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(54) Title: SUPPORT BODY FOR A BLANK

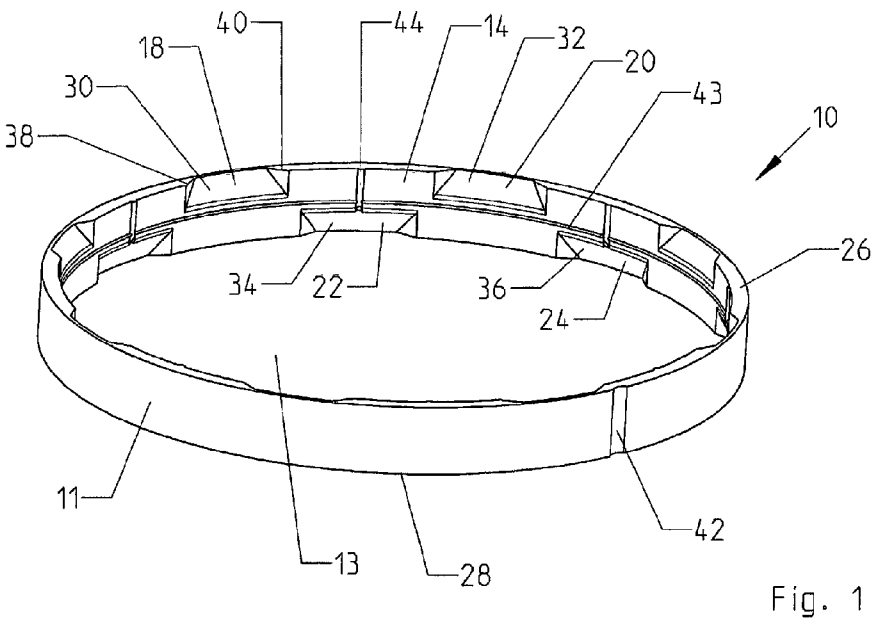


Fig. 1

(57) Abstract: The invention relates to a support body (10) for a blank, whereby the support body possesses a receiving opening (13) for the blank that is surrounded by an inner circumferential surface (14), which terminates in an upper and a lower edge (26, 28), and whereby a blank fixed in position within the support body is bonded to the latter by means of an adhesive agent. In order to be able to easily introduce the adhesive agent into a gap between the blank and the support body it is intended that the inner circumferential surface (14) possesses at least one depression (18, 20, 22, 24) and/or elevation extending to accommodate the adhesive agent.

WO 2016/116636 A1

— *with information concerning request for restoration of the right of priority in respect of one or more priority claims; the decision of the receiving Office regarding the request for restoration is pending and will be published separately once available (Rules 26bis.3 and 48.2(j))*

Description

Support body for a blank

The invention relates to a support body for a blank, in particular a blank consisting of ceramic, such as zirconium oxide or a glass ceramic, whereby the support body possesses a receiving opening for the blank with an inner circumferential surface that terminates in an upper and a lower edge, and und whereby when the blank is fixed in the support body, the blank is bonded to the support body by means of a binding agent. In particular, the support body is embodied with a hollow-cylinder geometry. The support body circumferentially surrounds the blank, which in particular possesses a disk shape or cylinder shape.

WO 02/45614 A1 discloses a mounting device for a ceramic blank that comprises a rectangular holder, which in turn accepts a rectangular frame, in which a blank is fixed in position by means of gluing. A two-component adhesive, for example, is introduced into an adhesive gap that exists between the blank and the frame.

In accordance with EP 0 982 009 A2, a blank is inserted into a passage opening of a plate-shaped support body.

A holding arrangement for workpieces according to WO 2007/143765 comprises a frame, in which a holder arrangement, which can accommodate a work piece by friction lock, is fixed in position by clamping.

A blank mount for a dental milling machine in accordance with DE 20 2013 103 515 U1 comprises a ring-shaped work-piece holder with clamping holders that are used to fix the blank in position.

In accordance with DE 20 2010 001 125 U1, detachable fastening elements are used to mount a blank in a mounting fixture.

For mounting a blank in a holder in accordance with DE 20 2012 008 015 U1, fastening means are provided that reach over and/or under the blank.

