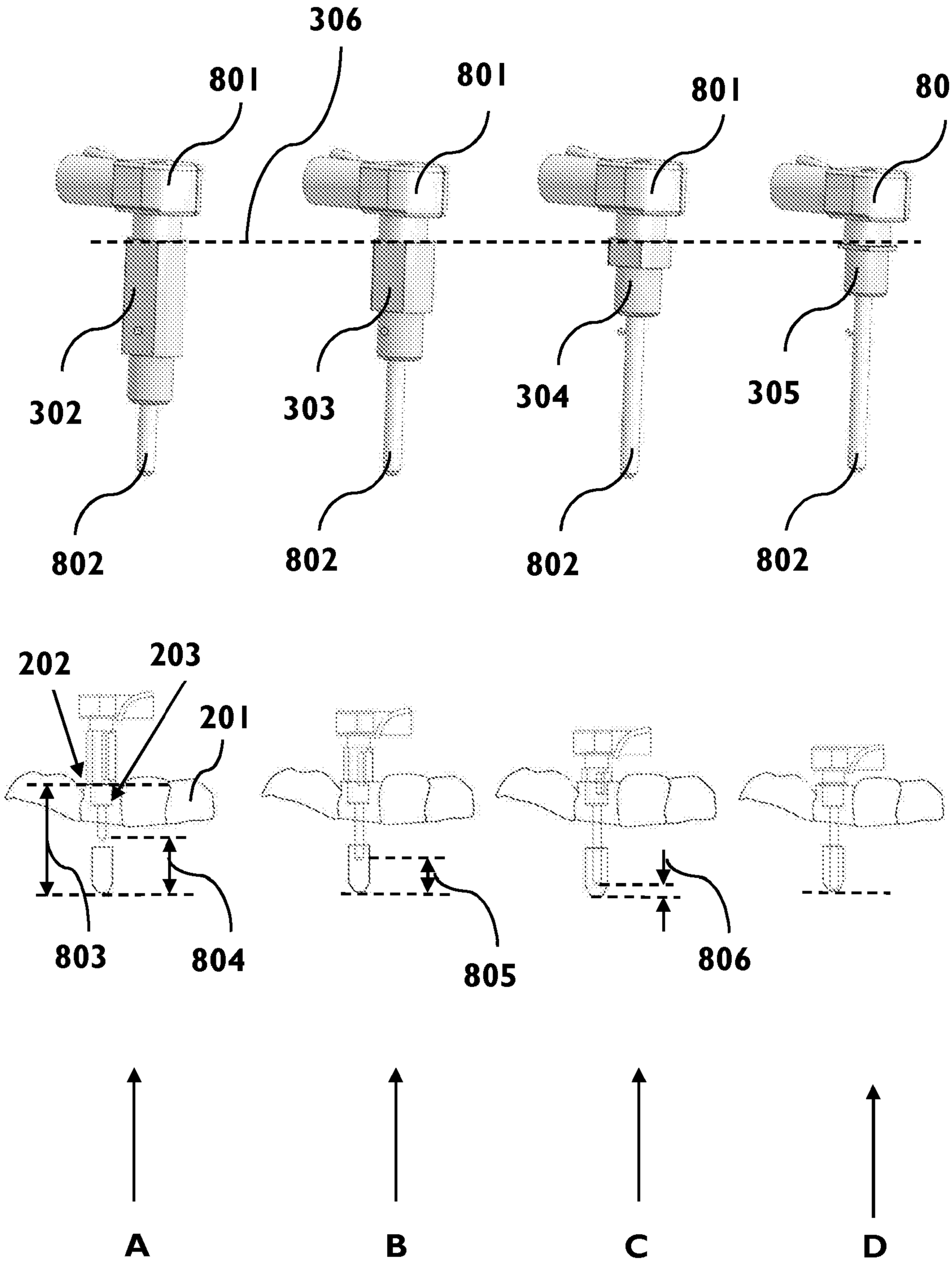
306
801
801
801
801
302
303
304
305
802
802
802
802
202
203
201
803
804
805
806
A
B
C
D

