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(54) **Plate for production of a dental implant and/or artificial prosthesis.**

(57) Abstract : The present invention concerns a plate (10) for producing a dental implant artificial prosthesis (14) using 3D printing; said plate (10) comprising at least one abutment cavity (32) provided in a first surface (16) of the plate (10) to lodge a dental implant abutment (12) characterized in that said dental implant abutment (12), comprises a carrier portion (40) and an abutment body (46), said at least one abutment cavity (32) comprises a first cavity portion (34) adapted to engage with at least one part of said carrier portion (40) of said dental implant abutment (12), said at least one abutment cavity (32) comprises a second cavity portion (36) adapted to lodge said abutment body (46) of said dental implant abutment (12), wherein said first and second cavity portions (34, 36) are coaxial to an axis (48); wherein said second cavity portion (36) is larger than the abutment body (46). Fig. 1
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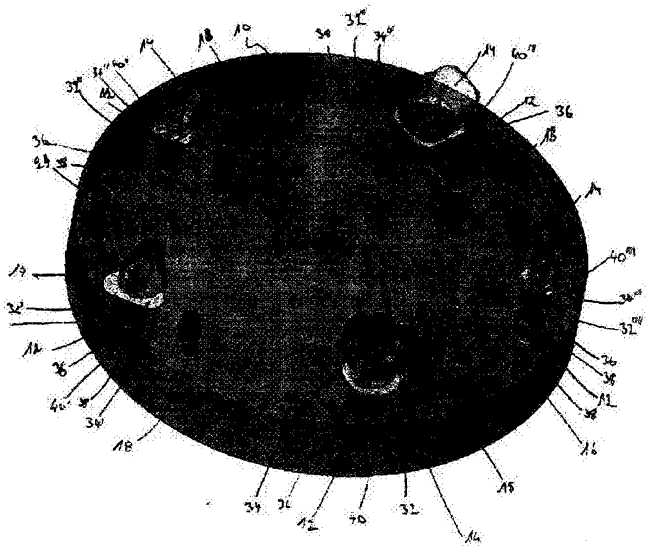

Fig. 1

PLATE FOR PRODUCTION OF A DENTAL IMPLANT AND/OR ARTIFICIAL PROSTHESIS

Technical field

[0001] The present invention generally relates to plate, in particular a plate for the production of dental implants and/or artificial prosthesis. The invention more particularly relates to a plate for producing a dental implant and/or an artificial prosthesis using 3D laser printing.

Background Art

[0002] Dental implants are often used when a patient requires a prosthetic device to hold one or more artificial teeth in place. Dental implants as well as dental abutments exist in a great variety of different shapes, sizes and materials. The dental implants are mostly of cylindrical shape and of screw-type implant tapped into the jawbone. Such a dental implant comprises multiple parts: a dental implant fixture, at least one dental implant abutment and a tooth crown or dental prosthesis. The dental fixture is substantially cylindrically shaped with a circular base and is inserted into the jawbone in order to act as an artificial root. The implant fixture is typically made out of titanium or a titanium alloy and is screwed in with its peripherally positioned threaded portion into an opening which has been bored in the jawbone. After the dental fixture is securely fixed, at least one dental implant abutment is connected to the implant fixture. The abutment is usually made of a metallic material for hygienic reason such as e.g. titanium and has an internal passageway with a screw passing through. The screw engages a thread inside the implant fixture to hold the abutment and the tooth crown or artificial prosthesis in place. The dental fixture and the dental implant abutment comprise each a form-fit end portion to each other in order to avoid the dental implant abutment to move or rotate relative to the dental fixture. Both the dental fixture and the dental implant abutment are mainly manufactured by machining comprising high precision tolerances to guaranty a neat insertion onto the jawbone of the patient. Various dental implant abutments are available; they are of all sorts of form, size and material.

[0003] The tooth crown or artificial prosthesis is adapted according to the requirement and position of each patient. Fig 8 shows one way of manufacturing a tooth crown. In fact, the tooth crown is machined out of a solid block 52. This "traditional" method has the disadvantage of great material losses and of unitary realization only. It is impossible to realize all possible forms and requires long and expensive milling cutter 50. Finally, the realization of such a tooth crown as represented in fig 8 is highly time-consuming.

[0004] The tooth crowns may also be manufactured using 3D printing. For the production of a dental implant and/or an artificial prosthesis, 3D laser printing has shown to be the most adequate one of all sort of different 3D printing. This allows the production of the artificial prosthesis or crown to be made out of material such as titanium. In order to be able to product the artificial prosthesis or crown, the patient mouth will be scanned for generating a 3D digital representation of the patient's set of teeth. This representation is then used for generating a physical embodiment with rapid prototyping technology serving as a master model. A machined hole is drilled in the master model at the exact position at which the dental implant will be inserted into the patient jawbone. The dental fixture as well as at least one dental implant abutment is form fit inserted into the machined hole in the master model. The master model is then used for producing the dental implant and/or an artificial prosthesis by 3D laser printing. As a result, for each production of a dental implant and/or an artificial prosthesis, a hole has to be machined in a master model for accurately accommodating the dental fixture and at least one dental implant abutment. This is time consuming and does not allow usage for same hole in a master model for different types of dental implant abutments.

Technical problem

[0005] It is an object of the present invention to provide a plate for production of a dental implant overcoming the problem that each time a new master model with a machined hole form-fitting the dental implant abutment is required. This object is achieved by a plate for producing a dental implant as claimed in claim 1.

General Description of the Invention

[0006] In order to overcome the above-mentioned issue, the present invention relates to a plate for producing dental implant and/or artificial prosthesis using 3D printing wherein a plate comprises at least one abutment cavity provided in a first surface of the plate to lodge a dental implant abutment. Furthermore the dental implant abutment preferably comprises a carrier portion and an abutment body. The at least one abutment cavity preferably comprises a first cavity portion adapted to engage with at least one part of the carrier portion of the dental implant abutment. The at least one abutment cavity further comprises a second cavity portion adapted to lodge the abutment body of the dental implant abutment, wherein the first and second cavity portions are coaxial to an axis and the second cavity portion is larger than the abutment body.

[0007] Since the second cavity portion is larger than the abutment body, a further advantage of the present invention is that different types of sizes and forms of abutments can be used in the same plate either at the same time or successively in different runs. The abutments are indeed maintained in place and positioned by the carrier portion of the abutment.

[0008] The at least one part of the carrier portion is advantageously engaged with the first cavity portion in such a manner that the dental implant abutment may be locked against any rotation about the axis.

[0009] A further advantageous effect of the present invention is that the first cavity portion has a shape of for example a hexagon, a rectangle, a triangle or of at least two inter-related circles. The first cavity portion preferably has a shape with no rotational symmetry.

[0010] The abutment cavity comprises a third portion preferably a through bore coaxial to the axis. The through hole may be positioned on the opposite surface of the plate and is preferably a counter bore through hole or countersunk through hole for accommodating a fixation means, preferably a screw, to enter the second cavity portion for engaging with a threaded portion of the dental implant abutment to fix the later to the plate. Furthermore, the plate preferably comprises a plurality of abutment cavities.

[0011] A dental implant abutment comprising a carrier portion and an abutment body, both are preferably made out of one piece, wherein the carrier portion advantageously is made in a form of a plate extending from said abutment body.

[0012] According to another aspect of the present invention, the carrier portion is adapted to engage, preferably form fit engage with at least one part of a first cavity portion of an abutment cavity of a plate as mentioned above in order to lock the dental implant abutment against a rotation relative to the first cavity portion about an axis.

[0013] A set for producing a dental implant artificial prosthesis preferably comprises a dental implant abutment and a plate with at least one abutment cavity as mentioned above.