In accordance with DE 10 2007 013 675 A1, a UV curing adhesive is used to mount a blank in a support body, which at least partially consists of a material that is transparent at least in the UV region of the spectrum.

In accordance with DE 10 2012 201 744 A1, a molded body is fixed in position in a workpiece holder by means of fasteners, whereupon the molded body is machined in a dental milling machine.

Known from DE 10 2005 008 004 A1 is a processing method for a workpiece that is fixed in position within a tenter by means of cast resin.

During the manufacture of a dental prosthesis, in accordance with WO 95/30382 A1, a blank is embedded in a ring, which is clamped in the chuck of a processing machine.

A silicon block to be worked is connected firmly to a support. To allow the support to be reliably bonded to the silicon block, the support is provided with a profile pattern (DE 10 2009 023 122 A1).

Holders of this type are required to be able to clamp a blank in a processing machine with great positional accuracy. In this, it must not only be ensured that the holder retains its shape during clamping but also that the blank with respect to the support body assumes a unique position that can not change during the processing.

The objective of the present invention is to further develop a support body of the above-mentioned type, in particular for accepting a blank consisting of ceramic, such as zirconium oxide, which is to be processed in a milling machine, for example, in such a way that with simple constructive measures, a secure positional fix will become possible using an adhesive agent, which can be introduced easily in between the support body and the blank and can remain between the support body and the blank to the required extent until curing has taken place.

In the present invention, this objective is substantially met that the inner circumferential surface possesses a structure that is formed by at least one depression that extends to at least one edge of the inner circumferential surface and/or at least one elevation that protrudes from the inner circumferential surface for the acceptance of an adhesive agent.

In accordance with the invention, the structural pattern of the inner surface, i.e. the formation of at least one depression and/or one elevation, makes it possible to introduce an adhesive agent into the space between the blank and the support body to the required extent, which remains in the gap sufficiently long for curing to take place.

In particular, it is intended that the structure is formed by at least one, in particular by several preferably bag-shaped depressions in the wall of the support body that is bordered by the inner circumferential surface, which extends or extend to the at least one edge, i.e. originates or originate from the edge.

This to be emphasized embodiment of the structure ensures that – independently of a small distance between the blank and the inner circumferential surface of the support body - adhesive agent can be introduced to an adequate degree, in particular via the pocket-shaped depression or depressions. The depressions are arranged at some distance from each other so that the wall thickness of the support body, which preferably possesses a ring-shaped or hollow-cylindrical geometry, remains constant over large

areas, which ensures the required amount of stability to ensure that the support body does not deform during the clamping process.

In particular it is intended that depressions originate in the receiving-side areas of both the upper and the lower edge and preferably end at some respective distance to the center – with respect to its height - of the inner circumferential surface.

In a top view onto the support body, the depressions originating from the lower or upper edge are arranged offset with respect to each other, so that there is no weakening of the wall of the support body between the inner boundary of a depression and the opposite edge.

In order to be able to introduce the adhesive agent easily and at the same time to weaken the wall as little as possible, a further development intends that the depression is bordered by a first surface that extends along the inner circumferential surface and a lateral surface extending perpendicular thereto, and that the distance of the first surface to the central axis of the support body decreases from its origin at one edge along the direction towards the opposite edge.

The first surface, which extends along the circumferential surface and also extends into the latter consequently possesses a ramp shape and consequently extends inclined with respect to the longitudinal axis of the support body. The first surface is bordered by lateral surfaces, which do not necessarily have to extend in parallel, but in a sectional view can exhibit a trapezoidal geometry together with the first surface. Thus the edges of the first surface may have the shape of a trapeze.

In order to offer enough free space to introduce the adhesive agent, even if there is only a narrow gap between the blank and the inner circumferential surface, it is intended that in the area of the depressions, the wall of the support body in the edge area has a thickness D1 and that the wall outside of the depressions has a wall thickness D2, with $8 * D1 \geq D2 \geq 2 * D1$. D2 may for example be 1.5 mm to 5 mm, in particular D2 = 2.5 mm.

In a preferred manner the invention intends that the distance A1 between successive depressions relative to the length A2 of the respective depression in the circumferential direction obeys $A2 \leq A1 \leq 2 * A2$. The distances A1 and A2 may be specified as arc length if the support body possesses a circular geometry. In this case, the central angle between two consecutive depressions should be between 20° and 30°, with a preferred value of 25°. The central angle for the length of the depression should be between 15° and 25°, in particular 20°.

