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(54) Title: PROTECTIVE MEMBER, PROTECTIVE MEMBER KIT, AND PROTECTION METHOD

(57) Abstract: To provide a protective member that can be easily secured to a target object. A protective member that serves as a protective member for dental treatment includes a band-shaped member that curves to one side in a thickness direction after a pulling force is applied in an extending direction and then released, and securing portions that secure the band-shaped member to a target object.

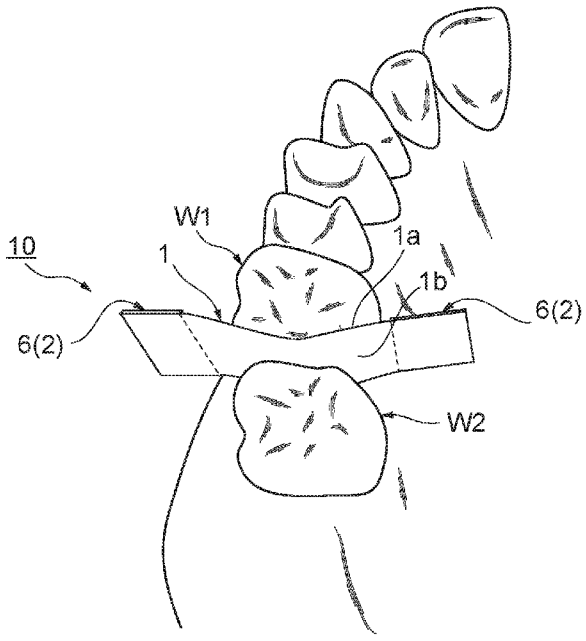


FIG. 2

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PROTECTIVE MEMBER, PROTECTIVE MEMBER KIT, AND PROTECTION METHOD

Technical Field

The present invention relates to a protective member that protects a target object, a protective member kit, and a protection method.

Background

Known protective members that protect a target object include the protective member set forth in Patent Document 1. This protective member is inserted between a pair of target objects that are opposite each other, and is disposed so as to cover the target object that is to be filled with a filler. As a result, the filler is prevented from flowing to the target object that is not to be filled with the filler.

Summary

When such a protective member as described above is set with respect to a target object, the protective member needs to be secured in a predetermined position. Further, the ease in securing the protective member to such a target object is imperative.

A protective member according to one aspect of the present invention is a protective member for dental treatment. The protective member includes a band-shaped member that curves to one side in a thickness direction after a pulling force is applied in an extending direction and then released, and securing portions that secure the band-shaped member to a target object.

According to such an aspect, the band-shaped member is set with respect to the target object, the pulling force is applied to the band-shaped member in an extending direction at that location, and then the pulling force is released. In this case, the band-shaped member curves to one side in the thickness direction, making it possible to surround the target object with the band-shaped member by a simple operation. Further, with the target object thus surrounded by the band-shaped member, the band-shaped member can be simply secured to the target object by the securing portions. This makes it possible to easily secure the protective member to the target object.

According to the present invention, it is possible to simply secure a protective member to a target object.

Brief Description of Drawings

FIGS. 1A and 1B are views illustrating an outer appearance of a protective member according to an embodiment.

FIG. 2 is a view illustrating use of the protective member.

FIGS. 3A to 3D are conceptual views for explaining the reason why a band-shaped member curves.

FIGS. 4A and 4B are schematic views illustrating a step in a protection method based on the protection member.

FIGS. 5A and 5B are schematic views illustrating a step in the protection method based on the protective member.

FIGS. 6A and 6B are views illustrating a protective member kit.

FIGS. 7A to 7C are views illustrating the protective member according to a modified example.

FIGS. 8A and 8B are views illustrating the protective member according to a modified example.

FIG. 9 is a view illustrating the protective member according to a modified example.

FIGS. 10A and 10B are views illustrating the protective member according to a modified example.

FIGS. 11A and 11B are views illustrating the protective member according to a modified example.

Detailed Description

Embodiments of the present invention will now be described in detail with reference to the attached drawings. Note that in the descriptions of the drawings, similar or identical components are assigned identical reference numerals and duplicate descriptions thereof are omitted.

First, a configuration of a protective member according to the present embodiment will be described with reference to FIGS. 1A to 5B. A protective member 10 according to the present embodiment is a member for protecting predetermined target objects. As illustrated in FIG. 2, teeth W are provided as examples of target objects to be protected. In this case, the protective member 10 is used as a protective member for dental treatment. When a tooth W1 to be treated and a tooth W2 (not to be treated) adjacent to the tooth W1 exist, a recess portion is formed by a treatment tool in an affected portion of the tooth W1 to be

treated, and filler is filled in the recess portion (refer to FIG. 5B). At this time, the protective member 10 is used to cover and secure the tooth W1 to be treated so that the filler does not adhere to the adjacent tooth W2 or a peripheral portion.

The recess portion of the prepared teeth may be located in an interproximal region between two adjacent teeth. If the filler is adhered on the surface of teeth W2 or on its peripheral, it will become very difficult for a dentist to remove excess filler material. So the effect protecting teeth from adhering the excess filler is very important as the protective member.

Such a protective member 10, as illustrated in FIGS. 1A to 2, includes a band-shaped member 1 and securing portions 2. Note that, in the descriptions that follow, a direction in which the band-shaped member 1 extends is referred to as an "extending direction," a direction orthogonal to the extending direction in a planar direction of the band-shaped member 1 is referred to as a "width direction," and a direction orthogonal to the extending direction and the width direction is referred to as a "thickness direction".