FIGURE 8

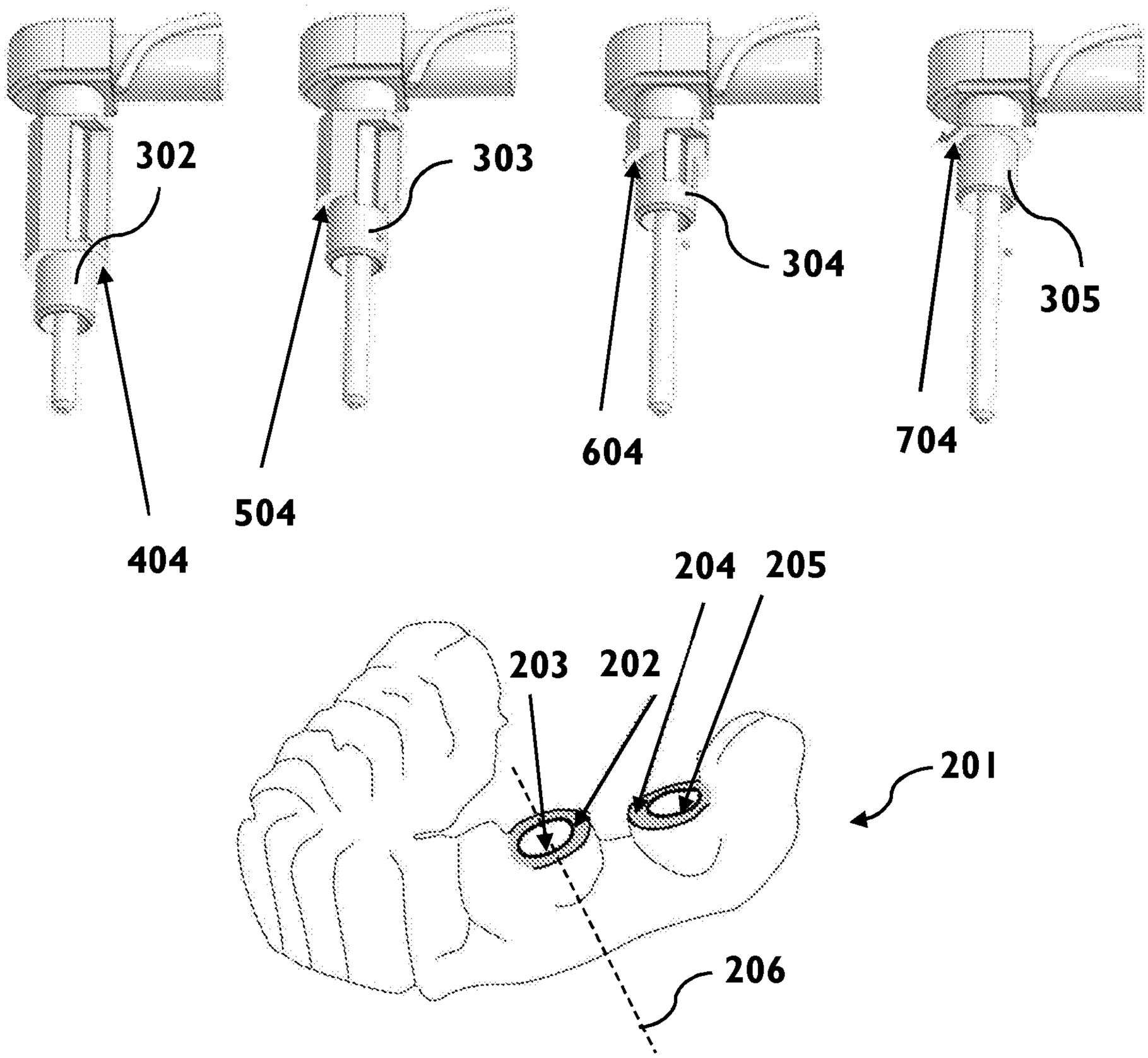

FIGURE 9

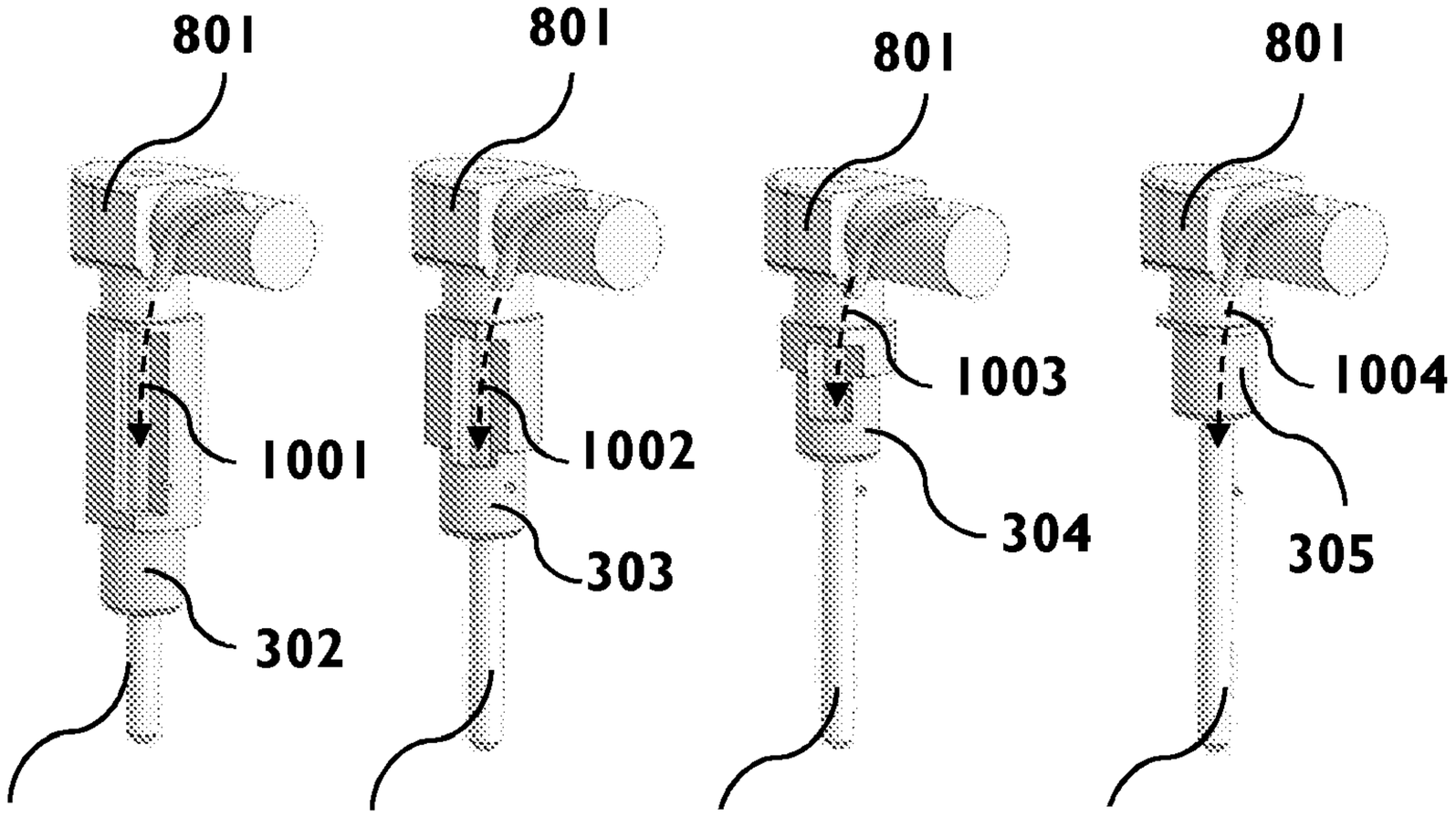
801
801
801
801
1001
1002
1003
1004
303
304
305
302
802
802
802
802

