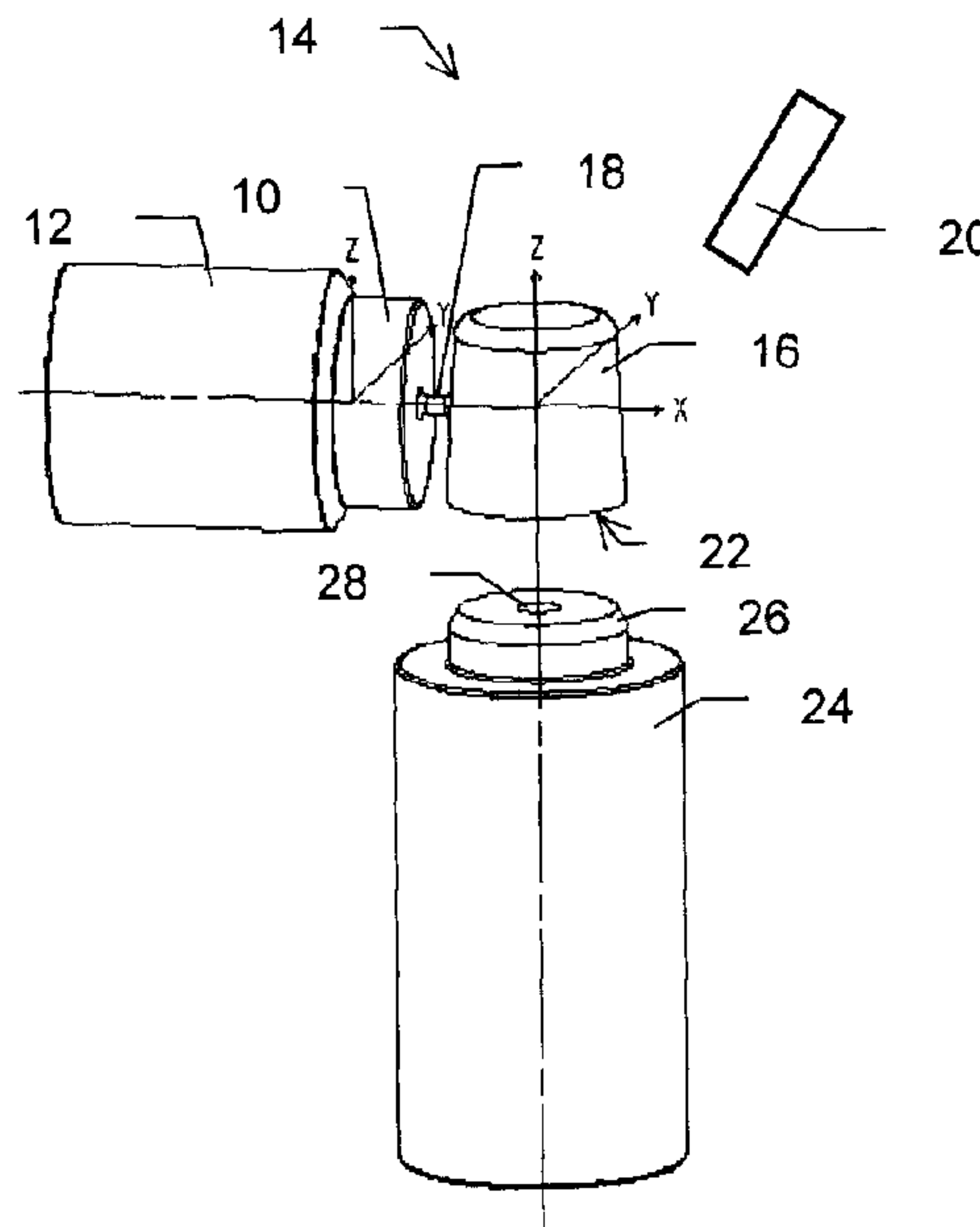




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(72) Inventeurs/Inventors:
MIQUEL, FLORENT, CA;
ARNAULD, GILLES, CA
(73) Propriétaire/Owner:
BIOCAD MEDICAL INC., CA
(74) Agent: FETHERSTONHAUGH & CO.

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(54) Title: METHOD AND DEVICE FOR PRODUCING A DENTAL COMPONENT



(57) Abrégé/Abstract:

The present invention relates to a method and device for producing a dental component. The method comprises: a) providing a piece of material (10) attached to or held by a first holding means (12); b) shaping the piece of material to form the dental component (16) and at least one support pin (18) maintaining the dental component attached to the first holding means or the initial piece of material; c) engaging a second holding means (24) to the dental component while the dental component still is attached to the first holding means or the initial piece of material via the at least one support pin; and d) removing the at least one support pin from the dental component while the dental component is engaged by the second holding means.

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(71) Applicant (for all designated States except US): **BIOCAD MEDICAL INC.** [CA/CA]; 750 boul du Parc-Technologique, Québec, Québec G1P 4S3 (CA).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **MIQUEL, Florent** [CA/CA]; 320 boulevard des Cèdres, Appartement #6, Québec, Québec G1L 1N2 (CA). **ARNAULD, Gilles** [CA/CA]; 3355 Chemin Saint-Louis, Appartement #6, Québec, Québec G1W 1S1 (CA).(74) Agent: **FETHERSTONHAUGH & CO.**; P.O. Box 2999, Station D, 900 - 55 Metcalfe Street, Ottawa, Ontario K1P 5Y6 (CA).

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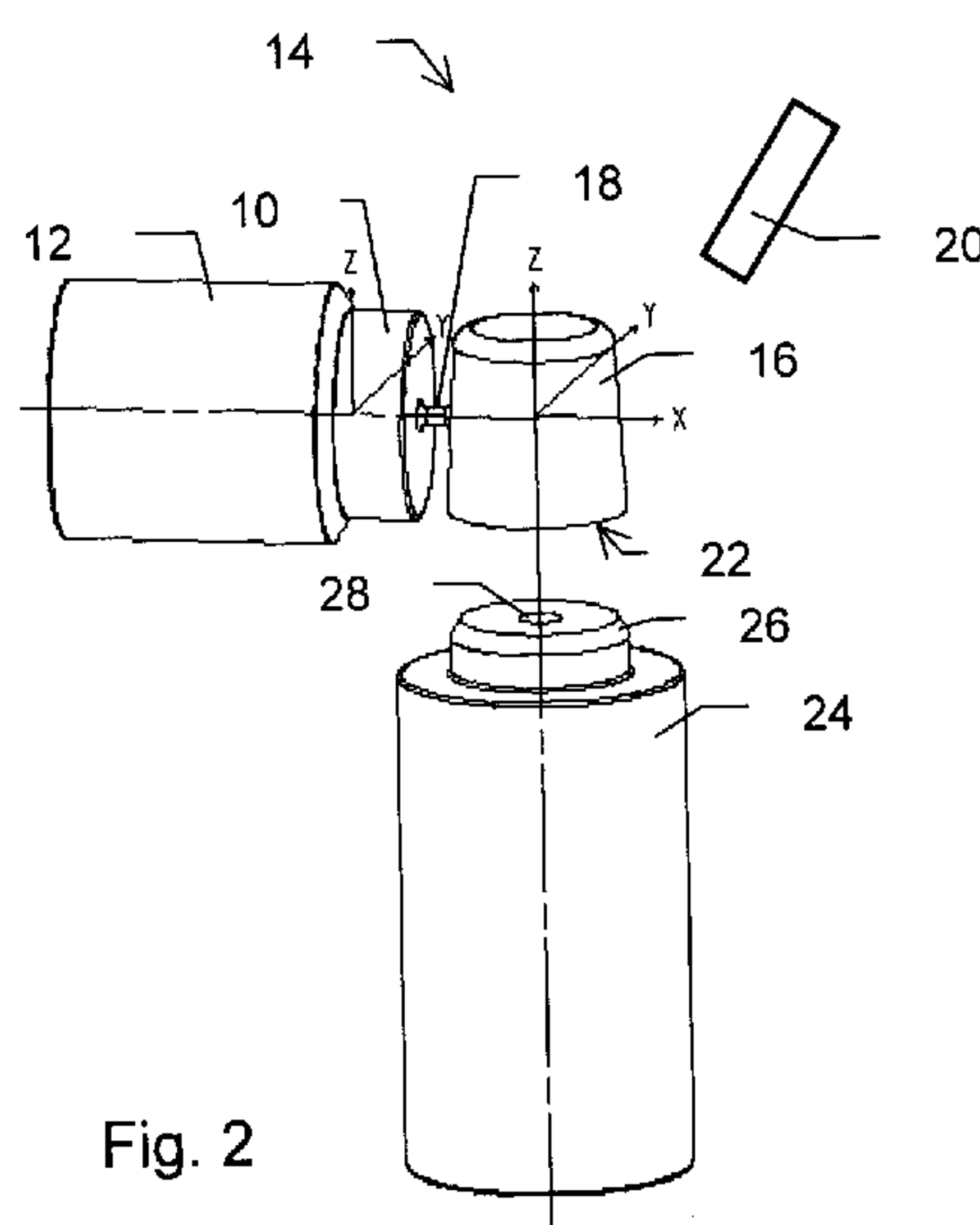