The band-shaped member 1 is a member made of a film that is long in the extending direction. In the present embodiment, the band-shaped member 1 has a rectangular shape that extends in the extending direction. However, the band-shaped member 1 may have any shape as long as the band-shaped member 1 extends in the extending direction. The band-shaped member 1 is disposed so as to be inserted between the tooth W1, which is the target object, and the tooth W2, and therefore needs to be thin to a certain degree. For example, the band-shaped member 1 may have a thickness of 100 μm or less, or 50 μm or less. Further, the band-shaped member 1 needs to be thick to a certain degree to maintain a posture. For example, the band-shaped member 1 may have a thickness of 10 μm or greater, or 30 μm or greater.

The band-shaped member 1 is a member that has followability, allowing deformation following the portion of an outer shape of the tooth W1. Specifically, when a pulling force is applied on the band-shaped member 1 in the extending direction (the state illustrated in FIG. 4B), the band-shaped member 1 curves to one side in the thickness direction (the state illustrated in FIG. 5A) after the pulling force is released. Here, the band-shaped member 1 curves to the side of one surface 1a of two surfaces 1a, 1b in the thickness direction. To exhibit such followability, the band-shaped member 1 includes a plurality of layers made from mutually different materials, as illustrated in FIG. 3A. While the number of layers is not limited, the band-shaped member 1 in the example illustrated in FIG. 3A

includes two layers: a first layer 3 and a second layer 4. The first layer 3 and the second layer 4 are made from materials having different amounts of permanent strain that remains after the pulling force has been applied. Here, the amount of permanent strain that remains in the first layer 3 is greater compared to that in the second layer 4.

For example, as illustrated in FIG. 3B, a pulling force is applied to the first layer 3 and the second layer 4 of the same length, extending the first layer 3 and the second layer 4 by an identical length. Subsequently, in the state after the pulling force has been released, a great amount of permanent strain remains in the first layer 3, resulting in a small amount of contraction to the original length, as illustrated in FIG. 3C. On the other hand, a small amount of permanent strain remains in the second layer 4, resulting in a great amount of contraction to the original length. When such a first layer 3 and a second layer 4 are joined to form the band-shaped member 1, the second layer 4 having a great amount of contraction pulls the first layer having a small amount of contraction inward, thereby causing the entire band-shaped member 1 to deform so as to curve to the second layer 4 side, as illustrated in FIG. 3D. Note that the method of connecting the first layer 3 and the second layer 4 is not particularly limited, allowing use of an adhesive material or heat fusion. Or, each layer may be connected by having one layer disposed in a mold and molding the other layer.

The material of the band-shaped member 1 is preferably a combination of materials having difference in permanent strain as described above. Further, when a photocurable material is used as the filler to be filled in the recess portion of the tooth W1, the band-shaped member 1 may have a transparency capable of transmitting light. (For example, the wave length of the light may be the between 400nm – 520 nm, more especially, under 460nm). Accordingly, examples of the material that constitutes either the first layer 3 or the second layer 4 of the band-shaped member 1 include polyurethane, polyethylene, ethylene-vinyl acetate (EVA), paraffin, and polyurethane. Examples of combinations of materials of the band-shaped member 1 include combinations such as “polyurethane and polyethylene,” “EVA and polyethylene,” and “paraffin and polyurethane.” Note that differences in permanent strain of the band-shaped members 1 are adjusted by the characteristics of the materials themselves as well as elements such as thickness. As a result, with respect to material combination described above, which material is used for the first layer 3 and which material is used for the second layer 4 are not particularly limited.

Note that both the first layer 3 and the second layer 4 do not need to be a resin film. One layer may be a resin film and the other layer may be a coating applied on the resin film. Examples of such a coating include urethane, acrylic, and the like. Or, one layer may be a metal or a metal oxide. Examples of such a metal or a metal oxide layer include aluminum, titanium oxide, silica, and the like. However, when a metal is used, attention should be paid to the decrease in optical transparency compared to a resin.

The securing portions 2 are for securing the band-shaped member 1 to the target object. As securing methods, some methods may be applicable, for example, the method using a special securing member (shown in Fig. 10), the method directly adhering to teeth, and the method to securing the band-shaped member (shown in Fig. 11(B). The securing portions 2 may be configured as any structure as long as the structure is capable of securing the band-shaped member 1 to the target object. In the present embodiment, the securing portions 2 are made of an adhesive material 6 (other configurations are described later). The adhesive material 6 is provided to the one surface 1a on the curving side of the band-shaped member 1. Further, the adhesive material 6 is disposed on both end portions in the extending direction of the band-shaped member 1. The pair of adhesive materials 6 is provided to the one surface 1a of the band-shaped member 1, each as rectangular sheets. The surface of the adhesive material 6 is covered by a peelable sheet when not in use, and the adhesive surface is exposed by peeling the peelable sheet at the time of use. As a result, the pair of adhesive materials 6 can be adhered to the tooth W1, securing the band-shaped member 1 to the tooth W1.