FIGURE 10

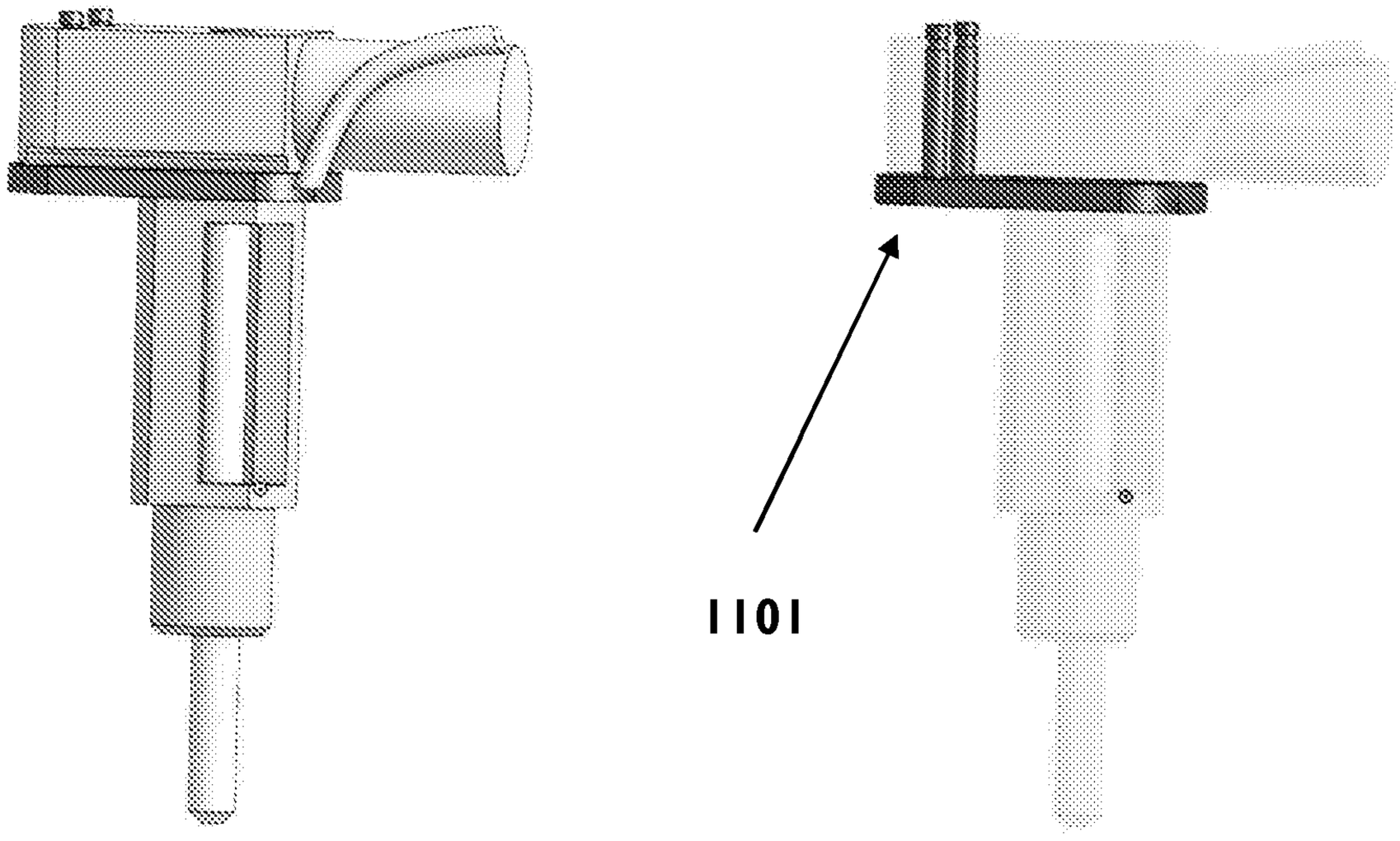

FIGURE 11

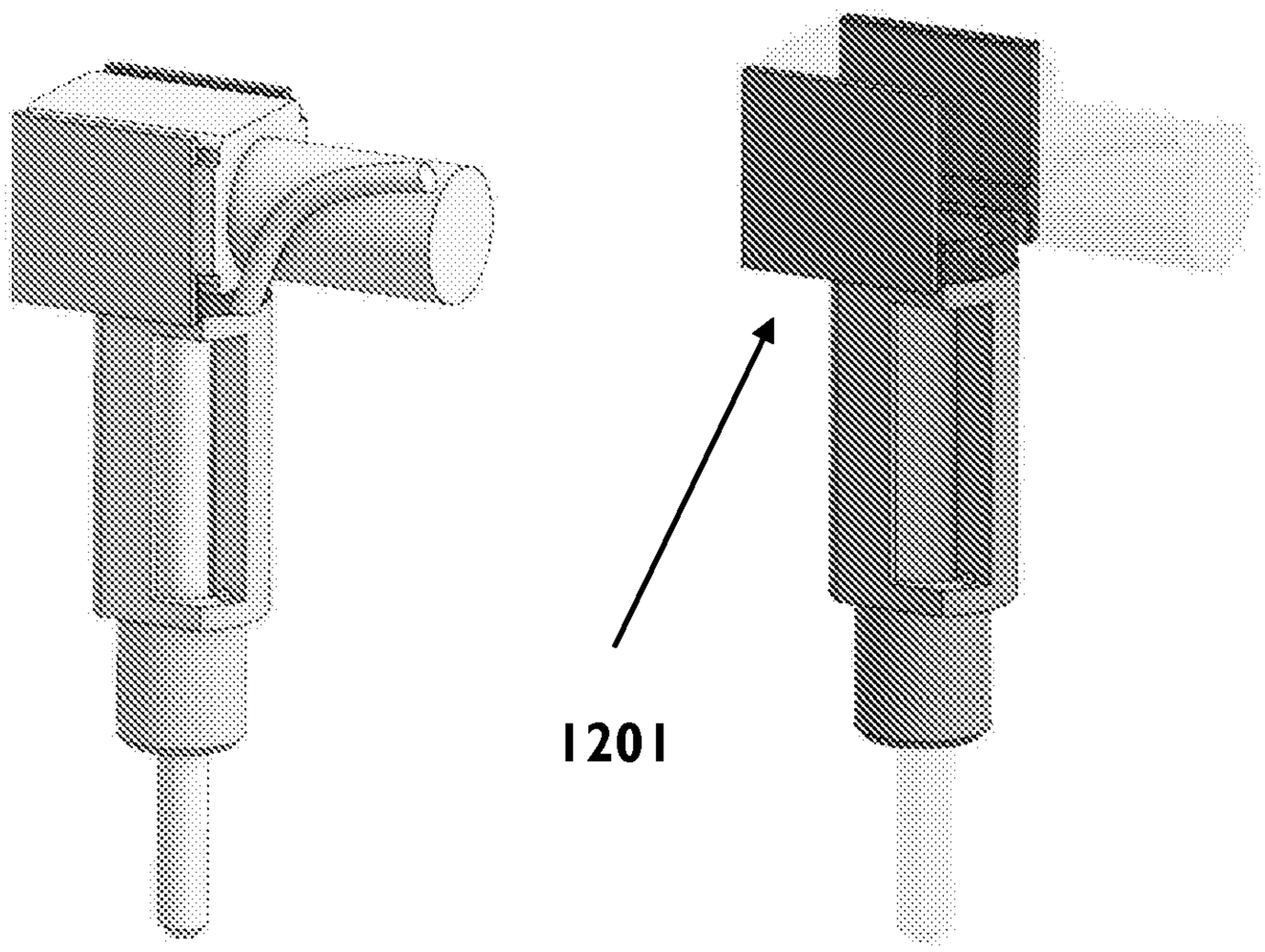

FIGURE 12

DENTAL SURGERY APPARATUS

Field of the Invention

The present invention relates to dental surgery apparatus, in particular to dental surgery apparatus for use in dental implant surgery.