[0014] According to a further aspect, the present invention concerns a method for producing a dental implant artificial prosthesis using 3D printing uses a dental implant abutment and/or a plate as mentioned above.

Brief Description of the Drawings

[0015] Further details and advantages of the present invention will be apparent from the following detailed description of a not limiting embodiment with reference to the attached drawing, wherein:

Fig. 1 is a perspective general view of the plate according to the invention in an assembly state of dental implant abutment and tooth crown or artificial prosthesis

Fig.°2 is a top view of the plate according to the invention..

Fig.° 3 is a sectional view along the line A-A from the top view of the plate in fig. 23 is a perspective general view of the plate in an assembly state of dental implant abutment and tooth crown or artificial prosthesis.

Fig.°4 is a front view and a perspective view of the plate in an assembled state with a dental implant abutment and tooth crown or artificial prosthesis.

Fig.°5 is a front view and a perspective view of the plate in an assembled state with the third dental implant abutment and tooth crown or artificial prosthesis .

Fig. 6 is composed of three perspective views of the plate, in a assembled state with the dental implant abutment, in a fixed state of the dental Implant abutment

onto the plate and of a front view of the assembled plate with the dental implant abutment, fixation means and tooth crown or artificial prosthesis .

Fig. 7 is composed of two top view of a further preferred embodiment of the plate having 7 equal (identical) first cavity portion and carrier portion and tooth crown or artificial prosthesis

Fig. 8 is a perspective general view of a "traditional" method for manufacturing a tooth crown or artificial prosthesis

Description of Preferred Embodiments

[0016] The above figures relate to a plate 10 for producing a dental implant and/or an artificial prosthesis and/or a tooth crown 14, in particular for producing a tooth crown 14 using 3D laser printing.

[0017] Figure 1 shows the plate 10 in a perspective view in a assembled state with dental implant abutments 12 and tooth crowns 14 or artificial prosthesis 14 (referring from now on as artificial prosthesis only) thereon. This plate 10 is used to affix the dental implant abutment 12 in order to be able to produce thereon an artificial prosthesis 14 using 3D laser printing. The 3D printing, also known as additive manufacturing (AM) refers to a processes used to synthetizes a three dimensional object. 3D printing for metal mainly refers to an additive manufacturing process using sintering or melting (i.e. selective laser sintering, direct metal laser sintering and selective laser melting). Figure 2 shows a top view of a plate 10 for manufacturing dental implant artificial prosthesis 14 using a 3D laser printer. The plate 10 of the present invention as shown in fig 2 is of a circular form, preferably a disc shaped plate having a diameter of about 60 to 80 mm, in particular a diameter of 65 to 75 mm, more preferable of a diameter of 69 mm. The plate 10 has a thickness of 7 to 15mm, in particular 10mm. The plate comprises a first surface 16 and an opposite surface 30, both parallel to each other. The plate 10 is mounted to the 3D laser printer by an opposite surface 30. This opposite surface 30 is preferably a machined surface. In order to be able to precisely position the plate 10 in the 3D laser printer, in this particular case, four equally spaced fixation blind bores 18 are provided onto the opposite surface 30 of the plate 10. These 4 fixation blind bores 18 are positioned in a circle 20 with a diameter of about 45 mm coaxial to the center 22 of the plate 10. Due to the

requirement of high precision, the fixation blind bores 18 have preferably a diameter of 3 mm with preferably a tolerance of H7 and a depth of about 6 mm. It is obvious that these fixation blind bores 18 could also be through bores.

[0018] The plate 10 further comprises a threaded through hole 24 with preferably a metric thread of M3. According to the embodiment shown in fig 1, this hole is positioned with a distance d of 22 mm away from the horizontal and vertical center line 26 and 28 respectively. This dimensions and tolerances mentioned here above may vary depending on the application and conditions.

[0019] On a first surface 16 of the plate 10, various sorts of abutment cavities 32 are provided, allowing an accommodation of a dental implant abutment. These abutment cavities 32 comprise a first cavity portion 34. In fig 2, the plate 10 has been presented containing abutment cavities 32 with 5 different first cavity portions 34. This has been done so for illustration purpose only. The plate 10 may contain a plurality of abutment cavities 32 with a plurality of different first cavity portions 34. The plate 10 may also contain a plurality of abutment cavities 32 comprising only one type first cavity portion 34.

[0020] A first abutment cavity 32 shown in fig 2 has a first cavity portion 34 of hexagonally shaped form with the corners of the hexagon being rounded. A second abutment cavity 32' has a first cavity portion 34' of a triangularly shaped form with the corners being rounded. A third abutment cavity 32" has a first cavity portion 34" which is shaped by a main circle from which three equally spaced smaller circles extending in such a way that their centers are positioned on the main circle. A fourth abutment cavity 32''' comprises a first cavity portion 34''' of rectangular shape with their corners be rounded. A fifth abutment cavity 32'''' presented in fig 2 has a first cavity portion 34'''' of circular shape from which one smaller circle extends in such a way that the center of the smaller circle lies on the edge of the main circle. This abutment cavity 32'''' thus comprises a preferred first cavity portion 34'''' with a non-rotational symmetry.

[0021] In these first cavity portions 34, 34', 34", 34''', 34'''' rest a carrier portion 40, 40', 40", 40''', 40'''' of the dental implant abutment 12. The shape of the carrier portions is such that the carrier portion fits inside the respective cavity portion.

Preferably, the upper surface of the carrier portion 34 is flush with the upper surface of the plate 10.

[0022] The first cavity portions 34 of the abutment cavities 32 extent from the first surface 16 of the plate 10.

[0023] The abutment cavity 32 further comprises a second cavity portion 36. This second cavity portion 36 extends from the first cavity portion 34 of the abutment cavities 32. The first and second cavity portions are positioned coaxial to an axis 48.

[0024] Figure 3 is a sectional view along the line A-A of the top view in figure 2 of the plate 10. From Fig 3, the fourth abutment cavity 32 can be clearly seen in cross sectional view. This second cavity portion 36 is a substantially cylindrical blind bore and has a diameter and a depth such that the second cavity portion 36 is larger than the abutment body 46 of the dental implant abutment 12. In fact, the second cavity portion is larger than the abutment body 46 of the dental implant abutment 12.

[0025] The various types of dental implant abutment 12 available on the market differ from each other mainly by the size and the shape. The shape and the size of the dental implant abutments are adapted to the dental implant of the different manufacturers. The dental implant abutments provide slightly different properties required for the different dental implant artificial prosthesis 14. According to the embodiment shown in figures 1 to 6, the second cavity portion 36 of the abutment cavities 32 are designed to be able to lodge many different types of dental implant abutment 12. The plate 10 may contain a plurality of abutment cavities 32 with the same second cavity portions 36. In fact, the second cavity portion 36 is designed and dimensioned to be able to lodge different types of dental implant abutment 12. As a result, the plate 10, according to the present invention, is able to be used for producing dental implant artificial prosthesis 14 on different dental implant abutment 12 of different size and shape.

[0026] So, instead of machining cavities in the plate that exactly match each type of dental implant abutment and thus have to use a multitude of plates, here it is possible to use only one plate. Indeed as the dental implant abutments need to be machined anyway, it is easy and it causes virtually no extra costs to machine a

carrier plate to the dental abutment because the carrier plate is machined at the same time as the dental abutment.

[0027] On the opposite surface 30 of the plate 10, comprising the four fixation blind bores 18, the abutment cavity 32 comprises a third cavity portion being a through hole 38 coaxial to the axis 48. The through hole 38 mainly allows a fixation means 44, such as a screw, to fix the dental implant abutment 12 to the plate 10. According to the embodiment shown in figure 3, the through hole 38 is in the form of the counter bore through hole 38.