The following describes the configuration of the protective member 10 at the time of distribution. At the time of distribution, the protective member 10 may be distributed with the adhesive materials 6 of the securing portions 2 provided to both ends of the band-shaped member 1. Further, as illustrated in FIGS. 6A and 6B, the protective member 10 may be distributed in a protective member kit 100. The protective member kit 100 includes the band-shaped member 1 that curves to one side in the thickness direction after a pulling force is applied in the extending direction and then released, and the securing portions 2 that are attachable to the band-shaped member 1 and secure the band-shaped member 1 to the target object. At the time of use, such a kit 100 is used by assembling the protective member 10 by attaching the securing portions 2 to the band-shaped member 1.

Next, a protection method that uses the protective member 10 according to the present embodiment will be described using FIGS. 4A to 5B. First, a recess

portion H is formed by grinding an affected portion of the tooth W using a treatment tool. Next, a first step of covering the tooth W1 with the band-shaped member 1 is executed. In the first step, the band-shaped member 1 is disposed so as to face the tooth W1, and a pulling force is applied to the band-shaped member 1 in the extending direction of the band-shaped member 1 and then released, thereby causing the band-shaped member 1 to curve to one side in the thickness direction and cover the tooth W1.

In this first step, the protective member 10 is disposed with respect to the tooth W1 so that the recess portion H of the tooth W1 and the one surface 1a of the protective member 10 face each other, as illustrated in FIG. 4A. Then, as illustrated in FIG. 4B, both ends of the band-shaped member 1 are pulled by hand, applying a pulling force to the band-shaped member 1. After the band-shaped member 1 has been extended by a predetermined amount, the pulling force applied to the band-shaped member 1 is released. As a result, as illustrated in FIG. 5A, the band-shaped member 1 curves to the one surface 1a side, thereby deforming so as to follow the outer shape of the tooth W1. The tooth W1 is thus covered by the band-shaped member 1. Besides, the band-shaped member may be extended at first, and after that, the band-shaped member may be adhered to the tooth W1 and the pulling force may be released.

Next, a second step of securing the band-shaped member 1 to the tooth W1 is executed. In the second step, as illustrated in FIG. 5B, the adhesive materials 6 provided to both end portions of the band-shaped member 1 as the securing portions 2 are adhered to the tooth W1. Next, a third step of filling the recess portion H of the tooth W1 covered by the band-shaped member 1 with a filler F is executed. Examples of materials used as the filler F include a restorative material for dental treatment, and more specifically a filler that contains a component such as acrylic acid or silica. The filler materials F with low viscosity may be particularly preferred since the material F may adapt to the inner surface of the recess portion H of tooth W1. Especially the filler F may be preferred as polymerizable (meth)acrylate resin and a filler (e.g., an inorganic filler such as silica), along with other ingredients such as initiators, pigments, and so forth. By using these material, the filler material may be prevented from adhering to the other teeth. In the third step, a filling tool 50 is positioned toward the recess portion H, and the filler F is discharged from the filling tool 50, thereby filling the recess portion H with the filler F. The protective member 10 at this time is covering the recess portion H of the tooth W1, thereby preventing the filler F from adhering to

the other tooth. Once the recess portion H has been filled, light is irradiated on the filler F filled in the recess portion H from outside the protective member 10, thereby curing the filler F. After the curing is completed, the protective member 10 is removed from the tooth W1. With the above, the protection method according to the present embodiment is completed.

Next, the action and effect of the protective member 10 according to the present embodiment will be described.

Comparative examples include a protective member provided with the band-shaped member 1 that does not curve even when a pulling force is applied, and securing members configured as members separate from the band-shaped member 1. When this protective member is attached, an operator needs to bend the band-shaped member 1 by hand along the tooth W1 from a state in which the band-shaped member 1 is extending straight between the tooth W1 and the tooth W2. Further, the operator needs to secure the protective member to the tooth W1 using the securing members while pressing and maintaining the bent state by hand. The protective member according to the comparative example thus requires effort in attachment to the tooth W1.

In the protective member 10 according to the present embodiment, the band-shaped member 1 is set with respect to the tooth W1, the pulling force is applied to the band-shaped member 1 in the extending direction at that location, and then the pulling force is released. In this case, the band-shaped member 1 curves to one side in the thickness direction, making it possible to surround the tooth W1 with the band-shaped member 1 by a simple operation. Further, with the tooth W1 thus surrounded by the band-shaped member 1, the band-shaped member 1 can be simply secured to the target object by the securing portions 2. In the present embodiment, the band-shaped member 1 is deformed along the tooth W1 in advance and, with this deformed state maintained, the operator need only secure the protective member to the tooth W1 by the securing portions. This makes it possible to easily secure the protective member 10 to the tooth W1.

The band-shaped member 1 includes a plurality of layers made from mutually different materials. This configuration makes it possible to deform the band-shaped member 1 following the tooth W1 by applying a pulling force to the band-shaped member 1.

The securing portions 2 are each made of the adhesive material 6. This makes it possible to secure the protective member 10 to the tooth W1 by a simple operation of just pressing the adhesive materials 6 onto the tooth W1.

The protective member kit according to the present embodiment is a protective member kit for dental treatment, including the band-shaped member that curves to one side in the thickness direction after a pulling force is applied in the extending direction and then released, and securing portions that are attachable to the band-shaped member and secure the band-shaped member to the target object.

According to this protective member kit, it is possible to achieve a similar action and effect as those of the protective member 10 described above.

The protection method according to the present embodiment is a protection method of protecting a target object. The protection method includes the first step of covering the target object with a band-shaped member, and the second step of securing the band-shaped member to the target object. In the first step, the band-shaped member 1 is disposed so as to face the target object, and a pulling force is applied to the band-shaped member 1 in the extending direction of the band-shaped member 1 and then released, thereby causing the band-shaped member 1 to curve to one side in the thickness direction and cover the target object.