Fig. 2

(57) Abstract: The present invention relates to a method and device for producing a dental component. The method comprises: a) providing a piece of material (10) attached to or held by a first holding means (12); b) shaping the piece of material to form the dental component (16) and at least one support pin (18) maintaining the dental component attached to the first holding means or the initial piece of material; c) engaging a second holding means (24) to the dental component while the dental component still is attached to the first holding means or the initial piece of material via the at least one support pin; and d) removing the at least one support pin from the dental component while the dental component is engaged by the second holding means.

WO 2012/068667 A1

Method and device for producing a dental component

Field of the invention

The present invention relates to a method and device
5 for producing a dental component.

Background of the invention

A dental component, such as a crown or bridge or
(prosthetic) coping, may be produced by milling in a
10 milling machine. First, a blank is attached to a holder
or feeder in the milling machine. The dental component is
then milled from the blank by removing material from the
blank.

However, the dental component is not fully finished
15 in the milling machine. There are typically one or more
support pins that still maintains the dental component to
the initial blank or holder. These support pins are then
removed manually outside the milling machine, for
instance by filing, grinding, and/or polishing. This
20 manual removal is both time-consuming and difficult, and
may result in that an outer surface of the dental
component is not given the optimal properties it should
have. The outer surface may even be damaged, and the
produced dental component may have to be scrapped.

25

Summary of the invention

It is an object of the present invention to at least
partly overcome the above-mentioned drawbacks, and to
provide an improved method and device for producing a
30 dental component.

This, and other objects will become apparent
from the following description.

According to an aspect of the present invention, there is provided a method for producing a dental component, which method comprises: a) providing a piece of material attached to or held by a first holding means; b) shaping the piece of material to form the dental component and at least one support pin maintaining the dental component attached to the first holding means or the initial (remaining) piece of material; c) engaging a second holding means to the dental component while the dental component still is attached to the first holding means or the piece of material via the at least one support pin; and d) removing the at least one support pin from the dental component while the dental component is engaged by the second holding means.

Engaging the second holding means to the dental component makes the supporting pin(s) for maintaining the dental component superfluous, whereby the at least one support pin can be removed, and an end product without any support pins can be readily produced. There is no need to remove the support pin(s) manually, but the support pin(s) can instead be removed automatically, typically in the same machine that shaped the dental component. In this way, the support pin removal can be quick and accurate.

In currently preferred embodiments, b) includes shaping the piece of material by milling and d) includes removing the at least one support pin by further milling, the shaping in b) and the removal in d) are made by the same equipment or tool, and/or the shaping in b) and the removal in d) are automated.

Further, c) may include engaging the second holding means in or to a cavity of the dental component. By

engaging the second holding means in/to the cavity, there is no risk that the second holding means will damage other portions of the dental component, such as the outer surface of the dental component.

5 The present method may further comprise:
manufacturing or shaping the second holding means to at least partly fit with the cavity of the dental component. This allows the dental component to be firmly held in place during the subsequent removal of the support
10 pin(s). The second holding means may for instance have an engaging portion that fully fits with the cavity of the dental component or that fits with only an opening portion of the cavity of the dental component.

Further, data for shaping the dental component may
15 be used also for manufacturing or shaping the second holding means, which allows a perfect fit between the dental component and the second holding means.

The second holding means may be manufactured or shaped by one of: milling; rapid prototyping; molding or
20 injecting a material directly in a cavity of the dental component; and molding or injecting a material in a cavity other than a cavity of the dental component.

Further, the dental component and/or the second holding means may be automatically positioned for
25 engagement of the second holding means to the dental component by one of: keeping track of the positions of the dental component and the second holding means during the preceding operation(s); assigning specific positions to the dental component and the second holding means for
30 the engagement; and using a detection means for detecting the actual positions of the dental component and the second holding means.

Further, the second holding means may be engaged to the dental component by suction through at least one hole

on the second holding means, the suction creating a vacuum bringing the second holding means and the dental component together. In this way, the dental component can be firmly held by the second holding means, with minimum
5 interference on the dental component. However, other solutions for engaging the dental component and the second holding means are also envisaged.

The dental component may be one of a crown, a bridge, and a coping.

10 Further, at least one of b), c), and d) may be controlled by a electronic control means, such as a microcontroller.

The second holding means may be manufactured or shaped before it is engaged to the dental component.

15 The at least one support pin may be shaped as at least one spoke.

According to another aspect of the present invention, there is provided a device adapted to perform the method according to the above description.

20 According to yet another aspect of the present invention, there is provided a device for producing a dental component, which device comprises: a first holding means adapted to maintain a piece of material by holding engagement or attachment; equipment adapted to shape the
25 piece of material to form the dental component and at least one support pin maintaining the dental component attached to the first holding means or the piece of material; one or more second holding means adapted to engage with the dental component; and
30 equipment adapted to remove the at least one support pin from the dental component while the dental component is held by the one or more second holding means. This aspect may exhibit the same or similar features and technical

effects as the previously described aspect of the invention.

The equipment adapted to remove the at least one support pin may be the same as the equipment adapted to shape the piece of material to form the dental component. Hence, the equipment adapted to shape the piece of material to form the dental component may further be adapted to (subsequently) remove the at least one support pin. Alternatively, a dedicated equipment for removing the support pin(s) may be used.

The device may be a milling machine and said equipment may be or include a milling tool.

The device may further comprise means for manufacturing or shaping the one or more second holding means to at least partly fit with a cavity of the dental component.

The device may further comprise means for automatically positioning the one or more second holding means for engagement to the dental component.

20

Brief description of the drawings

These and other aspects of the present invention will now be described in more detail with reference to the appended drawings.

25 Fig. 1 is a flow chart of a method according to an embodiment of the present invention.

Fig. 2 is a perspective view of device (milling machine) according to an embodiment of the present invention.

30 Figs. 3a-3b are schematic side views of second holding means according to embodiments of the present invention.

Figs. 4a-4b are schematic cross-sectional side views of the second holding means of figs. 3a-3b engaged with a dental component.

Fig. 5 is a cross-sectional side view of a second holding means engaged to a dental component according to an embodiment of the present invention.