Background of the Invention

Dental implant surgery is a procedure for replacing a damaged or missing tooth with an artificial tooth. When compared to conventional bridges or dentures, dental implants are often favoured for more closely achieving the aesthetic and structural qualities of natural teeth.

A dental implant is a surgical component that is fitted into the jaw to support a dental prosthesis such as a crown or bridge. A dental implant has a lower part, known as a fixture or post, that is inserted into the bone, and an upper part, known as an abutment or post extension, to which a dental prosthesis can be secured. Typically, the fixture is screwed into place within the jaw bone and a dental prosthesis is later fixed to the abutment. The biological process of osseointegration is utilised to form a secure, load-bearing bond between the fixture and the bone. The fixture and abutment parts of a dental implant may be made from the same or different materials.

The precise placement of the fixture of a dental implant in the jaw bone is important to achieve a properly aligned fitting of the dental prosthesis and to prevent the patient from experiencing avoidable discomfort.

Increasingly, software applications are used in conjunction with images of the oral cavity of the patient, such as X-ray or CT scan images, to determine a desired location and orientation for a dental implant.

Such a software application may also be utilised to design a surgical guide for use when drilling into the jaw to form the bony socket that the dental implant will be placed into.

A known type of surgical guide takes the form of a rigid body comprising a bridge portion disposed between a pair of mounting portions, the mounting portions removably mountable to teeth either side of the drill site and the bridge portion defining a guide aperture for guiding a drill to approach the drill site at a desired angle.

It is desirable to provide dental surgery apparatus that facilitates the expeditious and accurate positioning of the drilled hole into which a dental implant is to be sited and to facilitate correct installation of a dental prosthesis within the mouth of the patient.

Summary of the Invention

According to a first aspect there is provided dental surgery apparatus for use with a dental handpiece, a drill and a dental surgical guide that defines an aperture and a shoulder surrounding the aperture, comprising: at least one sleeve releasably securable to a dental handpiece; the sleeve having an axial direction, a first end, and a second end, the second end opposite the first end, and the sleeve defining a channel extending therethrough, in the axial direction, the channel open to both the first end and the second end, the channel for receiving a drill therein; the sleeve defining an external annular abutment surface, the external annular abutment surface positioned at a junction, in the axial direction, between a first portion of the sleeve, and a second portion of the sleeve, the first portion extending between the first end and the annular abutment surface and having a first diameter, and the second portion extending between the annular abutment surface and the second end and having a second diameter, the second diameter less than the first diameter; wherein the second portion of the sleeve is insertable into an aperture of a dental surgical guide into a condition in which the annular abutment surface abuts the shoulder surrounding the aperture; whereby when the sleeve is releasably secured to the dental handpiece, with the first end fixed and the second free, and a drill is engaged with the dental handpiece and extends through the channel of the sleeve, the second portion of the sleeve is insertable into an aperture of a dental surgical guide into a condition in which the annular abutment surface is in contact with the shoulder surrounding the aperture to limit the extent of insertion of the sleeve into the dental surgical guide and, in turn, limit the extent of insertion of the drill into the aperture of the dental surgical guide.

The at least one sleeve may comprise a plurality of sleeves, and the plurality of sleeve may comprise: a first sleeve and a second sleeve, the first portion of the first sleeve having a depth that is greater than a depth of the first portion of the second sleeve, and the second portion of the first sleeve having a depth that is the same as a depth of the second portion of the second sleeve.

The at least one sleeve may comprise a plurality of sleeves, and the plurality of sleeve may comprise at least one sleeve that defines an irrigation window, in a side wall portion thereof, that connects the channel of the sleeve to the exterior of the sleeve:

The at least one sleeve may comprise one part of a multi-part releasable securing arrangement for releasably securing the sleeve to a dental handpiece.

The at least one sleeve may be fabricated from a metal material or from a plastics material.

According to a second aspect there is provided a dental surgery apparatus kit, comprising dental surgery apparatus according to the first aspect, and further comprising at least one of: a dental handpiece, a drill, a dental surgical guide.

Further particular and preferred aspects of the invention are set out in the accompanying dependent claims.

Brief Description of the Drawings

The present invention will now be more particularly described, with reference to the accompanying drawings, in which:

Figure 1 shows a prior art drill removably engaged with a prior art dental handpiece;

Figure 2 shows a prior art dental surgical guide;

Figure 3 shows a set of sleeves;

Figures 4 to 7 show sleeves of the set of sleeves of **Figure 3** in further detail;

Figures 8 to 10 illustrate features of use of the sleeves of **Figure 3** with a dental handpiece, drill and dental surgical guide; and

Figures 11 & 12 illustrate example arrangements for releasably securing each of the sleeves of **Figure 3** to a dental handpiece.

Description

Illustrative embodiments and examples are described below in sufficient detail to enable those of ordinary skill in the art to embody and implement the apparatus, systems and/or processes described herein. It is to be understood that embodiments and examples can be provided in many alternate forms and the invention should not be construed as limited to the embodiments and examples set forth herein but by the scope of the appended claims.

A prior art drill 101 is shown in **Figure 1**. Drill 101 has an axial direction A, and a radial direction R. The drill has a shaft 102, which has a length 103 in the axial direction A. The shaft 102 of the drill 101 comprises a working portion 104 and a fitting portion 105. The fitting portion 105 of the shaft 102 is configured and dimensioned to be engaged with a dental handpiece. The working portion 104 may be configured to perform any suitable function, for example, bone removal, shaping or finishing, or implant driving.