According to this protection method, it is possible to achieve a similar action and effect as those of the protective member 10 described above.

The protection method further includes the third step of filling the recess portion H of the tooth W1 covered by the band-shaped member 1 with the filler F.

The present invention is not limited to the embodiments described above.

For example, the configuration of the securing portion is not limited to the adhesive material 6 described above. For example, as illustrated in FIGS. 7A to 8B, the securing portions 2 may include a loop member 16 provided on one end side of the band-shaped member 1, and a hook member 17, provided on the other end side of the band-shaped member 1, that engages with the loop member 16. As illustrated in FIGS. 7A to 7C, the loop member 16 is provided to the one surface 1a on one end side of the band-shaped member 1, and the hook member 17 is provided to the other surface 1b on the other end side of the band-shaped member 1. The loop member 16, as illustrated in FIG. 7C, includes a plurality of loops 31, a base 32 that supports the loops 31, and an adhesive portion 33 that secures the base 32 to the band-shaped member 1. The hook member 17, as illustrated in FIG. 7B, includes a plurality of hooks 21, a base 22 that supports the hooks 21, and an adhesive portion 23 that secures the base 22 to the band-shaped member 1. With such a protective member 10, after the tooth W1 is covered by the band-shaped member 1, the hook member 17 and the loop member 16 are joined, thereby engaging the hooks 21 with the loops 31. A tightened state of the band-shaped

member 1 around the tooth W1 is thus maintained, securing the protective member 10 to the tooth W1.

Note that a shape such as illustrated in FIGS. 8A and 8B may be adopted when the hook member 17 and the loop member 16 are used. Specifically, a narrow width portion 41 that is smaller in size in the width direction is formed on the hook member 17 and one end portion of the band-shaped member 1, and a slit portion 42 for passing the narrow width portion 41 therethrough is formed on the loop member 16 and the other end portion of the band-shaped member 1. As a result, when the band-shaped member 1 is tightened around the tooth W1, the narrow width portion 41 is inserted into the slit portion 42 and the loop member 16 is engaged with the hook member 17, thereby securing the protective member 10 to the tooth W1.

Further, the securing portions 2 may each be made of an adhesive layer formed on the band-shaped member 1 itself, for example. For example, an adhesive layer having an adhesive surface with extremely small beads provided on the surface is formed on the surface 1a of the band-shaped member 1. In this case, after the tooth W1 is covered by the band-shaped member 1, the band-shaped member 1 is pressed against the tooth W1, causing the adhesive surface separated from the surface of the tooth W1 by the beads to come into contact with and be secured to the surface of the tooth W1.

In addition, a configuration such as illustrated in FIG. 9 may be adopted as the securing portion. According to a protective member 60 illustrated in FIG. 9, an adhesive material 62 is disposed substantially entirely across one of the surfaces in the thickness direction of a band-shaped member 61. Further, a portion in a center in the extending direction of the adhesive material 62 is covered by an adhesive strength suppressing member 63. The adhesive strength suppressing member 63 is not a sheet, such as a peelable material, separable from the adhesive material 62, but rather a sheet secured to the adhesive material 62. According to such a configuration, securing portions 64 are made of sections of the adhesive material 62 exposed from the adhesive strength suppressing member 63. Here, because the adhesive material 62 is exposed at both end portions in the extending direction, the securing portions 64 are formed on both end portions in the extending direction of the band-shaped member 61. Note that when the adhesive material 62 affects the permanent strain of the band-shaped member 61, the adhesive material 62 may also be regarded as one layer that constitutes the band-shaped member 61. However, when the adhesive material 62 is too thin or the like to affect the

permanent strain, the adhesive material 62 need not be regarded as one layer of the band-shaped member 61. Similarly, the adhesive strength suppressing member 63 may also be regarded as one layer of the band-shaped member 61 when the adhesive strength suppressing member 63 affects the permanent strain, and need not be regarded as one layer of the band-shaped member 61 when the adhesive strength suppressing member 63 does not affect the permanent strain.

Further, a configuration such as illustrated in FIGS. 10A and 10B may be adopted as the securing portion. According to a protective member 70 illustrated in FIGS. 10A and 10B, the securing portions are made of a pair of securing members 73 formed on both end portions in the extending direction of a band-shaped member 71, and a pair of securing members 74 formed on a supporting member 72 separate from the band-shaped member 71. Note that each of the securing members 73 on the band-shaped member 71 side is one of a hook member and a loop member, and each of the securing members 74 on the supporting member 72 side is the other of the hook member and the loop member. Further, the supporting member 72 is made from a rubber, a resin, or the like. When the tooth W1 is covered by the protective member 70 thus configured, the supporting member 72 is set on the tooth W1 as illustrated in FIG. 10B. Then, the tooth W1 is covered by the band-shaped member 71, and the securing members 73 of the band-shaped member 71 are secured to the securing members 74 of the supporting member 72. As a result, the band-shaped member 71 is secured to the tooth W1.

As shown in Fig 11(A) , the band-shaped member may surround the multiple teeth (here, the tooth W1 and tooth W2) and the adhesive material 6 may be secured to tooth W2. As shown in Fig. 11 (B) , the adhesive material 6 may be secured to band-shaped material surrounding tooth W1.