Figs. 6a-6c are schematic partly cross-sectional side views showing pin removal and a resulting dental component according to the present invention.

Fig. 7 is a perspective view of device (milling machine) according to another embodiment of the present invention.

Detailed description of the invention

Fig. 1 is a flow chart of a method for producing a dental component according to an embodiment of the present invention. The dental component can for instance be a crown or a bridge or a (prosthetic) coping. In the following, the present invention is described in the context of milling in a milling machine, though it is envisaged that other techniques could be used, such as rapid prototyping.

In step S1 in fig. 1, a piece of material 10 is provided. The piece of material can be a blank (e.g. a cylinder, disc, bar, etc.) or a pre-manufactured shape. The pre-manufactured shape can for instance be made by rapid prototyping, custom powder pressing, etc. Further, the piece of material can be metal, ceramic, acrylic, glass, ceramic-glass, or other dental material.

The piece of material 10 is attached to or held by a first holding means 12 in a milling machine 14 (see fig. 2). The piece of material may for instance be for one dental component only, which piece of material can be glued or otherwise attached to the first holding means.

Alternatively, the piece of material can be a feedable length of material from which several dental components can be produced. Such a feedable length of material can be held by a feeder, the feeder thus constituting said
5 first holding means. Moreover, the present invention can also be used in conjunction with nesting technique for effectively milling a plurality of dental components from a larger blank.

In step S2, the piece of material is milled (shaped)
10 to form a dental component 16 and at least one supporting pin 18, as seen in fig. 2. Hence, the dental component 16 is at this stage not fully finished. The one or more support pins 18 maintain the dental component attached to the first holding means or to the remainder of the piece
15 of material 10. The support pin(s) may for instance be on the outer side portion of the dental component, as in fig. 2. Each support pin 18 may be discrete and shaped like a (thin, short) rod defining a point of attachment between the dental component 16 and the first holding
20 means 12/remaining piece of material 10. The at least one pin 18 does not extend all around the component 16, allowing most of the component 16 to be shaped in step S2. Further, the at least one support pin 18 may be one or more (support) spokes, i.e. one or more small
25 radiating bars.

The milling is done by equipment of the milling machine 14, which equipment may include or consist of a milling tool 20. The milling tool 20 is automated, and shapes the dental component based on CAD data input to
30 the milling machine. Preferably, the milling machine is set up for 5-axis milling, though also 3-axis milling may be used, e.g.

The milled dental component 16 has a cavity 22. By means of the cavity 22, the final dental component can be

fitted to a tooth or dental implant or abutment (on a dental implant) of a patient.

The present method may also comprise the step S3 of manufacturing or shaping a second holding means 24. The
5 second holding means could also be referred to as a support die. The second holding means 24 is generally adapted to engage with the dental component 16, while the dental component still is attached to the first holding means or the remaining piece of material via the at least
10 one support pin. Specifically, the second holding means 24 should be able to maintain the dental component 16 in position, to allow further processing in the milling machine 14. To this end, the second holding means 24 can be manufactured or shaped to at least partly fit with the
15 cavity 22 of the dental component 16, so that the second holding means 24 can be engaged in/to the cavity 22 of the dental component 16. This avoids unnecessary interaction with outer portions of the dental component 16.

20 The second holding means 24 may have an engaging portion 26 that fully fits in the cavity 22 of the dental component, as shown in figs. 3a and 4a. That is, engaging portion 26 completely fills the cavity 22. Alternatively, engaging portion 26 of the second holding means 24 may
25 fit with only an opening portion of the cavity 22 (see figs. 3b and 4b). Further, the material used in the second holding means (particularly in the engaging portion 26 thereof) can be "hard" and perfectly match the shape of the dental component, or a little "soft" to
30 adapt to a specific shape of the dental component. Preferably, (CAD) data used for shaping the cavity of the dental component is used to manufacture or shape the second holding means, which allows a perfect fit between the dental component and the second holding means.

The manufacturing or shaping process for the second holding means can be milling, for instance in the same milling machine 14 used to shape the dental component. Alternatively, rapid prototyping (e.g. stereolithography or 3D printing) could be used. Instead of milling the second holding means or rapid prototyping it, the second holding means may be formed by molding or injecting a material directly into the cavity of the dental component or another cavity. To this end, a nozzle etc. (not shown) for the molding or injection could be integrated into the automation of the milling machine. The material molded or injected in the cavity could be a liquid that subsequently is frozen, a temporary glue or binder or gum, a low melting point metal, a polymerizable organic product, a foam, thermoplastic or thermosetting products, etc. The (final) material could be hard or somewhat soft or sticky. Also, it could be dense or porous. The latter may be especially beneficial for engaging the second holding means with the dental component, as will be explained further in the following.

The present method may further comprise the step S4 of positioning the dental component and/or the second holding means for engagement. The positioning can be made automatically by some apparatus in the milling machine, though it could alternatively be made manually by an operator. However, due to the fine dimensions and narrow tolerances usually involved in the production of a dental component, the former alternative is currently preferred, since it can be more accurate. The dental component and/or the second holding means may be automatically positioned or aligned for engagement of the second holding means to the dental component. This can be achieved by keeping track of the positions of the dental component and the second holding means during the

preceding operation(s), i.e. the shaping of the dental component and the manufacturing/shaping of the second holding means. Alternatively, specific positions may be assigned to the dental component and the second holding means for the engagement. As yet another alternative, a detection means (e.g. a probe or scanning system, not shown) can be used for detecting the actual positions of the dental component and the second holding means. The positions of the dental component and the second holding means can be expressed as X, Y, and Z positions in the coordinate system shown in fig. 2, and also as angular positioning around the X, Y, and Z axis.

It should be noted that when the second holding means is manufactured/shaped by molding or injection directly in the cavity of the dental component, step S4 may be omitted, since the second holding means is formed directly on the dental component. Further, when the second holding means is manufactured/shaped by molding or injection directly in the cavity of the dental component, this (i.e. step S3) must be performed after the dental product has been milled (step S2). Contrary, if the second holding means is manufactured/shaped in a different way, e.g. by milling or rapid prototyping, the second holding means can be manufactured/shaped before or simultaneously as the dental component is milled. This may save some time.

In step S5, the second holding means 24 is engaged or temporarily fastened to the dental component 16. This is done while the dental component 16 still is attached to the first holding means or the remaining piece of material via the at least one support pin 18. In one embodiment, the second holding means 24 includes at least one hole 28, as shown in fig. 5. The hole 28 exits in a surface 30 of the engaging portion 26 of the second

holding means 24, which surface 30 is in communication with the cavity 22 of the dental component 16. By sucking air out from the cavity 22 through the hole(s) 28 (indicated by downward pointing arrow in fig. 5) by means of a suction device (not shown), a vacuum is created that brings the second holding means 24 and the dental component 16 together, whereby the dental component 16 is firmly held by the second holding means 24. The end opening of the hole 28 towards the dental component 16 is also shown in fig. 2. In case the second holding means 24 is porous as mentioned above, no dedicated hole(s) 28 may be necessary to allow suction.

Alternatives or complements for maintaining the dental component 16 on top of the second holding means 24 include, but are not limited to:

- the mere shape of the engaging portion of the second holding means fits with the shape of the cavity, so that the dental component is maintained on the second holding means;
- a foam is pressing the dental component towards the second holding means;
- two foam fingers pinch the dental component vertically; and
- freezing the dental component on the second holding means, for instance by adding some liquid on the contact surface between the dental component and the second holding means and freezing the liquid to stick the two items together.