In this Figure, the drill 101 is shown removably engaged with a prior art dental handpiece 106. It can be seen that a fitting end 107 of the fitting portion 105 of the shaft 102 of the drill 101 is releasably held within the dental handpiece 106. The fitting end 107 may be any suitable type of end, for example a latch-grip end or a friction-fit end, for use with any suitable type of dental handpiece. The working portion 104 of the shaft 102 of the drill 101 provides a leading end 108 of the drill 101, which may have any suitable profile.

A prior art dental surgical guide is shown in **Figure 2**. The dental implant surgical guide 201 comprises a shoulder 202 surrounding an aperture 203 that extends through the surgical guide 201 and, in this example, further comprises a second shoulder 204 that surrounds an aperture 205 that also extends fully through the surgical guide 201. It is to be understood that the or each aperture of such a surgical guide extends at a predetermined angle for guiding a drill at a pre-planned angle towards the jaw bone of the patient. For example, a central axis 206 through aperture 203 indicates a pre-determined

angle through the surgical guide 201 that a drill, such as drill 101, will be guided when inserted into the aperture 203.

Dental surgery apparatus comprising at least one sleeve, the at least one sleeve for use with a dental handpiece, a drill and a dental surgical guide that defines an aperture and a shoulder surrounding the aperture, will now be described.

A set of sleeves 301 is shown in **Figure 3**. In this illustrated example, the set of sleeves 301 comprises a first sleeve 302, a second sleeve 303, a third sleeve 304 and a fourth sleeve 305. It is to be appreciated that the set of sleeves may comprise a greater or a lesser number of sleeves than 4. Each of the sleeves 302, 303, 304, 305 has an axial direction A and a radial direction R, and is hollow.

The first sleeve 302 is shown in further detail in **Figure 4**. The second sleeve 303 is shown in further detail in **Figure 5**. The third sleeve 304 is shown in further detail in **Figure 6**. The fourth sleeve 305 is shown in further detail in **Figure 7**.

Referring now to **Figures 4, 5, 6 & 7**, each of the sleeves 302, 303, 304, 305 has a depth 401, 501, 601, 701, in the axial direction A of the sleeve, extending between a first end 402, 502, 602, 702 and a second, opposite end 403, 503, 603, 703 thereof respectively.

As shown, the depth 401 of the first sleeve 302 is greater than the respective depth 501, 601, 701 of each of the second, third and fourth sleeves 303, 304, 305. The depth 501 of the second sleeve 303 is greater than the respective depths 601, 701 of the third and fourth sleeves 304, 305 (but less than the depth 401 of the first sleeve 302). The depth 601 of the third sleeve 304 is greater than the depth 701 of the fourth sleeve 305 (but less than the respective depths 401, 501 of the first and second sleeves 302, 303). The depth 701 of the fourth sleeve 305 is less than the respective depths 401, 501, 601 of the first, second and third sleeves 302, 303, 304. The different depths 401, 501, 601, 701 of the sleeves 302, 303, 304, 305 can be visually compared in **Figure 3**, which shows the sleeves 302, 303, 304, 305 of the set of sleeves 301 with the respective first ends 402, 502, 602, 702 thereof aligned along a reference axis 306.

Each of the sleeves 302, 303, 304, 305 defines an annular abutment surface 404, 504, 604, 704 respectively, which is positioned between the respective first and second, opposite ends 402, 502, 602, 702; 403, 503, 603, 703 thereof, in the axial direction A, and oriented, in a plane that is perpendicular to the axial direction A, to face towards the respective second, opposite end 403, 503, 603, 703.

According to the shown arrangement, the respective annular abutment surface 404, 504, 604, 704 of each sleeve 302, 303, 304, 305 is positioned at a junction, in the axial direction A, between a first portion 405, 505, 605, 705 of the sleeve 302, 303, 304, 305 and a second portion 406, 506, 606, 706 of the sleeve 302, 303, 304, 305; the first portion 405, 505, 605, 705 extending between the first end 402, 403, 404, 405 and the annular abutment surface 404, 504, 604, 704, and the second portion 406, 506, 606, 706 extending between the annular abutment surface 404, 504, 604, 704 and the second, opposite end 403, 503, 603, 703 of the sleeve 302, 303, 304, 305, respectively.

A central axis 407, 507, 606, 707 of each of the sleeves 302, 303, 304, 305, extending in the axial direction A, is indicated. The first portion 405, 505, 605, 705 of each of the sleeves 302, 303, 304, 305 has a first diameter 408, 508, 608, 708 respectively, and the second portion 406, 506, 606, 706 of each of the sleeves 302, 303, 304, 305 has a second diameter 409, 509, 609, 709 respectively, the second diameter 409, 509, 609, 709 less than the first diameter 408, 508, 608, 708.

Thus, as can be seen from **Figures 3 to 7**, the annular abutment surface 404, 504, 604, 704 of each sleeve 302, 303, 304, 305 is an external annular abutment surface 404, 504, 604, 704.

According to this illustrated example, the first portions 405, 505, 605, 705 of the sleeves 302, 303, 304, 305 have the same first diameter 408, 508, 608, 708. However, in an alternative example, the first portion 405, 505, 605, 705 of at least one of the sleeves 302, 303, 304, 305 has a different first diameter 408, 508, 608, 708 to the first portion 405, 505, 605, 705 of at least one other of the sleeves 302, 303, 304, 305.

In addition, according to this illustrated example, the second portions 406, 506, 606, 706 of the sleeves 302, 303, 304, 305 have the same second diameter 409, 509, 609, 709. However, in an alternative example, the second portion 406, 506, 606, 706 of at least one of the sleeves 302, 303, 304, 305 has a different second diameter 408, 508, 608, 708 to the second portion 406, 506, 606, 706 of at least one other of the sleeves 302, 303, 304, 305.

Further, according to this illustrated example, the second portions 406, 506, 606, 706 of the sleeves 302, 303, 304, 305 have the same depth 406, 506, 606, 706. In an alternative example, the second portion 406, 506, 606, 706 of at least one of the sleeves 302, 303, 304, 305 has a different depth 406, 506, 606, 706 to the second portion 406, 506, 606, 706 of at least one other of the sleeves 302, 303, 304, 305.

Thus, in a set of sleeves, the diameters of the first portions of the sleeves may be the same or differ and/or the diameters of the second portions of the sleeves may be the same or differ and/or the depths of the second portions of the sleeves may be the same or differ.