During the introduction of the adhesive agent, the support body, which as mentioned above preferably possesses a ring-shaped or hollow-cylindrical geometry with edges extending in parallel to each other, is fixed in position, such as clamped, in order to subsequently fill the individual depressions, i.e. pockets, with an adhesive agent. Since preferably pocket-shaped depressions originate from each of the edges, a suggestion to be emphasized intends that the depressions originating from one edge have the same distance from a reference mark of the support body as the depressions originating from the other edge after a rotation of the support body by 180° about its transverse axis.

This ensures that the pockets are always in the same position during filling, i.e. independent of whether the one or the other edge of the support body faces the adhesive agent filling device.

To ensure that the adhesive agent does not flow through and exit the gap between the blank and the support body before curing, a characteristic feature that also is to be emphasized intends that from the inner surface, i.e. from the wall of the support body, project baffles that inhibit the free flow of the adhesive agent. The baffles hereby so to speak provide the option of an adhesive reservoir. In this respect, it is in particular intended that the structure in a supplementary or alternative manner is formed by at least one elevation such as a ridge and/or depression originating from the wall, whereby preferably the elevation and/or depression extending at some distance from the edge is provided in addition to the at least one preferably pocket-shaped depression.

In particular it may be intended in this connection that in the central area of the inner circumferential surface extends a preferably circumferential ridge or depression such as a groove, which in particular extends in parallel to the edges.

To arrange the blank in the support body with an equidistant distance to the circumferential surface it may further be intended that one or several projections originate from the inner circumferential surface, such as for example ridges that at least in sections extend with a height higher than that of the inner circumferential surface and serve as support for the blank.

Materials that are preferred for the manufacture of the ring-shaped or hollow-cylindrical support body are fiber reinforced materials such as glass fiber reinforced plastics such as thermoplastics, whereby the thermal expansion coefficient WAK_H of the material of the support body should be matched to the thermal expansion coefficient WAK_R of the blank, in particular so that the WAKs differ no more than 20 %, preferably not more than 10 %.

The content of fiber, such as glass fiber, of the plastic such as thermoplastic should be between 30% by volume and 70% by volume, in particular approximately 50 % by volume.

In particular the support body 10 consists of polyarylamide with a glass fiber content of between 30 % by volume and 70 % by volume, in particular 50 % by volume.

Further details, advantages, and distinguishing features of the invention are not only found in the claims, the characteristic features described therein – individually and/or in combination -, but also in the following description of a preferred embodiment example.

The figures show:

Fig. 1 shows a perspective representation of a support body,

Fig. 2 shows a top view onto the support body of Fig. 1,

Fig. 3 shows a sectional view along the line B-B of Fig. 2,

Fig. 4 shows the support body of Figs. 1 to 3 together with a blank,

Fig. 5 shows a detail "A" of Fig. 3, and

Fig. 6 shows a detail "B" of Fig. 2.

The figures show a support body 10 with a wall 11 of ring-shaped or hollow-cylindrical geometry that surrounds a receiving opening 13 to accommodate a blank 12, which in particular consists of ceramic and possesses a disk-shaped or hollow-cylindrical geometry, as is shown in Fig. 4. In this, the support body 10 surrounds the blank 12 circumferentially, i.e. the inner geometry of the support body 10 should match the circumferential geometry of the blank 12, if necessary with a required undersize of the blank 12.

The support body 10 is required to be able to process the blank 12, which for example may be a zirconium oxide blank, in a processing machine such as a milling machine, to produce for example a dental restoration.

The blank 12 is fixed in position within the support body 10 by means of an adhesive agent, in particular a UV curing adhesive. For this it is necessary to introduce the UV curing adhesive into the gap between the blank 12 and the support body 10. Capillary action draws the adhesive into the gap between the blank 12 and the support body 10. However, introducing the adhesive into the gap is not problem-free.