Further, while a tooth exemplifies the target object and the protective member 10 is used as a protective member for dental treatment according to the embodiments described above, the target object is not particularly limited. For example, the present invention may be used to repair an external resin part of an automobile, such as a bumper or a mirror, serving as the target object.

Aspect 1

A protective member that serves as a protective member for dental treatment, the protective member including a band-shaped member that curves to one side in a thickness direction after a pulling force is applied in an extending

direction and then released, and securing portions that secure the band-shaped member to a target object.

Aspect 2

The protective member according to aspect 1, wherein the band-shaped member includes a plurality of layers made from mutually different materials.

Aspect 3

The protective member according to aspect 1 or 2, wherein the securing portions are made from an adhesive material.

Aspect 4

The protective member according to aspect 1 or 2, wherein the securing portion includes a loop member provided on one end side of the band-shaped member, and a hook member, provided on the other end side of the band-shaped member, that engages with the loop member.

Aspect 5

The protective member according to aspect 3, wherein the adhesive material is disposed substantially entirely across one of the surfaces in the thickness direction of the band-shaped member;

a portion of the adhesive material is covered by an adhesive strength suppressing member; and

the securing portions are made of sections of the adhesive material exposed from the adhesive strength suppressing member.

Aspect 6

A protective member kit that serves as a protective member kit for dental treatment, the protective member kit including:

a band-shaped member that curves to one side in a thickness direction after a pulling force is applied in the extending direction and then released, and securing portions that are attachable to the band-shaped member and secure the band-shaped member to a target object.

Aspect 7

A protection method for protecting a target object, the protection method including:

a first step of covering the target object with a band-shaped member, and a second step of securing the band-shaped member to the target object,

the first step including:

disposing the band-shaped member so as to face the target object, applying a pulling force to the band-shaped member in an extending direction of the band-shaped member, and then releasing the pulling force, thereby causing the band-shaped member to curve to one side in a thickness direction and cover the target object.

Aspect 8

The protection method according to aspect 7, further including a third step of filling a recess portion of the target object covered by the band-shaped member with a filler.

Aspect 9

The protective member according to aspect 2, wherein the band-shaped member includes a polyurethane layer and a polyethylene layer.

Aspect 10

The protective member according to aspect 2, wherein the band-shaped member includes an ethylene-vinyl acetate (EVA) layer and a polyethylene layer.

Aspect 11

The protective member according to aspect 2, wherein the band-shaped member includes a paraffin layer and a polyurethane layer.

Aspect 12

The protective member according to aspect 2, wherein a layer of the band-shaped member is a coating applied on another layer.

Aspect 13

The protective member according to aspect 4, wherein the loop member is formed on one surface of the band-shaped member, and the hook member is formed on the other surface of the band-shaped member.

Aspect 14

The protective member according to aspect 1, wherein the securing portion is made of an adhesive surface formed on one surface of the band-shaped member, and

beads are disposed on a surface of the adhesive surface.

Aspect 15

The protective member according to aspect 1, wherein the band-shaped member has a transparency capable of transmitting light.

What is claimed is:

1. A protective member that serves as a protective member for dental treatment,

the protective member comprising:

a band-shaped member that curves to one side in a thickness direction after a pulling force is applied in an extending direction and then released; and

securing portions that secure the band-shaped member to a target object.

2. The protective member according to claim 1, wherein the band-shaped member comprises a plurality of layers made from mutually different materials.

3. The protective member according to claim 1 or 2, wherein the securing portions are made from an adhesive material.

4. The protective member according to claim 1 or 2, wherein the securing portion comprises

a loop member provided on one end side of the band-shaped member, and

a hook member, provided on the other end side of the band-shaped member, that engages with the loop member.

5. The protective member according to claim 3, wherein the adhesive material is disposed substantially entirely across one of the surfaces in the thickness direction of the band-shaped member;

a portion of the adhesive material is covered by an adhesive strength suppressing member; and

the securing portions are made of sections of the adhesive material exposed from the adhesive strength suppressing member.

6. A protective member kit that serves as a protective member kit for dental treatment, the protective member kit comprising:

a band-shaped member that curves to one side in a thickness direction after a pulling force is applied in an extending direction and then released; and

securing portions that are attachable to the band-shaped member and secure the band-shaped member to a target object.

7. A protection method for protecting a target object, the protection method comprising:

a first step of covering the target object with a band-shaped member; and

a second step of securing the band-shaped member to the target object,

the first step including:

disposing the band-shaped member so as to face the target object,

applying a pulling force to the band-shaped member in an extending direction of the band-shaped member, and then releasing the pulling force, thereby causing the band-shaped member to curve to one side in a thickness direction and cover the target object.

8. The protection method according to claim 7, further comprising a third step of filling a recess portion of the target object covered by the band-shaped member with a filler.