Once the second holding means 24 is engaged to the dental component 16, the at least one support pin 18 may be removed 18 in step S6, as showed in figs. 6a-6b. It will be appreciated that the support pin(s) 18 no longer is/are necessary to hold the dental component 16, since the latter at this stage (also) is held in place by the

second holding means 24. The pin(s) 18 may therefore be removed at this stage. The same milling tool 20 that was used to mill the dental component in step S2 may be used also to remove the support pin(s) 18. Alternatively,
5 another milling tool of the milling machine 14 could be used for the pin removal, e.g.

The milling tool 20 (both for shaping of the dental component and removal of the pin(s)) and the positioning and engagement of the second holding means may be
10 controlled by an electronic control means (not shown) of the milling machine 14.

The output of step S6 is hence a fully milled dental component 16' without any support pin(s). It is appreciated that no manual removal of the support pin(s)
15 is required, whereby the quality of the output dental component may be improved. Once the dental component is fully milled, it can be step out of the milling machine 14 alone (fig. 6c) or with the second holding means 24. If additional means (e.g. suction means or foam) has been
20 used to maintain the dental component to the second holding means, they can be disabled or released at this stage or later.

In case the dental component to be milled is a bridge 32 having several supporting teeth 34 (see fig.
25 7), the second holding means can be configured with one engaging portion 26 for each supporting tooth 34. Alternatively, additional second holding means 24 of the type discussed above in relation to e.g. fig. 2 can be used, for instance one second holding means 24 for each
30 supporting tooth of the bridge. As yet another alternative, only one of bridge's supporting teeth may be engaged by the second holding means.

The person skilled in the art realized that the present invention by no means is limited to the

embodiments described above. On the contrary, many modifications and variations are possible within the scope of the appended claims.

CLAIMS:

1. A method for producing a dental component, which method comprises:

5 a) providing a piece of material attached to or held by a first holding means;

b) shaping the piece of material to form the dental component and at least one support pin maintaining the dental component attached to the first holding means or the initial piece of material;

10 c) engaging a second holding means to the dental component while the dental component still is attached to the first holding means or the piece of material via the at least one support pin; and

15 d) removing the at least one support pin from the dental component while the dental component is engaged by the second holding means.

2. A method according to claim 1, wherein b) includes shaping the piece of material by milling, and wherein d) includes removing the at least one support pin by further
20 milling.

3. A method according to claim 1 or 2, wherein the shaping in b) and the removal in d) are made by the same equipment or tool.

4. A method according to any one of claims 1 to 3,
25 wherein the shaping in b) and the removal in d) are automated.

5. A method according to any one of claims 1 to 4, wherein c) includes engaging the second holding means in or to a cavity of the dental component.

6. A method according to claim 5, further comprising:

5 manufacturing or shaping the second holding means to at least partly fit with the cavity of the dental component.

7. A method according to claim 5 or 6, wherein the second holding means has an engaging portion that fully fits with the cavity of the dental component or that fits with only
10 an opening portion of the cavity of the dental component.

8. A method according to any one of claims 1 to 7, wherein data for shaping the dental component is used also for manufacturing or shaping the second holding means.

9. A method according to any one of claims 1 to 8,
15 wherein the second holding means is manufactured or shaped by one of:

milling;

rapid prototyping;

molding or injecting a material directly in a cavity
20 of the dental component; and

molding or injecting a material in a cavity other than a cavity of the dental component.

10. A method according to any one of claims 1 to 9, wherein the dental component and/or the second holding means

is/are automatically positioned for engagement of the second holding means to the dental component by one of:

keeping track of the positions of the dental component and the second holding means during the preceding
5 operation(s);

assigning specific positions to the dental component and the second holding means for the engagement; and

using a detection means for detecting the actual positions of the dental component and the second holding means.

10 11. A method according to any one of claims 1 to 10, wherein the second holding means is engaged to the dental component by suction through at least one hole on the second holding means, the suction creating a vacuum bringing the second holding means and the dental component together.

15 12. A method according to any one of claims 1 to 11, wherein the dental component is one of a crown, a bridge, and a coping.

13. A method according to any one of claims 1 to 12, wherein at least one of b), c), and d) is controlled by an
20 electronic control means.

14. A method according to claim 1, wherein the second holding means is manufactured or shaped before it is engaged to the dental component.

15. A method according to claim 1, wherein the at least
25 one support pin is shaped as at least one spoke.

16. A device for producing a dental component, which device comprises:

a first holding means adapted to maintain a piece of material by holding engagement or attachment;

5 equipment adapted to shape the piece of material to form a dental component and at least one support pin maintaining the dental component attached to the first holding means or the piece of material;

one or more second holding means adapted to engage
10 with the dental component; and

equipment adapted to remove the at least one support pin from the dental component while the dental component is held by the one or more second holding means.

17. A device according to claim 16, wherein the device is
15 a milling machine and said equipment is or includes a milling tool.

18. A device according to claim 16 or 17, further comprising means for manufacturing or shaping the one or more second holding means to at least partly fit with a cavity of
20 the dental component.

19. A device according to any one of the claims 16-18, further comprising means for automatically positioning the one or more second holding means for engagement to the dental component.

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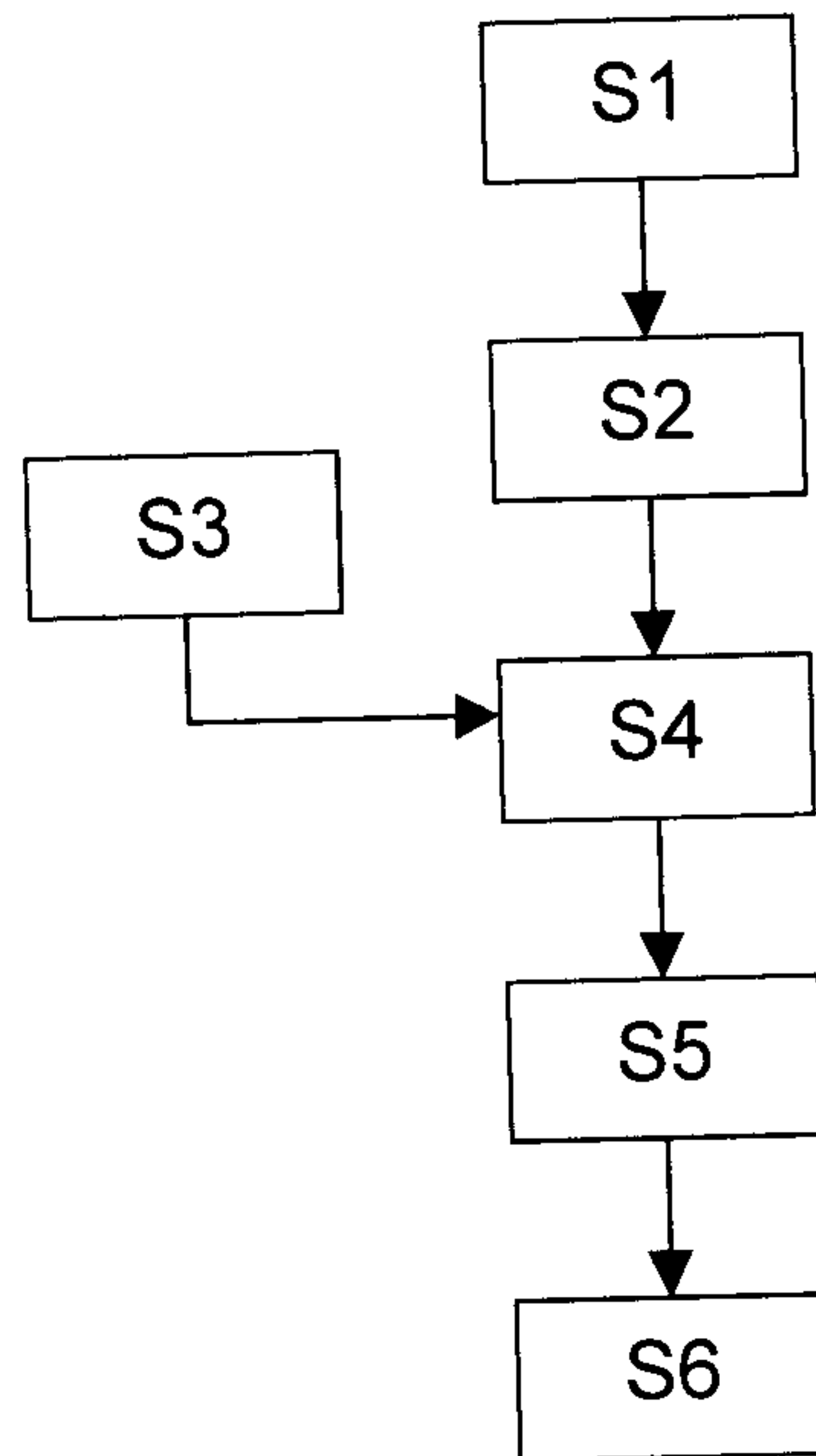