According to this illustrated example, the first, second and third sleeves 302, 303, 304 define a respective irrigation window 410, 510, 610, in a side wall portion thereof. As mentioned previously, each of the sleeves 302, 303, 304, 305 is hollow. More specifically, each of the sleeves 302, 303, 304, 305 defines a channel extending therethrough, in the axial direction A, that is open to both the first end 402, 502, 602, 702 and the second, opposite end 403, 503, 603, 703. The irrigation window 410, 510, 610 of each of the first, second and third sleeves 302, 303, 304 connects the channel of the respective sleeve 302, 303, 304 to the exterior of the respective sleeve 302, 303, 304. The irrigation window 410, 510, 610 therefore allows passage of a fluid and/or a liquid from outside the sleeve, 303, 304, 305 into the sleeve 303, 304, 305 and vice versa.

Thus, in a set of sleeves, at least one of the sleeves features an irrigation window that fluidly connects the interior of the sleeve to the exterior of the sleeve.

Use of the set of sleeves 301 will now be described. The channel of each sleeve 302, 303, 304, 305 is arranged to receive a drill therein. **Figure 8** shows at A, B, C, and D respectively, each of the sleeves 302, 303, 304, 305 arranged for use in an assembly with a dental handpiece 801 and a drill 802. When assembled as illustrated, the drill 802 is engaged with the dental handpiece 801, the sleeve 302, 303, 304, 305 is releasably secured to the dental handpiece 801, and the drill 802 extends through the channel of the sleeve 302, 303, 304, 305. In the assembly, the sleeve 302, 303, 304, 305 surrounds the drill 802, and the first end 402, 502, 602, 702 of the first portion 405, 505, 605, 705 of the sleeve 302, 303, 304, 305 is a fixed end, and the second end 403, 503, 603, 703 of the second portion 406, 506, 606, 706 is a free end.

The sleeve 302, 303, 304, 305 is releasably securable to the dental handpiece 801 by any suitable releasably securing arrangement. The sleeve 302, 303, 304, 305 and drill 802 can be assembled by sliding the sleeve 302, 303, 304, 305 over the drill 802 or conversely by sliding the drill 802 through the sleeve 302, 303, 304, 305, as allowed by the releasably securing arrangement. When the dental handpiece 801 is in use, the sleeve 302, 303, 304, 305 does not rotate with the drill 802.

As also illustrated in **Figure 8**, A, B, C, and D respectively, the second portion 406, 506, 606, 706 of each of the first, second, third and fourth sleeves 302, 303, 304, 305 is dimensioned to be inserted into an aperture of a dental surgical guide, for example aperture 203 of dental implant surgical guide 201. The second portion 406, 506, 606, 706 is insertable into the aperture 203 of the dental implant surgical guide 201 until the respective annular abutment surface 404, 504, 604, 704 abuts against the shoulder 202 of the aperture 203, thus limiting the extent of insertion of the sleeve 302, 303, 304, 305 into the dental implant surgical guide 201.

Conventionally, the internal profile of an aperture of a dental surgical guide is that of the interior of a hollow circular cylinder. According to this illustrated embodiment, second portion 406, 506, 606, 706 of each of the sleeves 302, 303, 304, 305 is formed as a hollow circular cylinder.

However, it is to be appreciated that the first and second portions 405, 505, 605, 705; 406, 506, 606, 706 of each of the sleeves 302, 303, 304, 305 may have any suitable external profile and any suitable internal profile.

The shoulder 202 of the dental implant surgical guide 201 is oriented in a plane that is perpendicular to a central axis of the implant when in its intended fitted position within the bone, for example, a central axis coaxial with central axis 206 through aperture 203.

The drilling depth 803, this being the distance below the shoulder 202 of the dental implant surgical guide 201 to which an implant socket is to be drilled, is shown at A. It can also be seen at A that when the second portion 406 of first sleeve 302 is inserted to the maximum extent within the aperture 203 of the dental implant surgical guide 201, there is a remaining depth 804 between the drill 802 and the drilling depth 803. As can be seen at B, when the second portion 506 of second sleeve 303 is inserted to the maximum extent within the aperture 203 of the dental implant surgical guide 201, there is also a remaining depth 805 between the drill 802 and the drilling depth 803; however, from comparison with A, it can be seen that the remaining depth 805 associated with the second sleeve 303 is less than the remaining depth 804 associated with the first sleeve 302. Similarly, as can be seen at C, when the second portion 606 of third sleeve 304 is inserted to the maximum extent within the aperture 203 of the dental implant surgical guide 201, there is a remaining depth 806 between the drill 802 and the drilling depth 803; however, from comparison with B, it can be seen that the remaining depth 806 associated with the third sleeve 304 is less than the remaining depth 805 associated with the second sleeve 303 (and, consequently, also less than the remaining depth 804 associated with the first sleeve 302). Finally, it can be seen at D that when the second portion 506 of fourth sleeve 305 is inserted to the maximum extent within the aperture 203 of the dental implant surgical guide 201, there is no remaining depth and the drilling depth 804 is reached.

It is to be understood that sleeves of the set of sleeves are usable to limit the extent of insertion of the drill into the aperture of the dental surgical guide.

Thus, it is to be appreciated that the set of sleeves 301 can be used in a sequence of first sleeve 302, to second sleeve 303, to third sleeve 304 to fourth sleeve 305 to drill an implant socket in stages, each stage associated with a different maximum drilling length. In this way, an implant socket can be drilled in increments. The sleeves 302, 303, 304, 305 may be used with the same drill or a plurality of drills that differ from one another in one or more features, for example in diameter and/or tip profile. Thus, for example, it is possible to drill to a first depth with a drill having diameter, drill to the same first depth with a drill having a second, greater diameter, then drill to a second, deeper depth with the drill having the second depth, then drill to that second depth with a drill having a third, greater drill diameter and so on.

Each sleeve 302, 303, 304, 305 is insertable into an aperture of a dental surgical guide into a condition in which the annular abutment surface abuts the shoulder surrounding the aperture. The physical contact of the annular abutment surface with the shoulder surrounding the aperture limits the extent that the sleeve is inserted into the dental surgical guide. In addition, during a drilling stage, the annular abutment surface can be rested against the shoulder surrounding the aperture for self-levelling of the drill in the planned direction/angulation of drilling associated with that aperture of that dental surgical guide.