[0028] As it can be seen from fig 1, the first abutment cavity 32 with a hexagonally shaped form is not provided with a counter bore through hole 38.

[0029] According to the present embodiment, a screw can enter into the second cavity portion 36 for fixing the dental implant abutment 12 onto the plate 10. However, the first abutment cavity 32 also could be provided with counter bore through hole 38. Moreover, it is easily understood that this counter bore through hole 38 could easily be exchanged with a different type of through hole 38 allowing the dental implant abutment 12 to be fixed with a different type of fixation means 44 onto the plate 10. The through hole 38 may i.e. be a counter sunk through hole providing a self-positioning of the dental implant abutment 12 on the plate. The dental implant abutment 12 can also be fixed onto the plate 10 by any other fixation means 44, such as nuts and bolts, glue, magnet ...

[0030] As can be seen from figure 1 and 4 to 6, the dental implant abutment comprises a carrier portion 40 and an abutment body. In fact the carrier portion extends from abutment body and is preferably shaped in the form of plate. As the second cavity portion 36 of the abutment cavity 32, allowing all sorts of abutment bodies 46 of dental implant abutment 12 to be lodged therein, is loose fit engaged with the abutment body 46, the dental implant abutment 12 is held in place by resting with its carrier portion 40 in the first cavity portion 34 of the abutment cavity 32. During the machining of the dental implant abutment 12, the carrier portion 40 is formed to have any one of the various specific shapes to engage at least partially with the first cavity portion 34 of the abutment cavity 32 in the plate 10. The form-fit engagement of at least part of the carrier portion 40 with the first cavity portion 34 is a form-fit engagement and therefore hinders any rotation of the

dental implant abutment 12 relative to the abutment cavity 32 during the production of the dental implant artificial prosthesis using 3D laser printer. Once the dental implant artificial prosthesis 14 has been manufactured on the dental implant abutment 12 using the 3D laser printer, the carrier portion 40 will at least partially be removed by machining.

[0031] According to the embodiment shown in figures 1 and 4 to 6, the form-fit engagement of the first cavity portion 40 is a full form-fit with the carrier portion 40 of the dental implant abutment. This form-fit engagement guaranties at the same time a locking against a rotation about the axis 48 as well as a self-centering onto to the plate 10.

[0032] Alternatively, a countersunk through hole (not shown), as described above, allows an adequate centering of the dental implant abutment 12 on the plate10, such that a form fit engagement of the carrier portion 40 with only a part of the first cavity portion 34 is required to lock the dental implant abutment against rotation about the axis. In a further embodiment of the present invention (not shown), engages the carrier portion 40 with the first cavity portion 34 with a conical surface. As a result, the dental implant abutment 12 is self-centered onto the plate 10 and requires a form-fit engagement of the carrier portion 40 with only at least one part of the first cavity portion 34 to lock the dental implant abutment against a rotation about the axis 48.

[0033] The dental implant abutment 12 comprises an internal threaded portion to be able to engage with the screw passing through the third cavity portion 38 into the second cavity portion to be fixed onto the plate 10.

[0034] Fig 4 shows a focused front view of the plate 10 with the first abutment cavity 32 having a first cavity portion 34 with a hexagonal shape as well as a perspective view of the same abutment cavity 32, in both views an dental implant abutment 12 is mounted thereon comprising a more complex dental implant artificial prosthesis 14 produced thereon in a 3d laser printer.

[0035] Fig 5 shows a focused front view of the plate 10 with the second abutment cavity 32 having a first cavity portion 34 with a triangular form as well as a perspective view of the same abutment cavity 32, in both views a dental implant

abutment 12 is mounted thereon comprising a dental implant artificial prosthesis 14 for recovering the axis produced thereon in a 3D laser printer.

[0036] From both figures 4 and 5, the form-fit engagement of at least one part of the carrier portion 40 of the dental implant abutment 12 and the first cavity portion 34 of the abutment cavity 32 in the plate 10 can be clearly identified. In the embodiment of the present invention as shown in figure 4 and 5, the depth of the first cavity portion 34 of the abutment cavity 32 is chosen to be approximately equal to the thickness of the carrier portion 40 of the dental implant abutment 12. As a result, in an assembled state, the first surface 16 of the plate 10 and the upper surface 42 of the carrier portion 40 of the dental implant abutment 12 form a flush surface to each other. This is for illustration purposes only and it can be easily understood that the upper surface 42 of the carrier portion 40 could protrude inwardly and outwardly to the first surface 16 of the plate 10.

[0037] Figure 6 shows four different views of the third abutment cavity 32 in the plate 10 formed by the circular cavity from which three further smaller circular cavities extend such that their centers lie on the edge of the main circular cavity. The first view is a perspective view of the third abutment cavity 32 in the plate 10. The second view is a perspective view of the third abutment cavity 32 with a dental implant abutment 12 form-fit engaging with at least one part of the carrier portion 40 to the first cavity portion 34. The third view is a perspective view of the abutment cavity 32 shown from opposite surface 30 of the plate 10 comprising the four fixation blind bores 18, wherein a dental implant abutment 12 is accommodated therein and fixed with a screw 44 in the counter bore through hole 38. In this embodiment, the screw 44 has been chosen to be a socket head cap screw 44. The fourth view is a front view showing the third abutment cavity 32 in the plate 10 with the dental implant abutment 12 accommodated therein affixed with the socket head cap screw 44. The screw head is fully embedded in the counter bore through hole 38 in such a way that the head does not protrude the opposite surface 16 of the plate 10. The depth of the counter bore through hole 38 of the abutment cavity 32 is chosen so that the screw head can be fully immerged. As a result, the plate 10 is mountable to the 3D laser printer with the opposite surface 30 containing the 4 fixation blind bores.

[0038] Figure 7 is composed of two top view of a further preferred embodiment of a plate. The first top view shows the plate 10 according to the present invention comprising 7 sixth abutment cavities 32 with the same first cavity portion 34''''''. This first cavity portion 34'''''' of the sixth abutment cavity 32 is of circular shape having a flatten portion and therefore has no rotational symmetry. On the plate 10 as shown in the first top view of figure 7 are further mounted dental implant abutments 12 comprising a carrier portion 40'''''' shaped to form fit engage with the first cavity portions 34'''''' of the abutment cavities 32 in the plate 10. The second top view from figure 7 shows an assembled plate 10 according to the present invention wherein different artificial prosthesis 14 have been manufactured on top of the dental implant abutment 12 using 3D laser printing.

[0039] The precise position of the plate 10 in the 3D laser printer, as well as a correct and accurate locking against rotation, centering and fixation of different dental implant abutments 12 to the plate 10 of the present invention allows the production of the dental implant artificial prosthesis 14 without the necessity of manufacturing and machining a new and suitable physical master model.

Legend:

10 Plate
12 Dental implant abutment
14 Artificial prosthesis
16 First surface
18 Fixation blind bore
20 Circle
22 Center
24 Threaded through bore
26 Horizontal center line
28 Vertical center line
30 Opposite surface
32 Abutment cavity
34 First cavity portion
36 Second cavity portion
38 Through bore
40 Carrier portion
42 Upper surface
44 Fixation means
46 Abutment body
48 Axis
50 Milling cutter
52 Solid block

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REVENDICATIONS

1. Plaque (10) destinée à la production d'une prothèse artificielle pour implant dentaire (14) par impression 3D ; ladite plaque (10) comprenant au moins une cavité pour pilier (32) ménagée sur une première surface (16) de la plaque (10) pour loger un pilier pour implant dentaire (12), caractérisée en ce que :
ledit pilier pour implant dentaire (12) comprend une partie porteuse (40) et un corps de pilier (46),
ladite au moins une cavité pour pilier (32) comprend une première partie de cavité (34) conçue pour entrer prise avec au moins une partie de ladite partie porteuse (40) dudit pilier pour implant dentaire (12),
ladite au moins une cavité pour pilier (32) comprend une seconde partie de cavité (36) conçue pour loger ledit corps de pilier (46) dudit pilier pour implant dentaire (12), dans laquelle lesdites première et seconde parties de cavité (34, 36) sont coaxiales à un axe (48) ; dans laquelle ladite seconde partie de cavité (36) est plus grande que le corps de pilier (46).