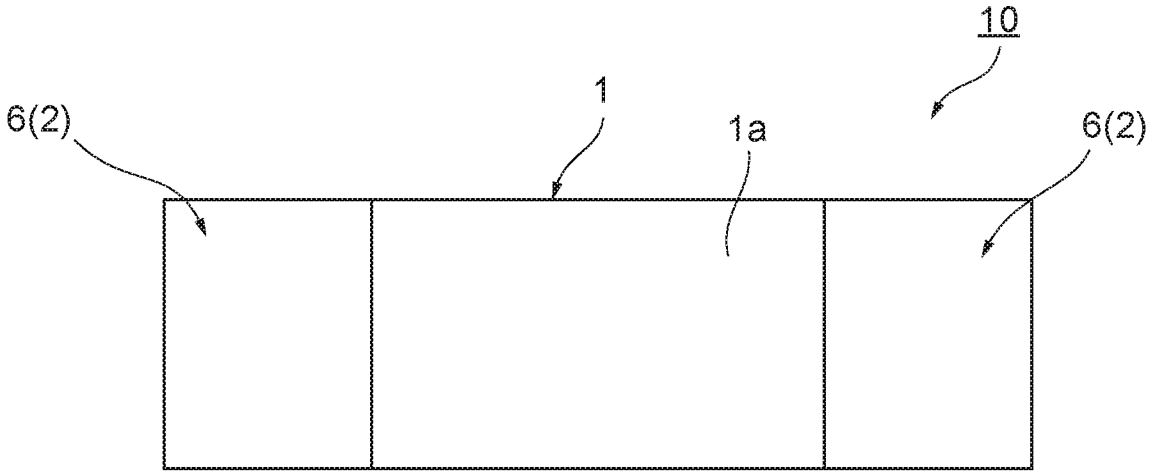


FIG. 1A

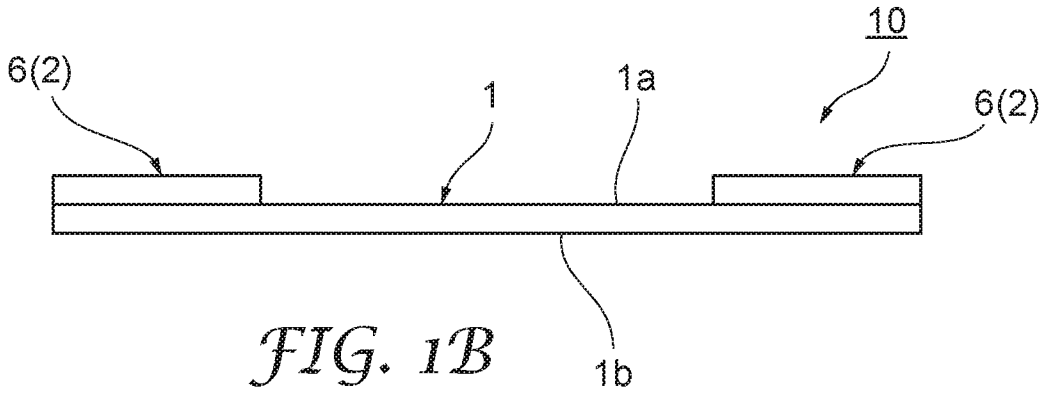


FIG. 1B

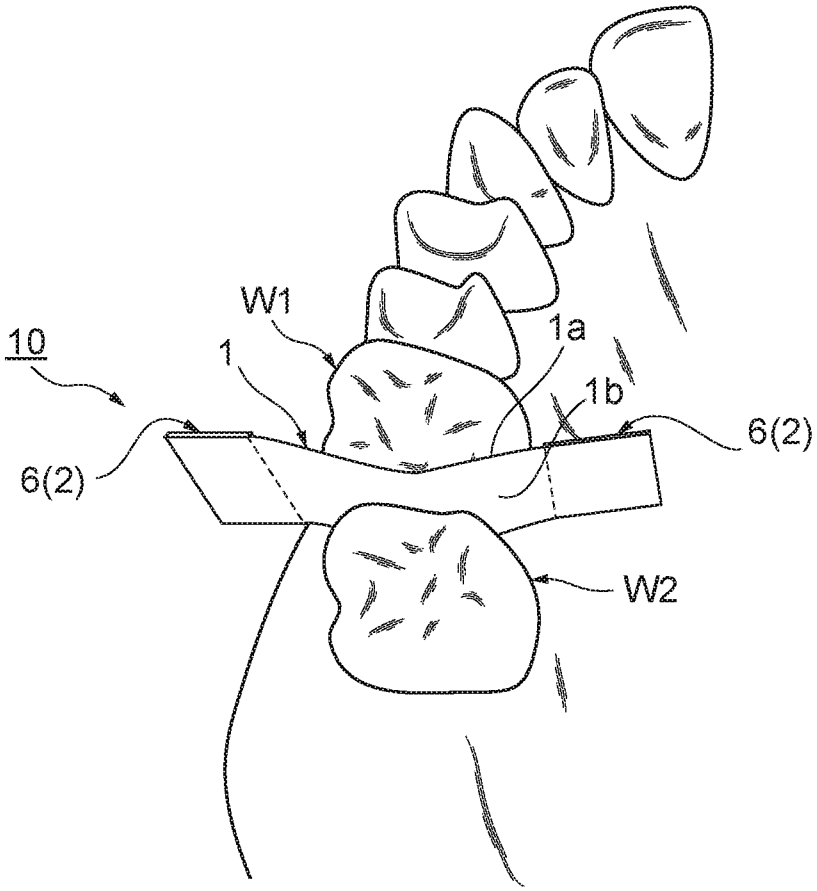


FIG. 2

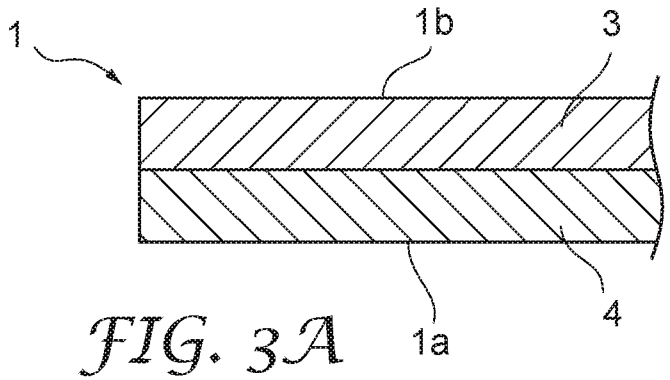