Fig. 1

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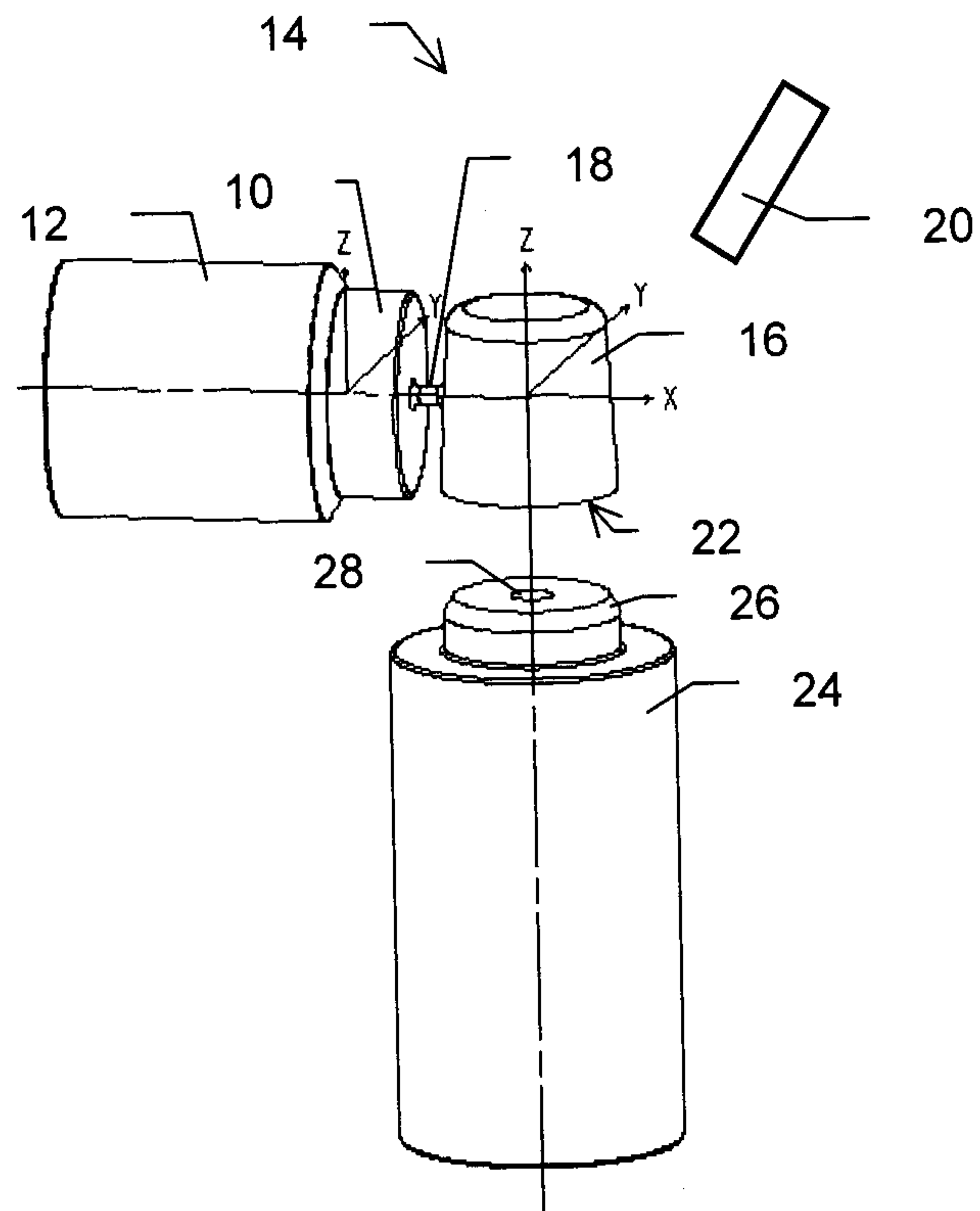


Fig. 2

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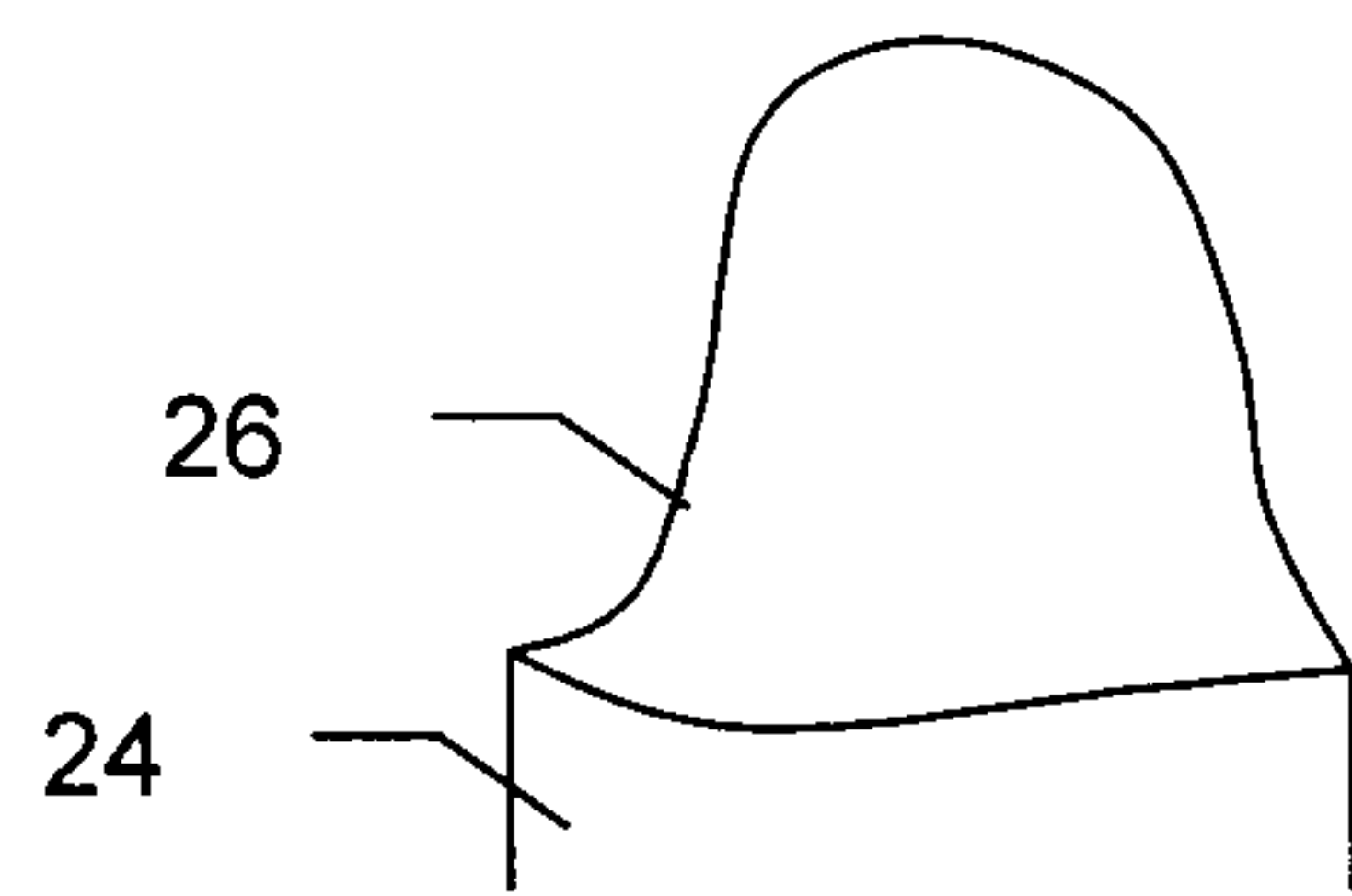