2. Plaque (10) selon la revendication 1, dans laquelle ladite au moins une partie de ladite partie porteuse (40) est en prise avec ladite première partie de cavité (34) de manière à être bloquée en rotation autour de l'axe (48).

3. Plaque (10) selon l'une des revendications précédentes, dans laquelle ladite première partie de cavité (34) a de préférence une forme d'hexagone, de rectangle, de triangle ou d'au moins deux cercles reliés entre eux.

4. Plaque (10) selon l'une des revendications précédentes, dans laquelle ladite première partie de cavité (34) a de préférence une forme non symétrique en rotation.

5. Plaque (10) selon l'une quelconque des revendications précédentes, dans laquelle ladite cavité pour pilier (32) comprend une troisième partie, de préférence un alésage traversant (38) coaxial à l'axe (48).

6. Plaque (10) selon la revendication 5, dans laquelle ledit trou traversant (38) est positionné sur ladite surface opposée (30) de la plaque (10).

7. Plaque (10) selon l'une quelconque des revendications 5 et 6, dans laquelle ledit alésage traversant (38) est un trou traversant lamé (38) ou un trou traversant fraisé destiné à recevoir un moyen de fixation (44), de préférence une vis (44), devant entrer dans ladite deuxième partie de cavité (36) pour entrer en prise avec une partie filetée dudit pilier pour implant dentaire (12) afin de fixer celui-ci à la plaque (10).

8. Plaque (10) selon l'une quelconque des revendications précédentes, dans laquelle ladite plaque (10) comprend une pluralité de cavités pour piliers (32).

9. Pilier pour implant dentaire (12) comprenant une partie porteuse (40) et un corps de pilier (46), ladite partie porteuse (40) étant conçue pour entrer en prise avec au moins une partie d'une première partie de cavité (34) d'une cavité pour pilier (32) de plaque (10) selon l'une quelconque des revendications 1 à 8.

10. Pilier pour implant dentaire selon la revendication 9, dans lequel ladite partie porteuse (40) est formée de manière à entrer en prise par

complémentarité de forme avec au moins une partie de ladite première partie de cavité (34) de la cavité pour pilier (32) de ladite plaque (10)

11. Pilier pour implant dentaire (12) selon l'une quelconque des revendications 9 et 10, dans lequel ladite partie porteuse (40) et ledit corps de pilier (46) sont constitués d'une seule pièce.

12. Pilier pour implant dentaire (12) selon l'une quelconque des revendications 9 à 11, dans lequel ladite partie porteuse (40) se présente sous la forme d'une plaque s'étendant à partir dudit corps de pilier (46).

13. Pilier pour implant dentaire (12) selon l'une quelconque des revendications 9 à 12, dans lequel ladite mise en prise par complémentarité de forme de ladite partie porteuse (40) dudit pilier pour implant dentaire (12) avec ladite au moins une partie de ladite première partie de cavité (34) de ladite cavité pour pilier (32) dans ladite plaque (10) bloque ledit pilier pour implant dentaire (12) en rotation par rapport à ladite première partie de cavité (34) autour d'un axe (48).

14. Ensemble destiné à produire une prothèse artificielle pour implant dentaire (14) comprenant un pilier pour implant dentaire (12) selon l'une quelconque des revendications 9 à 13 et une plaque (10) comprenant au moins une cavité pour pilier (32) selon l'une quelconque des revendications 1 à 8.

15. Procédé de production d'une prothèse artificielle pour implant dentaire (14) par impression 3D, à l'aide d'un pilier pour implant dentaire (12) selon l'une quelconque des revendications 9 à 13 et/ou d'une plaque (10) selon l'une quelconque des revendications 1 à 8.