It is to be appreciated that the depth 406, 506, 606, 706 of the second portions 406, 506, 606, 706 of the sleeves 302, 303, 304, 305 should not be so great as to cause the sleeve 302, 303, 304, 305 to project through the other side of the dental surgical guide when the sleeve 302, 303, 304, 305 is inserted into an aperture thereof.

However, if the second diameter 409, 509, 609, 709 of each of the second portions 406, 506, 606, 706 of the sleeves 302, 303, 304, 305 is only slightly less than the diameter of the aperture of the dental surgical guide, and the depth 406, 506, 606, 706 of the second portions 406, 506, 606, 706 of the sleeves 302, 303, 304, 305 is only slightly less than the depth of the aperture of the dental surgical guide, then this can ensure stable positioning of sleeve 302, 303, 304, 305 within the aperture of the dental surgical guide when the annular abutment surface 404, 504, 604, 704 thereof is resting on the shoulder surrounding the aperture.

Figure 9 shows the annular abutment surfaces 404, 504, 604, 704 of the first, second, third and fourth sleeves 302, 303, 304, 305 respectively and the shoulder 202 of dental implant surgical guide 201 in further detail.

Figure 10 illustrates an irrigation feature of the first, second, third and fourth sleeves 302, 303, 304, 305 respectively in use. The first, second and third sleeves 302, 303, 304 define irrigation windows 410, 510, 610 and the depth of the fourth sleeve 305 is relatively shallow, allowing saline irrigation for cooling of the drill and/or bone. A direction of flow from the dental handpiece 801 downwards, across the first end 402, 502, 602, 702 and towards the second, opposite end 403, 503, 603, 703 of each sleeve 302, 303, 304, 305 is shown by arrow 1001, 1002, 1003, 1004 respectively. This feature is beneficial for enabling control of heat generated during the drilling process to be removed. It is to be appreciated however that the degree of cooling implemented during the drilling process may vary, for example as localised areas of higher temperature may affect healing of the bone and the speed of osseointegration of the fitted implant with surrounding bone.

Any suitable form of releasable securing arrangement may be utilised to removably attach each sleeve to a dental handpiece. A first example releasable securing arrangement 1101, which comprises a rail system, is shown in **Figure 11**. A first example releasable securing arrangement 1201, which comprises a clamp system, is shown in **Figure 12**. A releasable securing arrangement may be used that involves one or more of: a sliding action, a twisting action, a screwing action, a push-fit action. The releasable securing arrangement may comprise a first part carried by the sleeve and a second part carried by the dental handpiece, the first part and the second part co-operable to releasably secure the sleeve to the dental handpiece. Thus, the sleeve may comprise one part of a multi-part releasable securing arrangement for releasably securing the sleeve to a dental handpiece, the dental handpiece comprising another part of the multi-part releasable securing arrangement.

It is to be appreciated that, with the releasable securing arrangements illustrated in **Figure 11** and **Figure 12**, when the sleeve is fixed to the dental handpiece, the sleeve does not rotate with the drill, and is therefore static.

The or each sleeve may be fabricated from any suitable material or combination of materials. In an example, at least one sleeve is fabricated from a metal material. In an example, at least one sleeve is fabricated from a plastics material. The or each sleeve may be manufacture using any suitable process or combination of processes. In an example, at least one sleeve is manufactured using an additive manufacturing process.

The apparatus of the present invention enables a maximum drilling depth to be quickly and simply adjusted by exchanging the sleeve used on the drill.

The apparatus of the present invention enables a stepped drilling approach, where required depth is achieved by staged drilling and levelling.

The apparatus of the present invention is advantageously usable with standard drills. A dental handpiece adapted for use with the sleeve may be provided. A dental handpiece comprising one part of a multi-part releasable securing arrangement for releasably securing a sleeve to a dental handpiece, the sleeve comprising another part of the multi-part releasable securing arrangement may thus be provided.

An example use of dental surgical apparatus as disclosed herein, in a method of dental implant surgery, will now be described.

In preparation for performing surgery on the mouth of a patient, a dental surgical guide is designed and produced. The dental surgical guide defines an aperture therethrough, which is oriented at a desired angle of approach for a dental drill being advanced towards the jaw bone of the patient.

Appropriate equipment, including a plurality of sleeves, each sleeve as described with reference to **Figures 3 to 12**, a suitable handpiece, and at least one suitable drill is made available for use by the dental professional. The at least one drill may comprise a plurality of drills, which includes a bone leveller, which is used to level crestal bone, and an implant driver, which is used to place a dental implant into a pre-drilled hole.

A qualified user positions the dental surgical guide at the intended position within the mouth of the patient and then levels the surface of the cortical bone using a first sleeve and a bone leveller. A first maximum drilling depth is associated with the first sleeve.

The operator can then perform a drilling stage to produce the implant socket.

An initial drilling phase is performed using a second sleeve and a first drill. A second maximum drilling depth is associated with the second sleeve.

A subsequent drilling phase is performed using a third sleeve and the first drill. A third maximum drilling depth is associated with the third sleeve, which is greater than the second maximum drilling depth.

A further subsequent drilling phase is performed using a fourth sleeve and the drill. A fourth maximum drilling depth is associated with the fourth sleeve, which is greater than the third maximum drilling depth (and, in turn, greater than the second maximum drilling depth).

Thus, using the second, third and fourth sleeves sequentially with the drill provides for a stepped progression of the drilling of the implant socket.

At the close of a drilling phase, before withdrawing the sleeve from the aperture of the dental surgical guide, the user can rest the annular abutment surface of the sleeve on the shoulder surrounding the aperture of the dental surgical guide so that the drill can self-level by adjusting to the intended drilling direction. Importantly, this action serves to ensure the that drilling is progressing along the planned drilling path. Therefore, the sleeve can be used at distinct points during the procedure to ensure compliance with the planned surgery.

It is to be appreciated that the drilling phases described above may be repeated using another drill having a greater diameter. Thus, the sleeves can be used in a sequence to incrementally increase the depth and the diameter of the socket being drilled.

It is to be understood that a drilling stage, during which a particular drill is used, may comprise one or more drilling phases, with a different sleeve being used with the drill in each phase of a plurality of drilling phases of the drilling stage.

It is further to be understood that any suitable number of drilling stages, with a particular drill being used in each drilling stage, each drilling stage comprising any suitable number of drilling phases, with, when the drilling stage comprises more than one drilling phase, a different sleeve being used with the drill in each of the plurality of drilling phases, may be performed to drill a socket having a particular diameter and a particular depth.