In order to facilitate this and still to maintain the stability of the support body 10, i.e. without weakening the thickness of the wall 11 of the support body 10, but at the same

time to be able to introduce sufficient amounts of adhesive easily even in the case of narrow distances between the inner circumferential surface 14 of the wall 11 - hereinafter simply referred to as inner surface – and the outer surface 16 of the blank, the invention's teaching provides for a pattern of pocket-shaped depressions in the inner circumferential surface 14, i.e. the wall 11 of the support body 10, which as an example are marked with the reference labels 18, 20, 22, 24. In this, the pocket-shaped depressions 18, 20, 22, 24, which hereinafter will be referred to as pockets, originate directly at the respective edge, i.e. from the upper edge 26 and the lower edge 28 in the drawing. In this respect the drawing is self-explanatory. The pockets 18, 20, 22, 24 possess first surfaces 30, 32, 34, 36 that extend along the inner circumferential surface 16 and obliquely thereto, which results in a ramp-shaped geometry. The angle between the respective first surfaces 30, 32, 34, 36 and the inner circumferential surface 14 may be between 20° and 30°, and in particular may be 25°. The first surfaces 30, 32, 34, 36 are bordered by lateral surfaces – two of which have been marked with the reference labels 38, 40 as an example -, which with the first surfaces 30, 32, 34, 36 enclose an obtuse angle, as is illustrated in the top view of Fig. 2. Both in a top view and in a sectional view the respective first surface 30, 32, 34, 36 and the lateral surfaces 38, 40 generate a trapezoidal geometry, as is made evident in the top view of Fig. 2, without this constituting any limitation on the invention's teaching.

However, the support body 10 not only exhibits a trapezoid geometry in a top sectional view but also in a front view, i.e. in a view from the interior of the support body 10 in the direction towards the inner circumferential surface 14, as is shown in Fig. 3. In other words: The first surface 30, 32, 34, 36 possesses a trapezoidal shape.

The perspective representation of Fig. 1 further illustrates that the pockets 18, 20 originating from the upper edge 26 are offset in such a way from the pockets 22, 24 originating from the lower edge 28 that the pockets originating form one edge are situated in the spaces between the pockets originating from the other edge and vice versa. In this, the pockets 18, 20, 22, 24 are arranged in a way so that after a rotation of the arrangement 10, the pockets that have moved to the top have assumed the exact same positions relative to a reference mark, which in the embodiment example is

embodied in form of a longitudinal groove 42, so that filling of adhesive material can always take place at the same positions and thus can easily be automated.

In other words: If the support body 10 is rotated by the reference mark amount, then positions of the pockets 18, 20 which in the drawing are now at the top, will have been occupied by pockets that in the graphic representation originate from the lower edge 28.

The figures further illustrate that longitudinal ridges originate from the inner surface 14, in particular from the lower pockets 22, 24 in the present embodiment example. A corresponding ridge is labelled with the reference label 44 as an example (Fig. 5). This ridge 44, which extends in parallel to the longitudinal axis of the support body 10, protrudes into the interior of the support body 10 to such an extent that a blank 12 accommodated in the support body 10 is positioned relative to the inner surface 14 in a way so that one obtains a gap width between the blank 12 and the support body 10 that is constant along the entire circumference.

If the length of each pocket 18, 20, 22, 24 along the circumferential direction is A2, then the distance A1 between consecutive pockets 18, 20, 22, 24 should be greater than that. This distance is labelled A1 in Fig. 2. In particular, the distance A1 between successive depressions 18, 20, 22, 24, i.e. in the area of the lowest wall thickness, with respect to the length A2 of the respective depression along the circumferential direction should obey $A2 \leq A1 \leq 2A2$.

With respect to the wall thickness of the wall 11 at the origin of the pockets 18, 20, 22, 24, i.e. at the edge 26, 28, and with respect to the wall thickness of the wall 11 outside of the pockets 18, 20, 22, 24 it should be noted that they should obey proportions such as $8 * D1 \geq D2 \geq 2 * D1$, whereby D1 is the wall thickness in the area of the origin of the pockets 18, 20, 22, 24 and D2 represents the wall thickness outside of the pockets 18, 20, 22, 24.

To mention specific figures; the wall thickness D2 can for example be 1.5 mm to 5.0 mm, in particular 2.5 mm and the wall thickness in the pocket 18, 20, 22, 24 entrance area can be for example 0.5 mm to 0.9 mm, in particular 0.7 mm.