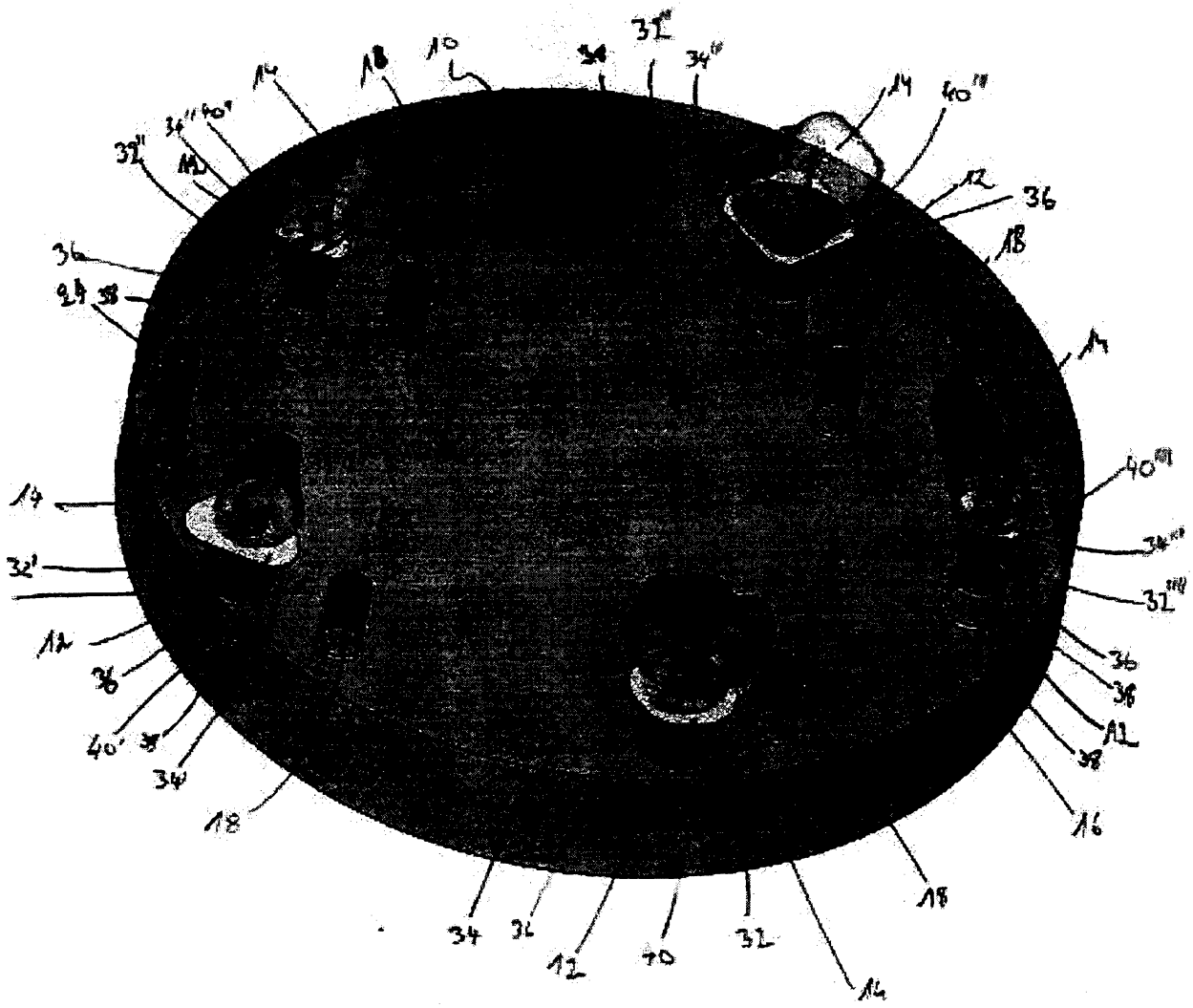


Fig. 1

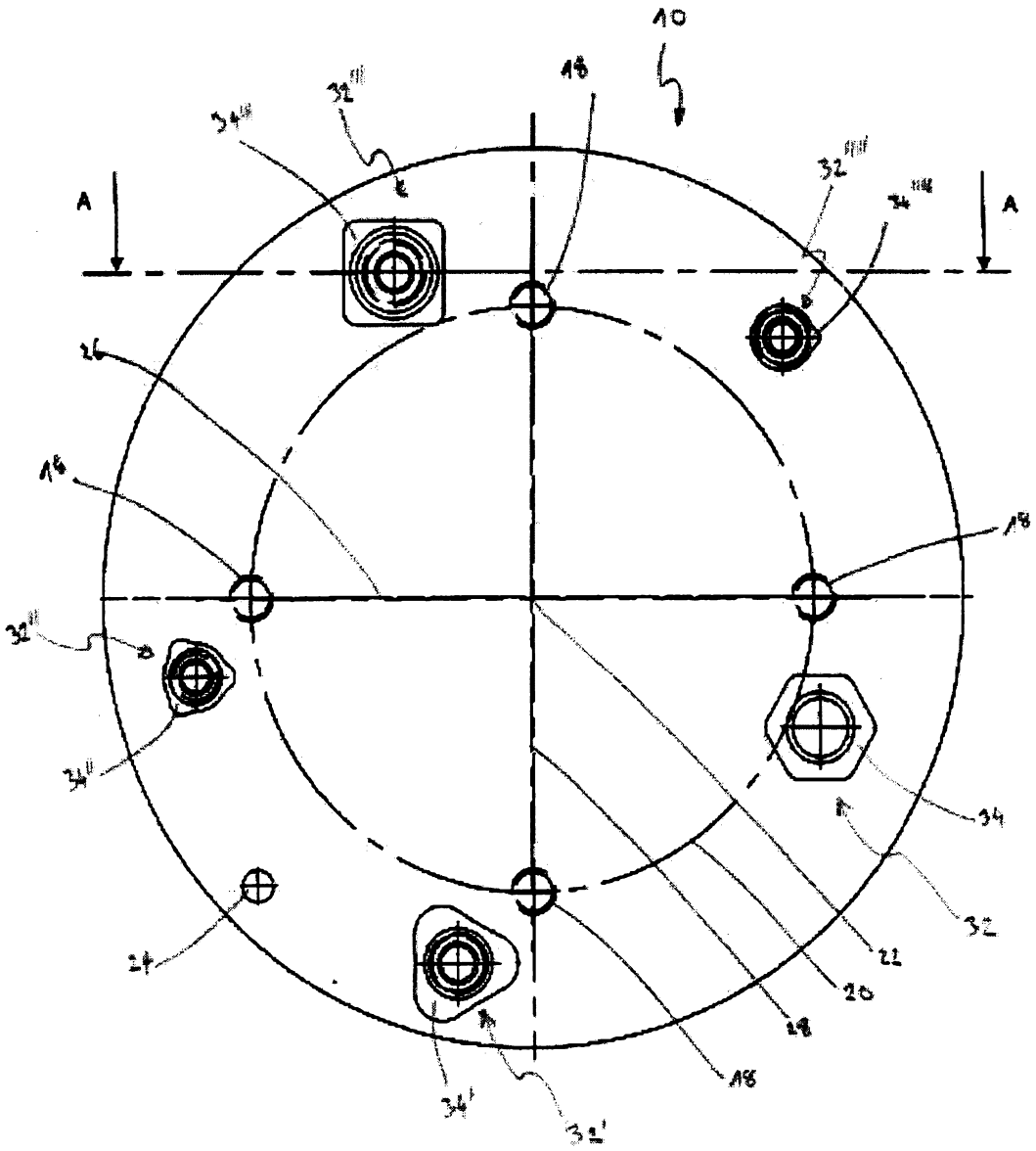


Fig. 2

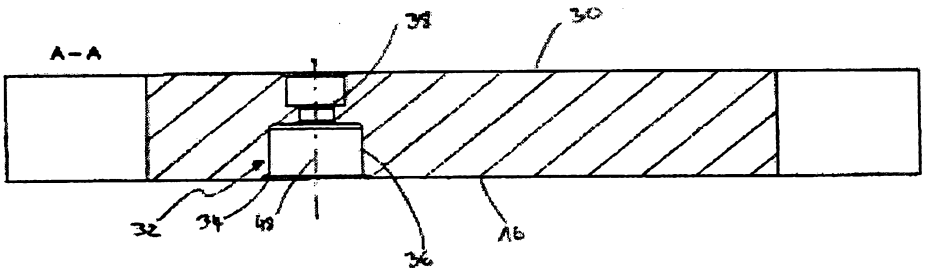
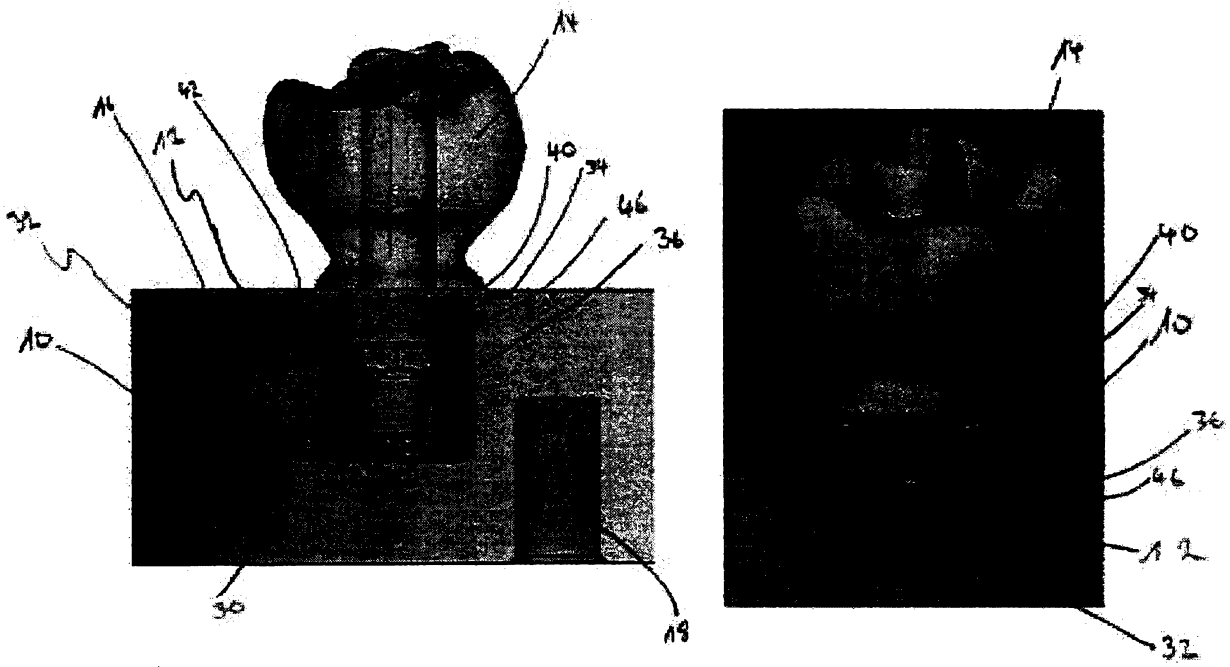