When the socket has been drilled, the dental implant may be fitted into it.

An implant fitting stage is performed using a suitable one of the sleeves and an implant driver.

A sleeve of the dental surgery apparatus disclosed herein may be usable with each of plurality of drills, each drill of the plurality of drills having a different function to another drill of the plurality of drills.

It is to be appreciated that the dental surgical apparatus disclosed herein may be used with any suitable type of dental handpiece and any suitable type of dental surgical guide.

According to an aspect, there is provided dental surgery apparatus comprising at least one sleeve as described with reference to **Figures 3 to 12**.

According to an aspect, there is provided dental surgery apparatus comprising at least one sleeve as described with reference to **Figures 3 to 12**, and at least one of: a dental handpiece, a drill, a dental surgical guide.

According to another aspect, there is provided dental surgery apparatus comprising at least one sleeve as described with reference to **Figures 3 to 12** and a dental handpiece, the at

least one least sleeve comprising a first part of a releasable securing arrangement and the dental handpiece comprising a second part of the releasable securing arrangement, the first part and the second part co-operable to releasably secure the sleeve to the dental handpiece.

According to a further aspect, there is provided dental surgery apparatus comprising at least one sleeve as described with reference to **Figures 3 to 12** and a dental handpiece, the at least one least sleeve comprising a first part of a releasable securing arrangement and the dental handpiece comprising a second part of the releasable securing arrangement, the first part and the second part co-operable to releasably secure the sleeve to the dental handpiece, and a dental surgical guide defining an aperture therethrough within which the second portion of the at least one sleeve is receivable.

The dental surgery apparatus disclosed herein facilitates the expeditious and accurate positioning of the drilled hole into which a dental implant is to be sited and facilitates correct installation of a dental prosthesis within the mouth of the patient.

Disclosed herein is dental surgery apparatus comprising at least one sleeve releasably securable to a dental handpiece, each sleeve defining a channel axially therethrough, for receiving a drill therein, and further defining an external annular abutment surface positioned axially at a junction between a first portion that extends between a first end of the sleeve and the annular abutment surface and has a first diameter, and a second portion that extends between the annular abutment surface and a second end of the sleeve and has a second, lesser diameter. The sleeve is insertable into an aperture of a dental surgical guide into a condition in which the annular abutment surface abuts a shoulder surrounding the aperture.

Although illustrative embodiments and examples of the invention have been disclosed in detail herein, with reference to the accompanying drawings, it is to be understood that the invention is not limited to the precise embodiment and examples shown and/or described and that various changes and modifications can be effected therein by one skilled in the art without departing from the scope of the invention as defined by the appended claims.

Claims

1. Dental surgery apparatus for use with a dental handpiece, a drill and a dental surgical guide that defines an aperture and a shoulder surrounding the aperture, comprising:

at least one sleeve releasably securable to a dental handpiece;

the sleeve having an axial direction, a first end, and a second end, the second end opposite the first end, and the sleeve defining a channel extending therethrough, in the axial direction, the channel open to both the first end and the second end, the channel for receiving a drill therein;

the sleeve defining an external annular abutment surface, the external annular abutment surface positioned at a junction, in the axial direction, between a first portion of the sleeve, and a second portion of the sleeve, the first portion extending between the first end and the annular abutment surface and having a first diameter, and the second portion extending between the annular abutment surface and the second end and having a second diameter, the second diameter less than the first diameter;

wherein the second portion of the sleeve is insertable into an aperture of a dental surgical guide into a condition in which the annular abutment surface abuts the shoulder surrounding the aperture;

whereby when the sleeve is releasably secured to the dental handpiece, with the first end fixed and the second free, and a drill is engaged with the dental handpiece and extends through the channel of the sleeve, the second portion of the sleeve is insertable into an aperture of a dental surgical guide into a condition in which the annular abutment surface is in contact with the shoulder surrounding the aperture to limit the extent of insertion of the sleeve into the dental surgical guide and, in turn, limit the extent of insertion of the drill into the aperture of the dental surgical guide.

2. Dental surgery apparatus as claimed in claim 1, wherein said at least one sleeve comprises a plurality of sleeves, and said plurality of sleeves comprises:

a first sleeve and a second sleeve,

the first portion of the first sleeve having a depth that is greater than a depth of the first portion of the second sleeve, and

the second portion of the first sleeve having a depth that is the same as a depth of the second portion of the second sleeve.

3. Dental surgery apparatus as claimed in claim 1, wherein said at least one sleeve comprises a plurality of sleeves, and said plurality of sleeves comprises at least one sleeve that defines an irrigation window, in a side wall portion thereof, that connects the channel of the sleeve to the exterior of the sleeve:

4. Dental surgery apparatus as claimed in claim 1, wherein said at least one sleeve comprise one part of a multi-part releasable securing arrangement for releasably securing the sleeve to a dental handpiece.

5. Dental surgery apparatus as claimed in claim 1, wherein said at least one sleeve is releasably securable to a dental handpiece by a rail system.

6. Dental surgery apparatus as claimed in claim 1, wherein said at least one sleeve is releasably securable to a dental handpiece by a clamp system.

7. Dental surgery apparatus as claimed in claim 1, wherein said at least one sleeve is fabricated from a metal material.

8. Dental surgery apparatus as claimed in claim 1, wherein said at least one sleeve is fabricated from a plastics material.

9. A dental surgery apparatus kit, comprising dental surgery apparatus as claimed in any of claims 1 to 8, and further comprising a dental handpiece, the at least one sleeve comprising a first part of a releasable securing arrangement and the dental handpiece comprising a second part of the releasable securing arrangement, the first part and the second part co-operable to releasably secure the sleeve to the dental handpiece.

10. A dental surgery apparatus kit as claimed in claim 9, further comprising a dental surgical guide defining an aperture therethrough within which the second portion of the at least one sleeve is receivable.

Intellectual Property Office

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Claims searched:	1-10	**Date of search:**	6 May 2020

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1 & 3-10	CN 110353832 A (LIN) See figures 5, 8A & 9A.
A	-	FR 2880534 A (BOINOT)
A	-	US 2018/177567 A1 (KLEIN)
A	-	US 2008/311538 A1 (ZIMMER)

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X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

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A61B; A61C

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC, Patent Fulltext

International Classification:

Subclass	Subgroup	Valid From
A61C	0001/08	01/01/2006
A61C	0008/00	01/01/2006