Fig. 3a

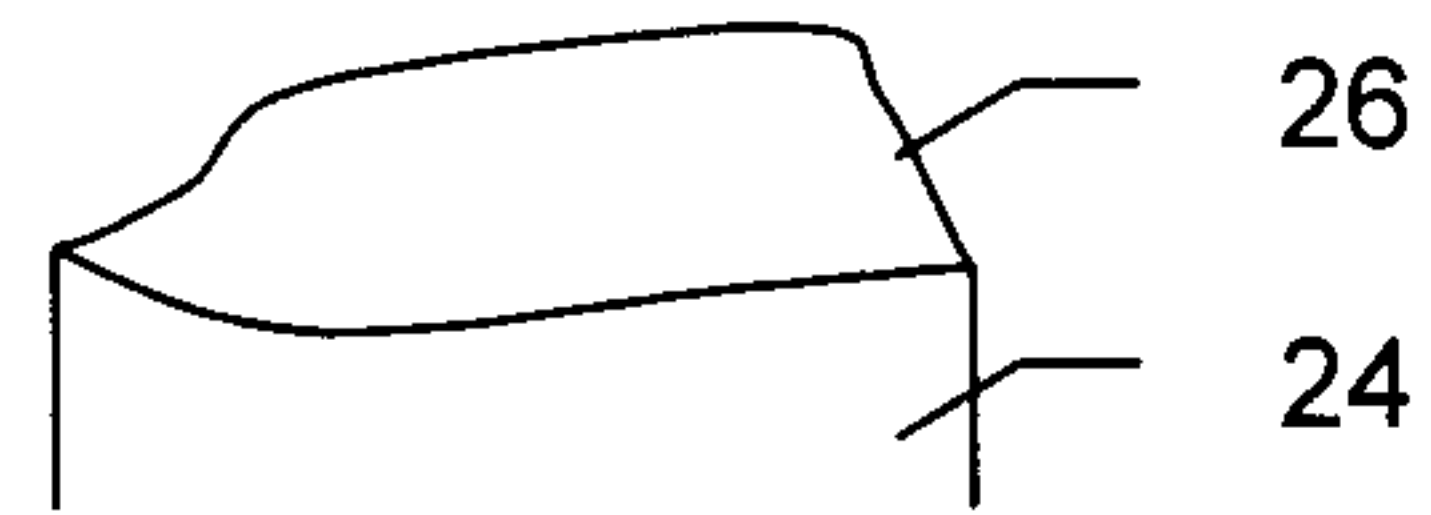


Fig. 3b

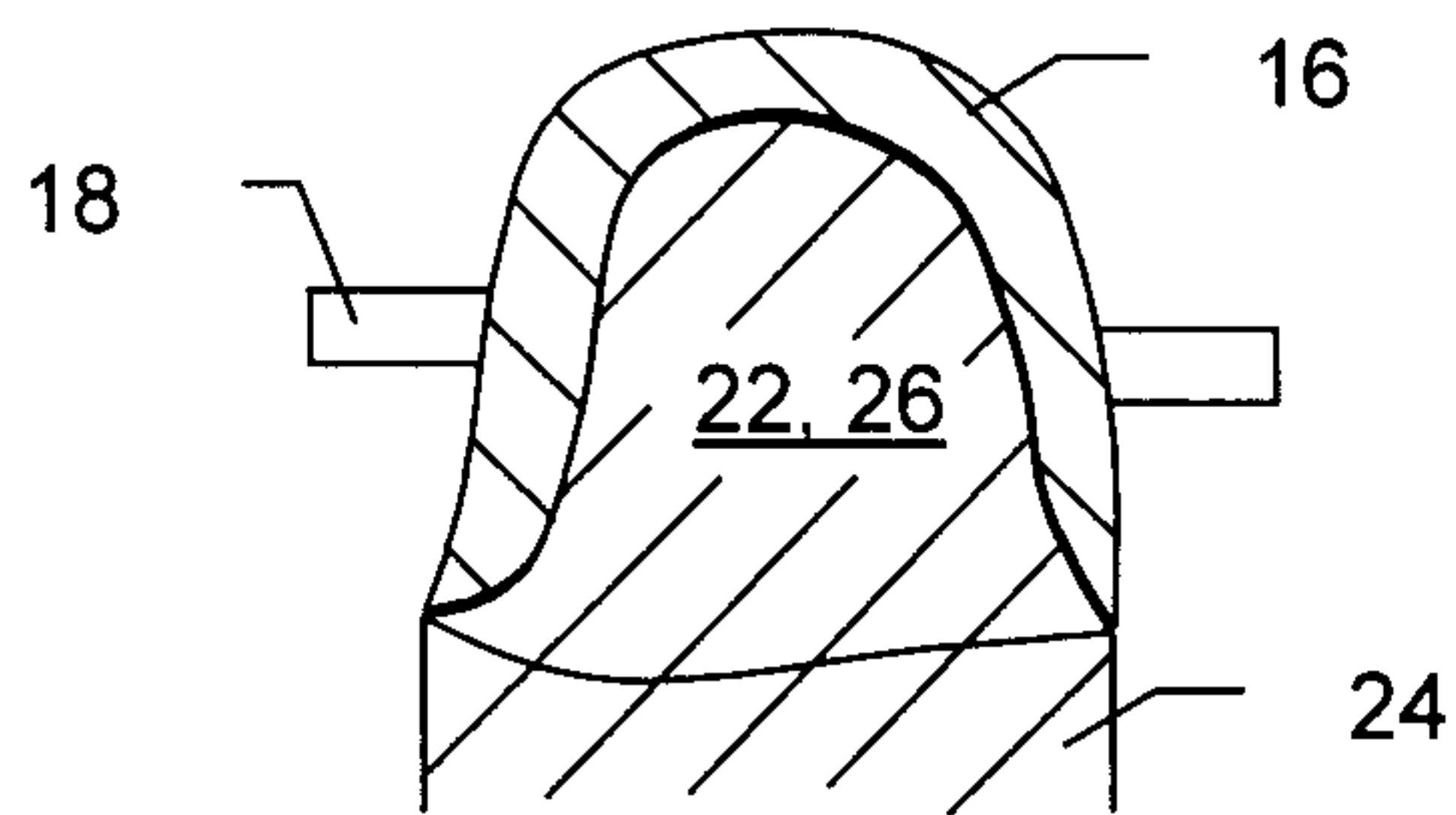


Fig. 4a

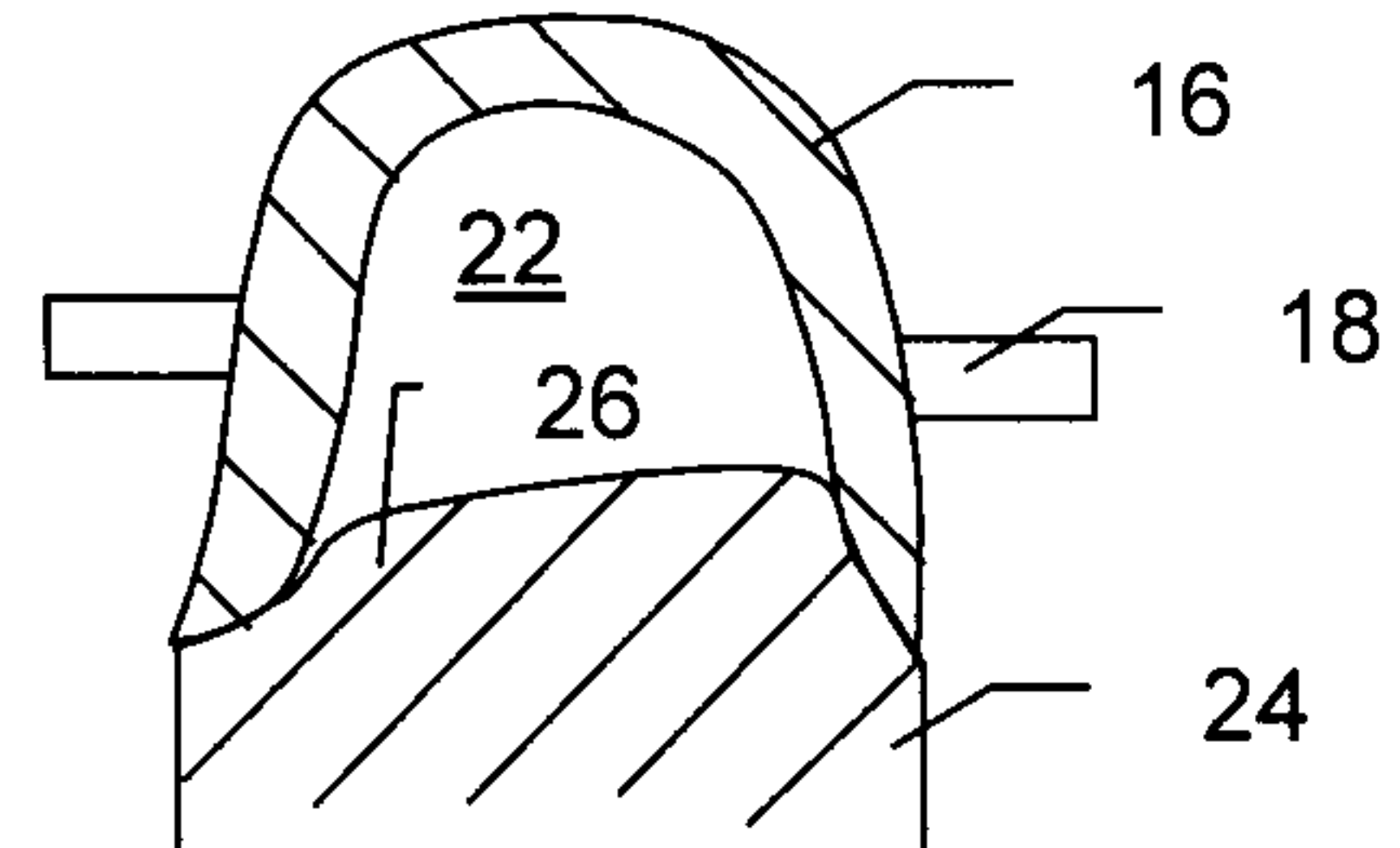