Fig. 3


14
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32

Fig. 4

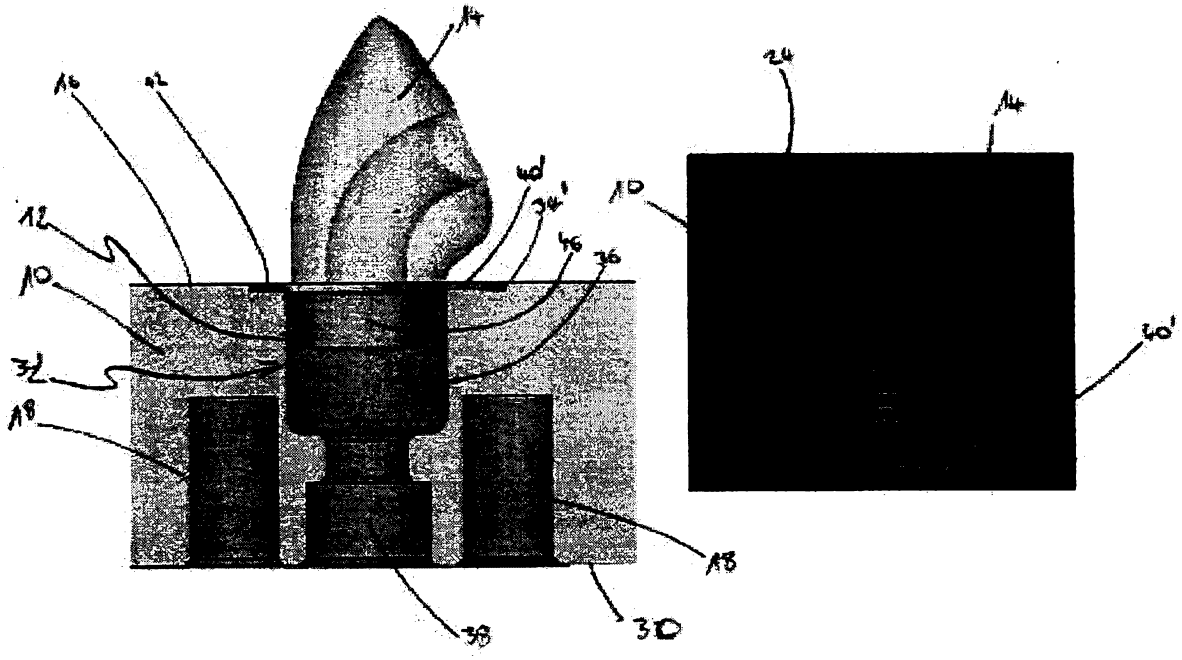
14
16
42
40'
34'
12
10
46
36
32
18
38
30
24
14
10
40'