The height of the holding bracket 10 may for example be between 5 mm and 30 mm, in particular in dependence of the height of the blank to be accommodated, which preferably possesses an extent of its height that is greater than that of the support body 10, i.e. its circular outer surfaces 44, 46 project beyond the edges 26, 28.

The inner diameter of the holding bracket 10 may for example be 94 mm to 100 m, to provide some exemplary figures.

Between the edges 26, 28, which extend parallel relative to each other, in the central area of the support body 10 and in particular originating from the inner surface 14, extends a preferably circumferential ridge 43 (Fig. 1, 5), which prevents the adhesive agent flowing through the gap between the blank 12 and the support body 10 from dripping out on the opposite side. Rather, the corresponding ridge 43 in this respect acts as a baffle. Other geometries for the retention of the adhesive agent are of course also possible. The ridge 43 is forming a structure.

Feasible materials for the support body 10 are in particularly fiber reinforced such as glass fiber reinforced plastics such as thermoplastics, whereby the thermal expansion coefficient WAK_H of the material of the support body 10 should be matched to the thermal expansion coefficient WAK_R of the blank 12; in particular the WAKs should differ no more than 20 %, preferably no more than 10 %. The fiber content, such as glass fiber content, of the plastic, such as thermoplastic, should be between 30 % by volume and 70 % by volume, in particular approximately 50% by volume.

In particular, the support body 10 consists of polyarylamide with a glass fiber content of 30 % by volume to 70 % by volume, in particular 50 % by volume.

Irrespective hereof, the figures are self-explanatory and illustrate the characteristic features of the support body 10 of the invention unambiguously.

Claims

Support body for a blank

1. A support body (10) for a blank, in particular a blank consisting of ceramic such as zirconium oxide or a glass ceramic, whereby the support body comprises a receiving opening (13) for the blank that is surrounded by an inner circumferential surface (14) bordered by an upper and a lower edge (26, 28), and when the blank is fixed in position within the support body, it is bonded to the latter by means of an adhesive agent, whereby the support body in particular possesses a hollow cylindrical geometry and circumferentially surrounds the blank, which in turn preferably possesses a disk-shaped or cylindrical geometry,
characterized in that
the inner circumferential surface (14) possesses a structure in form of at least one depression (18, 20, 22, 24) that extends to at least one edge (26, 28) and/or at least one elevation to accommodate the adhesive agent.

2. The support body of claim 1,
characterized in that
the structure is formed by at least one, in particular by several preferably pocket-shaped depressions (18, 20, 22, 24) within the wall (11) of the support body (10) that is bordered by the inner circumferential surface (14), whereby the depressions extend to the at least one edge (26, 28).

3. The support body of claim 1 or 2,
characterized in that
from the receiving-side area of both the upper and the lower edge (26, 28) originate depressions (18, 20, 22, 24), which preferably terminate at some distance from the center of the inner circumferential surface – relative to the latter's height.

4. The support body of at least one of claims 1 -3,
characterized in that
the depression (18, 20, 22, 24) is bordered by a first surface (30, 32, 34, 36) extending along the interior circumferential surface (14) and lateral surfaces (38, 40) extending perpendicularly thereto, and in that the distance from the first surface to the central axis of the support body (10) decreases from one edge (26) along the direction towards the opposite edge (28).

5. The support body of at least one of claims 1 - 4,
characterized in that
the depressions (18, 20, 22, 24) are uniformly distributed along the inner circumference of the support body.

6. The support body of at least one of claims 1 - 5,
characterized in that
the depressions (18, 20) originating from one edge (26) will exhibit the same distances to a reference mark (42) of the support body as the depressions (22, 24) originating from the other edge (28) after a rotation of the support body (10) by 180° about its transverse axis.

7. The support body of at least one of claims 1 - 6,
characterized in that
the structure is formed in a supplementary or alternative manner by at least one elevation such as ridge (43) and/or depression that extends at some distance to the edge (26, 28) and originates from the inner circumferential surface (14) of the wall (11), whereby preferably the elevation and/or depression extending at some distance to the edge is provided in addition to the at least one preferably pocket-shaped depression (18, 20, 22, 24).