Fig. 4b

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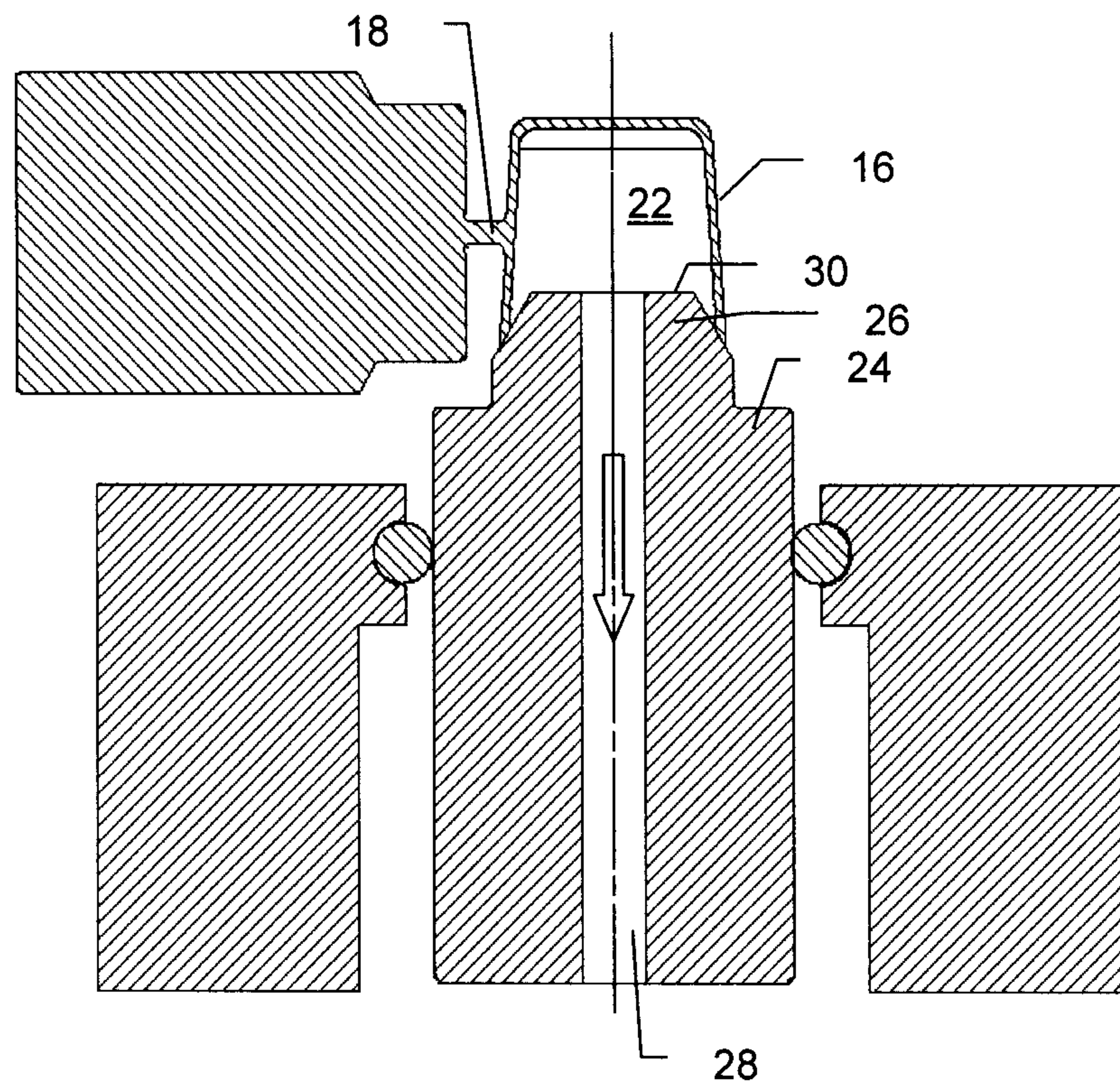
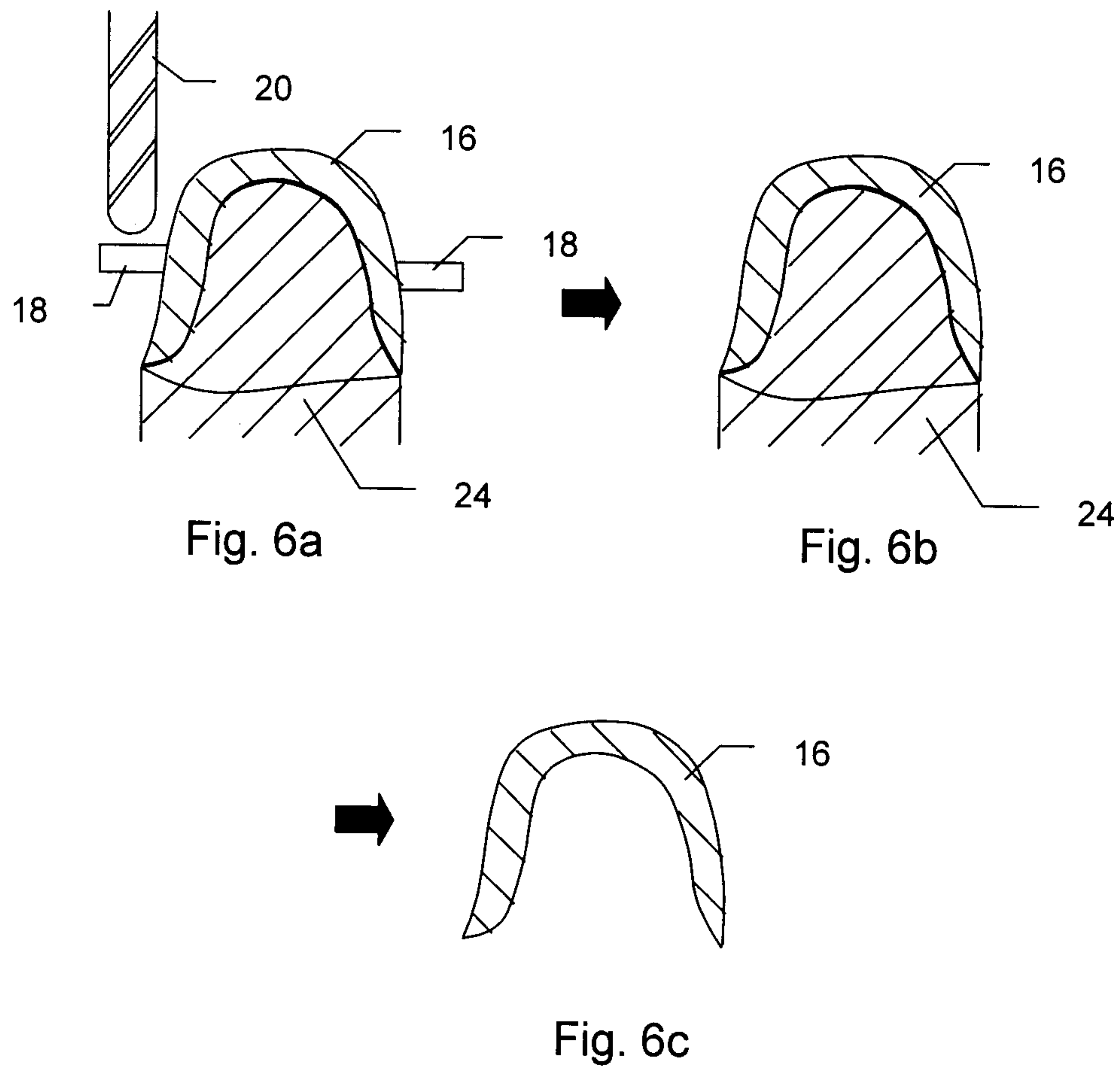