Fig. 5

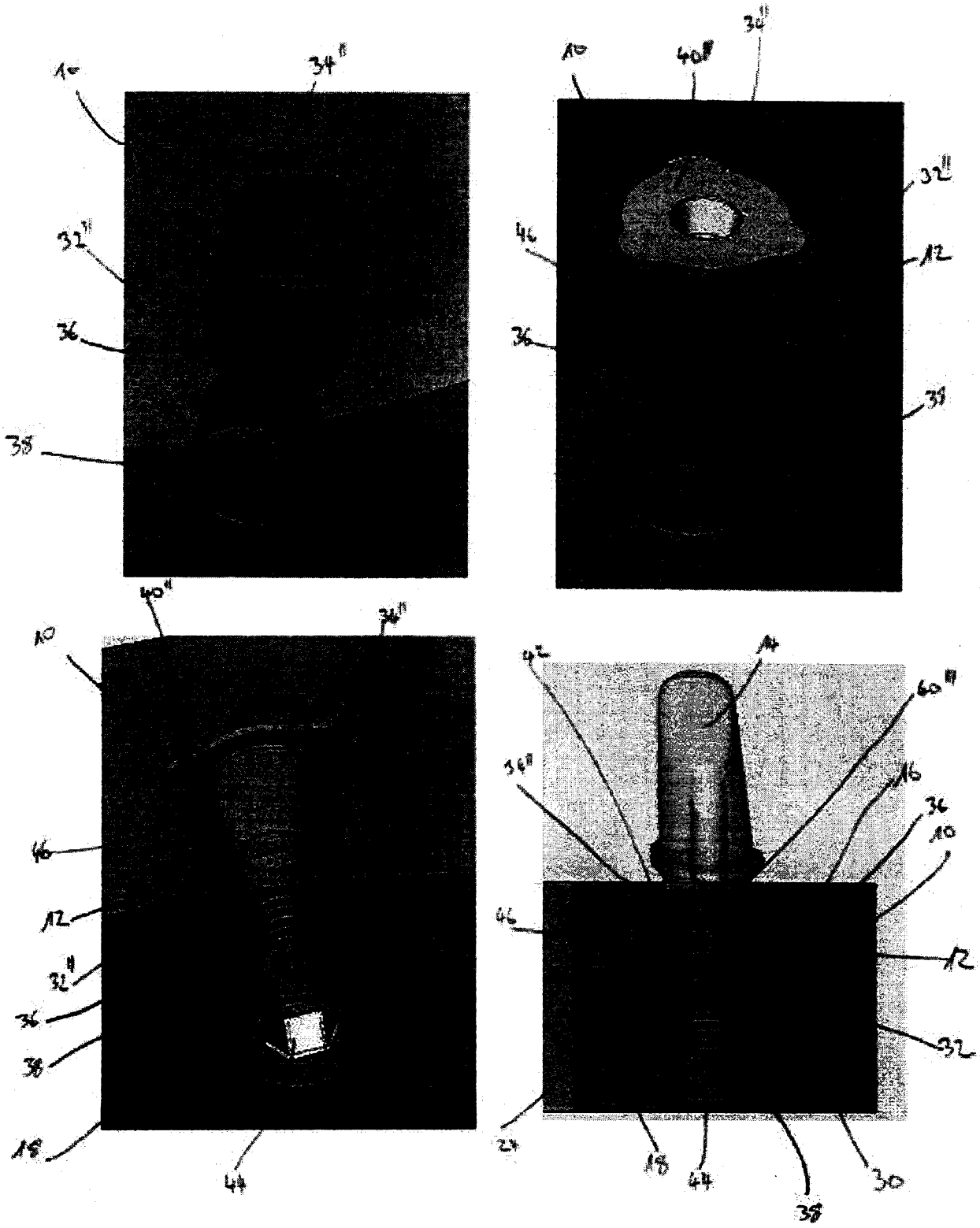

Fig. 6

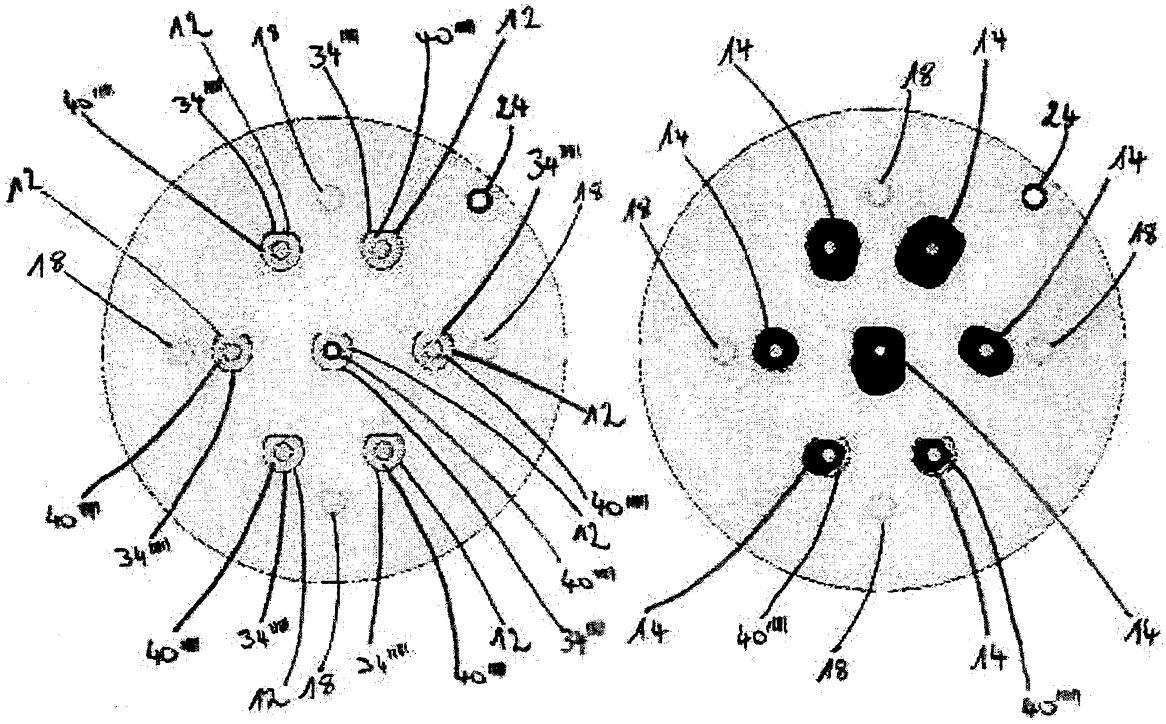

Fig. 7

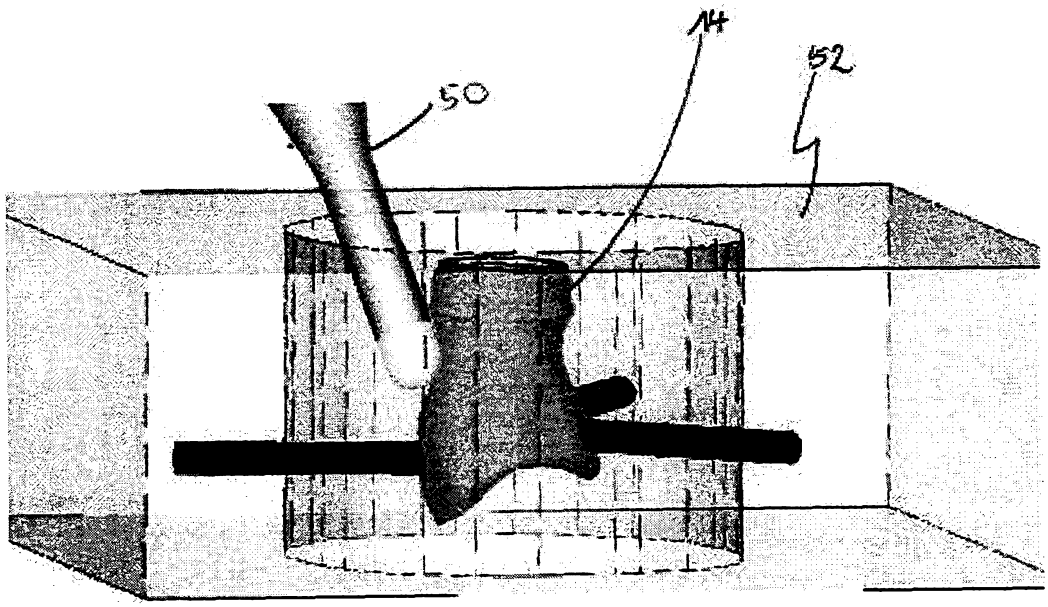

Fig. 8 PRIOR ART

Abstract

The present invention concerns a plate (10) for producing a dental implant artificial prosthesis (14) using 3D printing; said plate (10) comprising at least one abutment cavity (32) provided in a first surface (16) of the plate (10) to lodge a dental implant abutment (12) characterized in that said dental implant abutment (12), comprises a carrier portion (40) and an abutment body (46), said at least one abutment cavity (32) comprises a first cavity portion (34) adapted to engage with at least one part of said carrier portion (40) of said dental implant abutment (12), said at least one abutment cavity (32) comprises a second cavity portion (36) adapted to lodge said abutment body (46) of said dental implant abutment (12), wherein said first and second cavity portions (34, 36) are coaxial to an axis (48); wherein said second cavity portion (36) is larger than the abutment body (46).

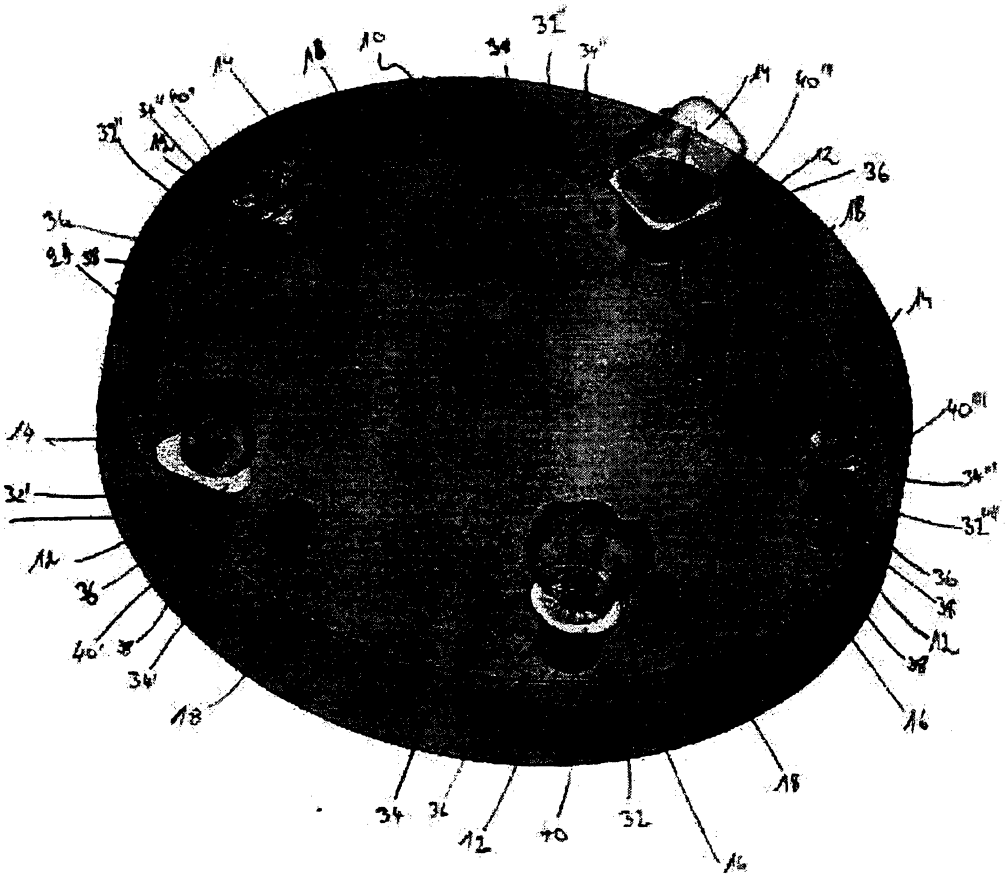

Fig. 1

LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Économie
et du Commerce extérieur