FIG. 3A

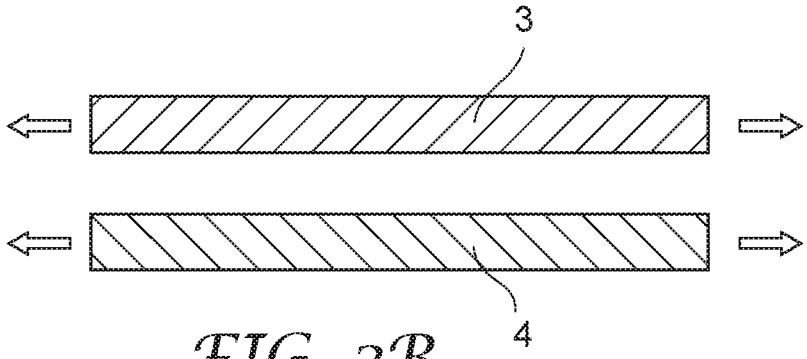


FIG. 3B

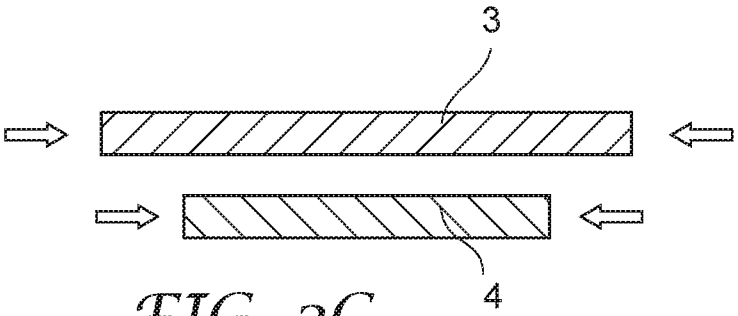


FIG. 3C

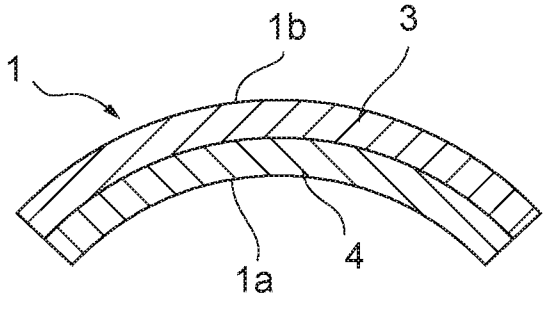


FIG. 3D