Fig. 5

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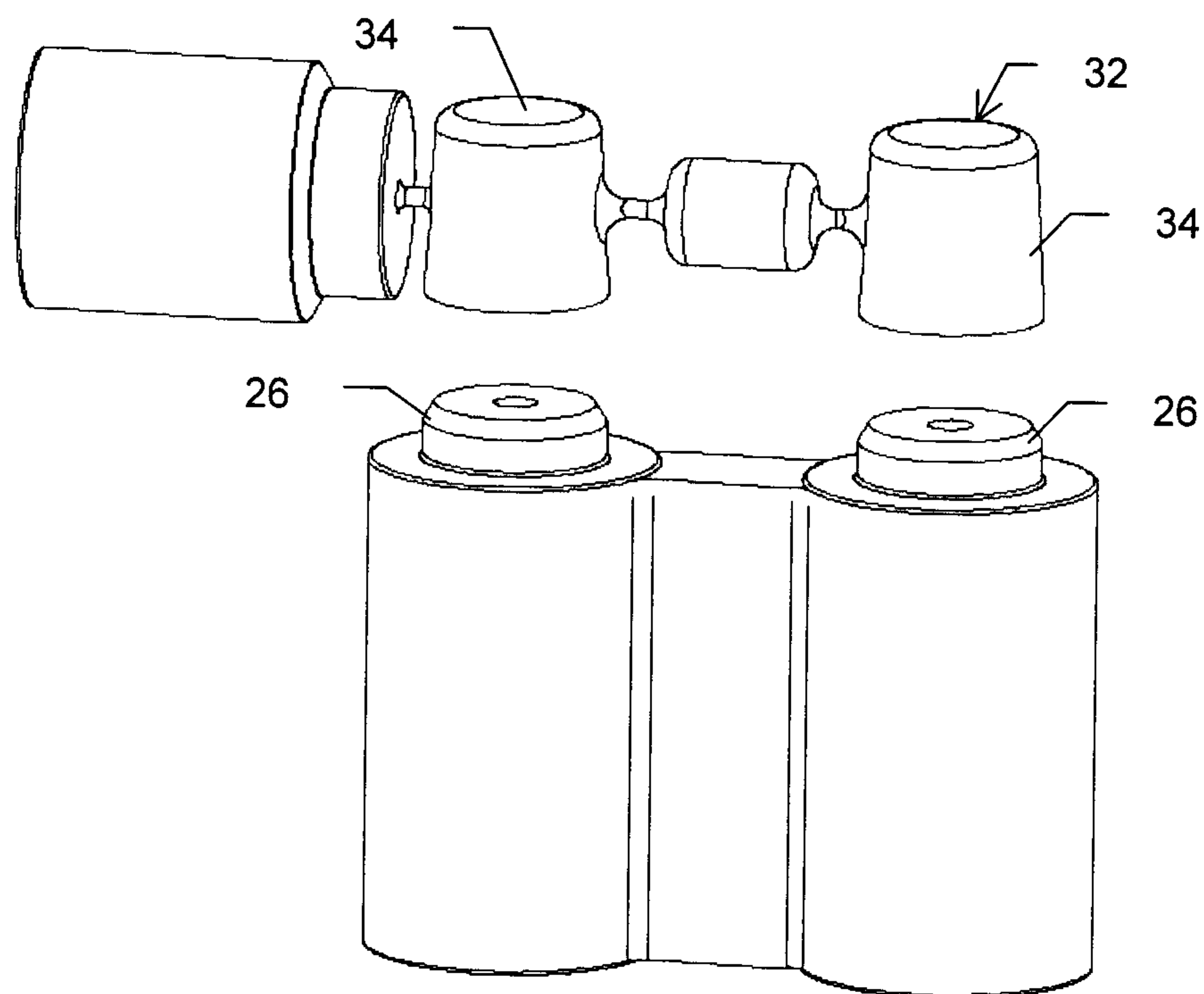


Fig. 7