8. The support body of at least one of claims 1 - 7,
characterized in that
from the inner circumferential surface (14) originate one or several projections, such as ridges (44) that at least in sections extend above the height of the inner circumferential surface and serve as support for the blank (12).

9. The support body of at least one of claims 1 - 8,
characterized in that
the first surface (30, 32, 34, 36) of the depression (18, 20, 22, 24) encloses with the inner circumferential surface (14) an angle α with $20° \leq \alpha \leq 30°$, in particular $\alpha = 25°$.

10. The support body of at least one of claims 1 - 9,
characterized in that
in the central area of the inner circumferential surface (14) extends a preferably circumferential ridge or depression, such as a groove, which in particular extends in parallel to the edges (26, 28).

11. The support body of at least one of claims 1 - 10,
characterized in that
in the area of the depression (18, 20, 22, 24), the wall (11) of the support body (10) in the edge area possesses a thickness D1 and outside of the depressions it possesses a thickness D2, whereby $8 * D1 \geq D2 \geq 2 * D1$.

12. The support body of at least one of claims 1 - 11,
characterized in that
the distance A1 between successive depressions (18, 20, 22, 24) relative to the length A2 of the respective depression along the circumferential direction obeys $A2 \leq A1 \leq 2 * A2$.

13. The support body of at least one of claims 1 - 12,
characterized in that
the support body (10) consists of plastic, in particular of fiber reinforced plastic such as glass fiber reinforced plastic such as thermoplastic, whereby in particular the thermal expansion coefficient WAK_H of the material is matched to the thermal expansion coefficient WAK_R of the blank, and in particular the thermal expansion coefficients differ no more than 20 %, preferably no more than 10 %.

14. The support body of at least one of claims 1 - 13,
characterized in that
the fiber content such as glass fiber content of the support body (10) amounts to between 30% by volume and 70% by volume, in particular approximately 50% by volume.