National Application Number

LO 1226
LU 92887

SEARCH REPORT

in accordance with Article 35.1 a)
of the Luxembourg law on patents
dated 20 July 1992

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
	LACK OF UNITY OF INVENTION see sheet B INCOMPLETE SEARCH see sheet C		INV. A61C8/00 A61C13/00 B23Q3/06
X	KR 2010 0048244 A (BYUN TAE HEE [KR]) 11 May 2010 (2010-05-11) * figure 6b *	1-8,14	
A	WO 2013/012113 A1 (DENTCOM CO LTD [KR]; BYUN TAE-HEE [KR]; BYUN JAE-KYUNG [KR]; BYUN JAE-) 24 January 2013 (2013-01-24) * figures *	1-8,14	

TECHNICAL FIELDS SEARCHED (IPC)
A61C B23Q

The present search report has been drawn up for all claims

Date of completion of the search	Examiner
13 July 2016	Fouquet, Michèle

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C55)

INCOMPLETE SEARCH
SHEET C

Application Number
LO 1226
LU 92887

This search report has not been established in respect of certain claims, because they relate to parts of the application that do not comply with the prescribed requirements to such an extent that no meaningful search can be carried out, specifically:

Claim(s) completely searchable:
1-14

Claim(s) not searched:
15

Reason for the limitation of the search:

The method according to claim 15 does not comprise method steps. It has not been defined HOW a dental implant artificial prosthesis is produced using 3D printing using a dental implant abutment and/ or a plate. Therefore, the method cannot be searched.

LACK OF UNITY OF INVENTION
SHEET B

Application Number
LO 1226
LU 92887

The Search Division considers that the present patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-8(completely); 14(partially)

   a plate

   ---

2. claims: 9-13(completely); 14(partially)

   a dental implant abutment

The search has been limited to the first subject.

ANNEX TO THE SEARCH REPORT ON LUXEMBOURG PATENT APPLICATION NO.

LO 1226
LU 92887

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

13-07-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 20100048244 A	11-05-2010	NONE	
WO 2013012113 A1	24-01-2013	NONE	

LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Économie
et du Commerce extérieur

WRITTEN OPINION

File No.	Filing date *(day/month/year)*	Priority date *(day/month/year)*	Application No.
LO1226	26.11.2015		LU92887

International Patent Classification (IPC)
INV. A61C8/00 A61C13/00 B23Q3/06

Applicant
Laboratoire dentaire Hornbeck Jacques Sàrl

This report contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☒ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the application
- ☒ Box No. VIII Certain observations on the application

Examiner
Fouquet, Michèle

WRITTEN OPINION

Box No. I Basis of the opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the application as filed.

   ☐ filed together with the application in electronic form.

   ☐ furnished subsequently.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

WRITTEN OPINION

Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step, or to be industrially applicable have not been examined in respect of

☐ the entire application

☒ claims Nos. 9-13, 15(completely); 14(partially)

because:

☐ the said application, or the said claims Nos. relate to the following subject matter which does not require a search *(specify)*:

☐ the claims, the description or the drawings or said claims Nos. are so unclear that no meaningful opinion could be formed *(specify)*:

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed *(specify)*:

☒ no search report has been established for the whole application or for said claims Nos. 9-13, 15(completely) ; 14(partially)

☐ a meaningful opinion could not be formed as the sequence listing was either not available, or was not furnished in the international format (WIPO ST25).

☐ a meaningful opinion could not be formed without the tables related to the sequence listings; or such tables were not available in electronic form compliant with he international norm (WIPO ST.25).

☒ See Supplemental Box for further details

Box No. IV Lack of unity of invention

1. The requirement of unity of invention is not complied with for the following reasons:

   see separate sheet

2. This opinion has been established in respect of the following parts of the application:

   ☐ all parts.

   ☒ the parts relating to claims Nos. (see Search Report)

Application No.

WRITTEN OPINION

LU92887

Box No. V Reasoned statement with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes:	Claims	6, 7
	No:	Claims	1-5, 8(completely); 14(partially)
Inventive step	Yes:	Claims	
	No:	Claims	1-8(completely); 14(partially)
Industrial applicability	Yes:	Claims	1-8(completely); 14(partially)
	No:	Claims	

2. Citations and explanations

see separate sheet

Box No. VIII Certain observations on the application

see separate sheet

Re item IV

It is considered that there are 2 inventions covered by the claims indicated as follows:

1. claims: 1-8(completely); 14(partially)

   a plate

2. claims: 9-13(completely); 14(partially)

   a dental implant abutment

The reasons for which the inventions are not so linked as to form a single general inventive concept, are as follows:

There is a lack of unity a priori between a plate according to claims 1-8 and a dental implant abutment according to claims 9-13.

There are no common or corresponding features linking together a plate and a dental implant abutment.

The place according to claim 1 only has specific cavity portions and due to the fact that the abutment is not part of the subject-matter of claim 1, a lack of clarity arises when trying to define the dimensions of the cavity in relation to a dental implant abutment which could be able to engage the cavity portions (see below under item VIII).

The problem solved by the plate according to claim 1 is for producing a dental implant artificial prosthesis.

The problem solved by a dental implant abutment according to claim 9 is to support a suprastructure, a prosthesis onto a dental implant.

Re item VIII

In claims 1-8 only a plate is claimed. In claims 9-13 only a dental implant abutment is claimed.

In order to clearly defined the claimed subject-matter, the claims shall define the matter for which protection is sought in terms of their own technical, structural features.

Consequently, in claims 1-8, claiming a plate, features related to the dental implant abutment can not be considered for the examination of novelty and inventive step.

The same applies in claims 9-13, a dental abutment for features related to the plate.

In case the relationship between the plate and the dental abutment is important, which seems to be the case in the present application, a combination of a plate and a dental implant abutment should be claimed.

All the features following expressions such as "preferably" are optional features and are therefore not considered for the assessment of novelty and inventive step (see for example in claims 3-5, 7...). Consequently, claims 3 and 4 do not contain additional mandatory technical features.

In claim 5 a through bore (38) is claimed, whereas in claim 6 a through hole (38) and again in claim 7 a through bore (38) and hole (38) is defined. This inconsistency renders the claims as whole unclear.

Although this is the case in claim 14, defining a set comprising a dental implant abutment and a plate, no clear technical features of the set have been defined as it is referred to the previous claims for defining the plate and the dental implant abutment. Such a claim would only be allowable if the plate and the dental implant abutment on their own would be patentable.

Re item V

The present application does not meet the criteria of patentability, because the subject-matter of claims 1-5, 8, 14 is not new.

KR1020100048244, fig. 6b, §50-58 especially the enlargement of a cavity discloses a plate having cavities as defined in claims 1-5, and 8. For the present invention, it is irrelevant that in KR1020 the plate when used in the method consists of two plates as shown in figures 8, 9.

KR1020, figures 1, 2, reference signs B1 and B2 discloses a dental implant abutment and figure 3 discloses the processing material which will be formed into a dental implant abutment. Figures 8, 9 discloses the features of claim 14.

The present application does not meet the criteria of patentability, because the subject-matter of claims 6 and 7 does not involve an inventive step.

The feature through hole/bore is merely one of several straightforward possibilities from which the skilled person would select, see for example plate 21 in accordance with circumstances, without the exercise of inventive skill, in order to solve the problem posed.

Re item III

The method according to claim 15 does not comprise method steps. It has not been defined HOW a dental implant artificial prosthesis is produced using 3D printing using a dental implant abutment and/**or** a plate. Therefore, the method cannot be searched.