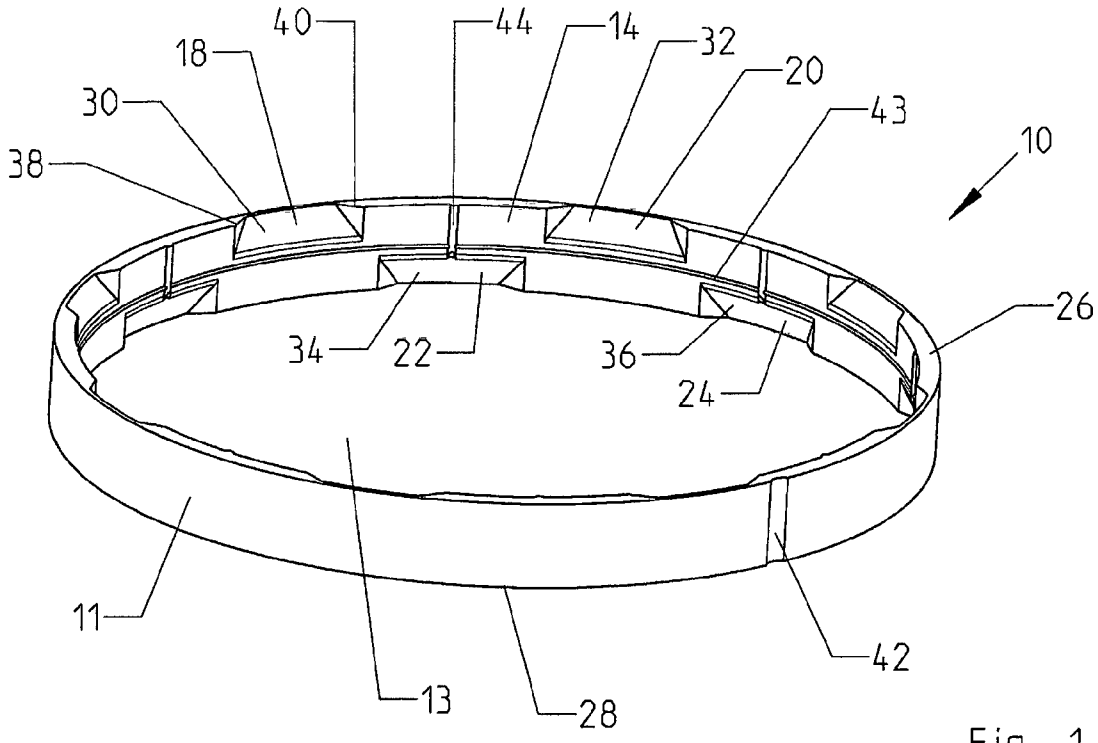

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Fig. 1

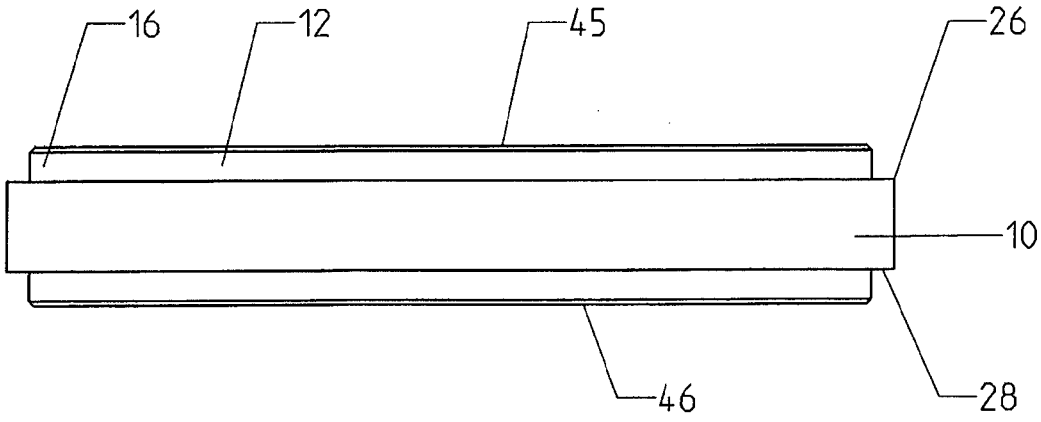

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Fig. 4

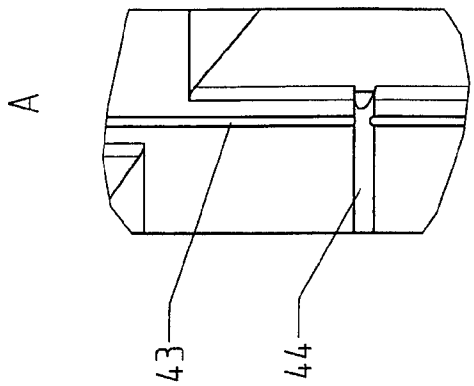


Fig. 5

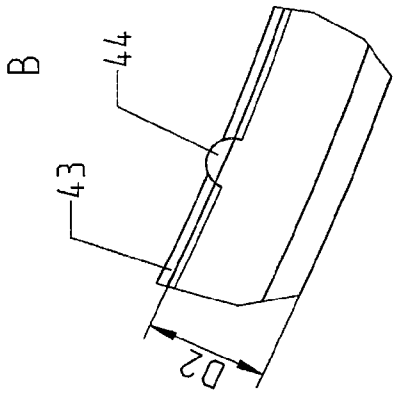


Fig. 6

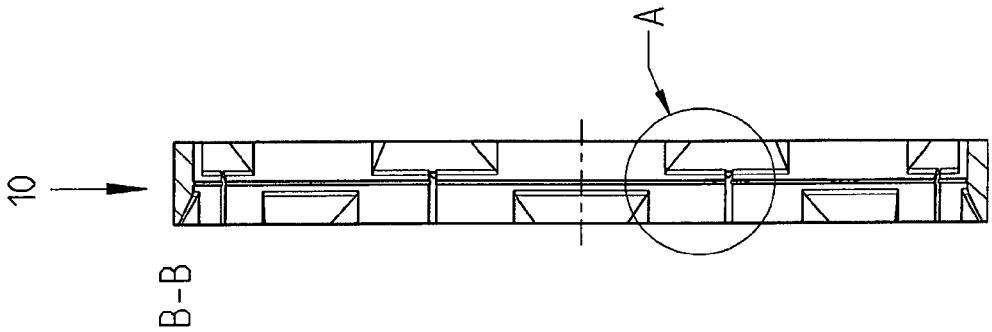


Fig. 3

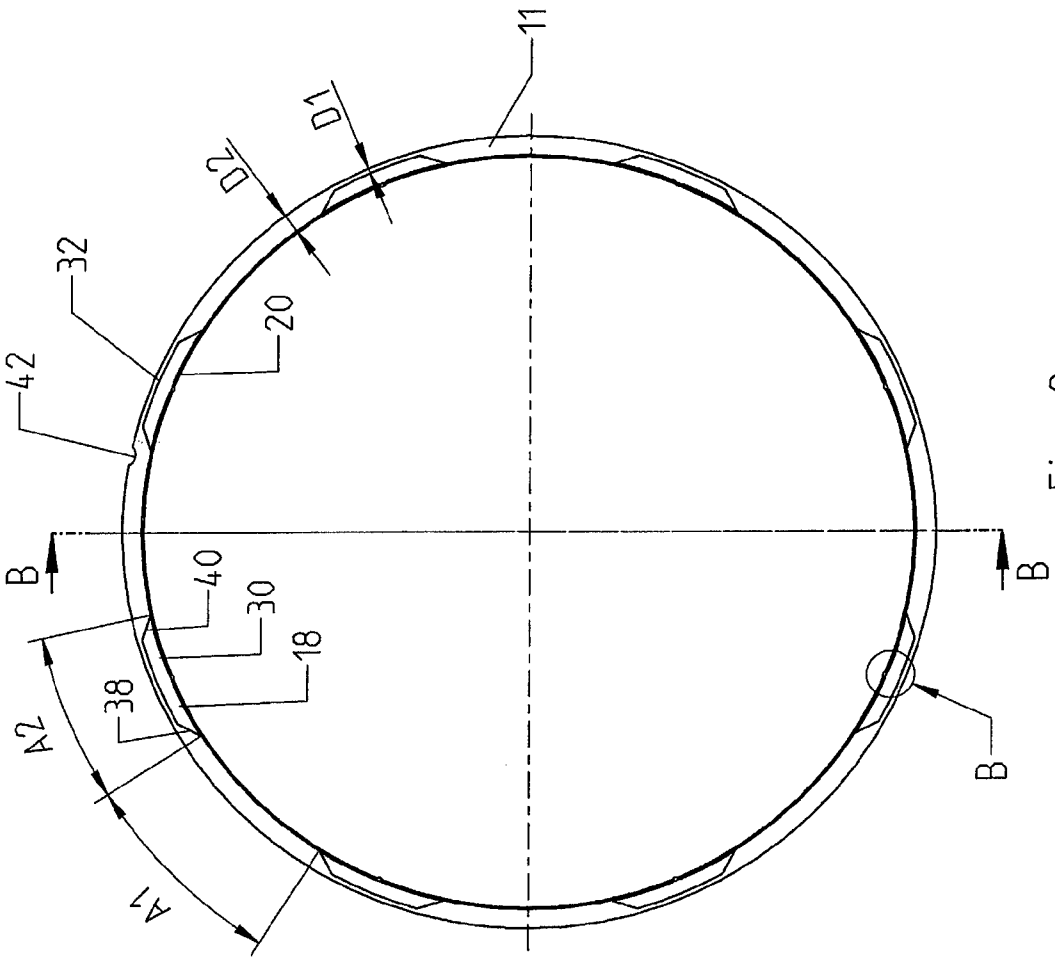


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/053431

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61C13/00
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2014/200226 A1 (MUNGYO GYPSUM & ENGINEERING CORP [KR]) 18 December 2014 (2014-12-18) paragraphs [0021] - [0023]; figures 4,6	1-3,6-8, 11-14
X	DE 20 2013 103515 U1 (IVOCLAR VIVADENT AG [LI]) 12 September 2013 (2013-09-12) paragraphs [0039], [0051], [0052]; figures 1,3a	1,2,5, 7-14
X	DE 10 2005 008004 A1 (BRINKMANN JOHANNES [DE]) 24 November 2005 (2005-11-24) cited in the application paragraphs [0011], [0012]; figures 1,2	1-3,5,6
X	WO 95/30382 A1 (HINTERSEHR JOSEPH [DE]) 16 November 1995 (1995-11-16) cited in the application figures 4,5	1,7,10

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

☒ See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
10 May 2016	20/05/2016

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2016/053431

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