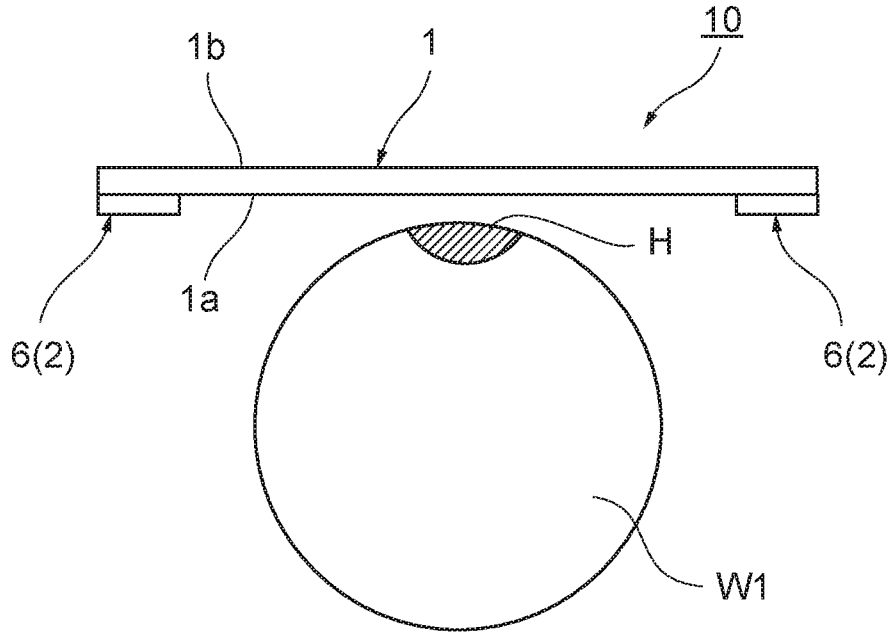


FIG. 4A

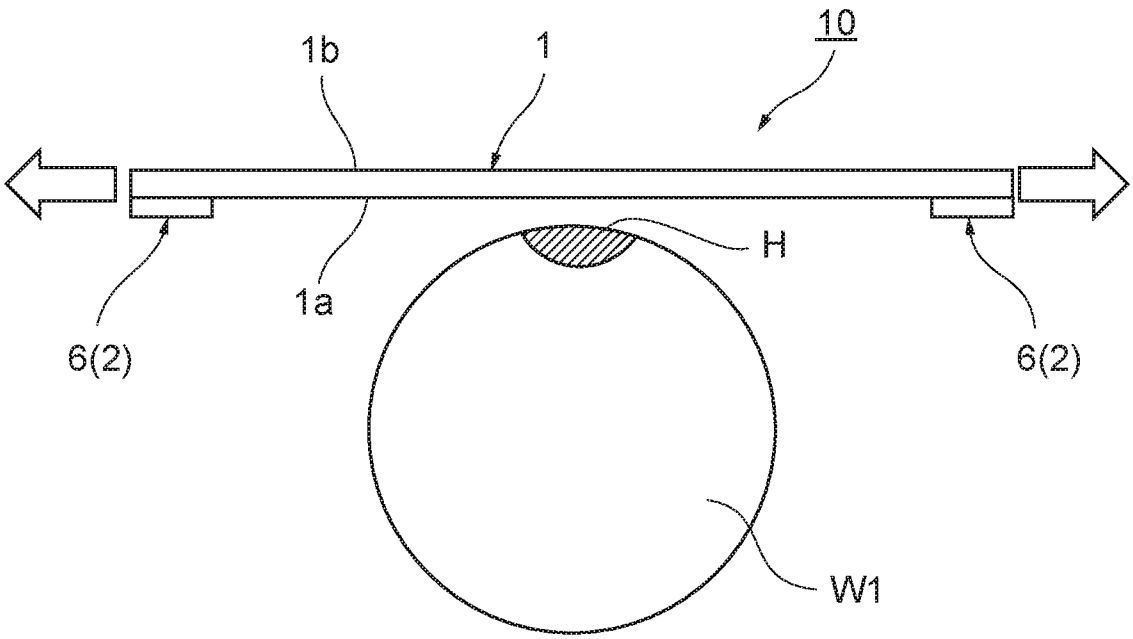


FIG. 4B

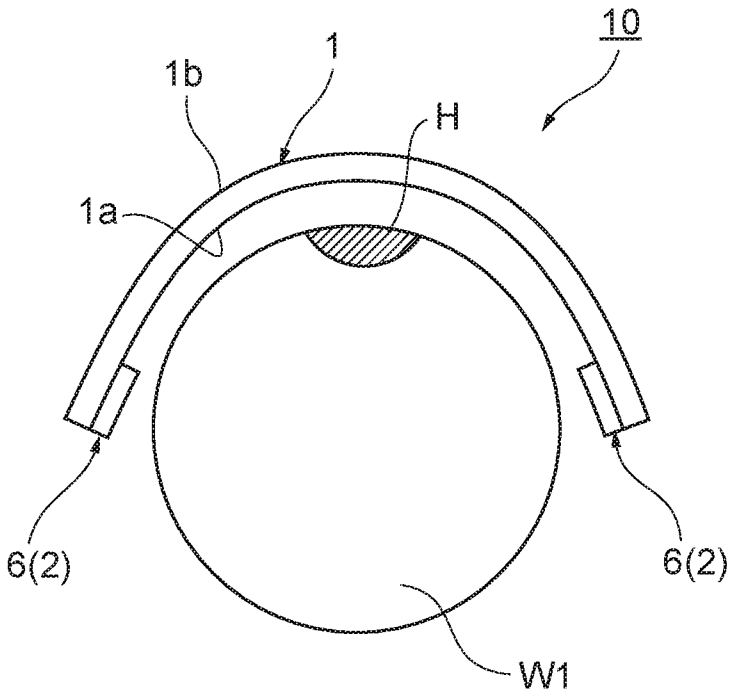


FIG. 5A

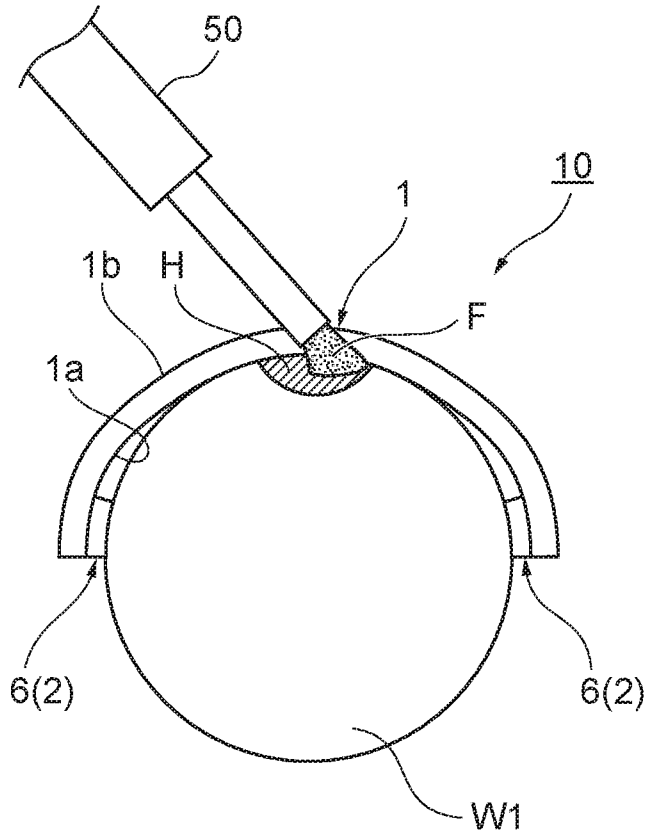


FIG. 5B

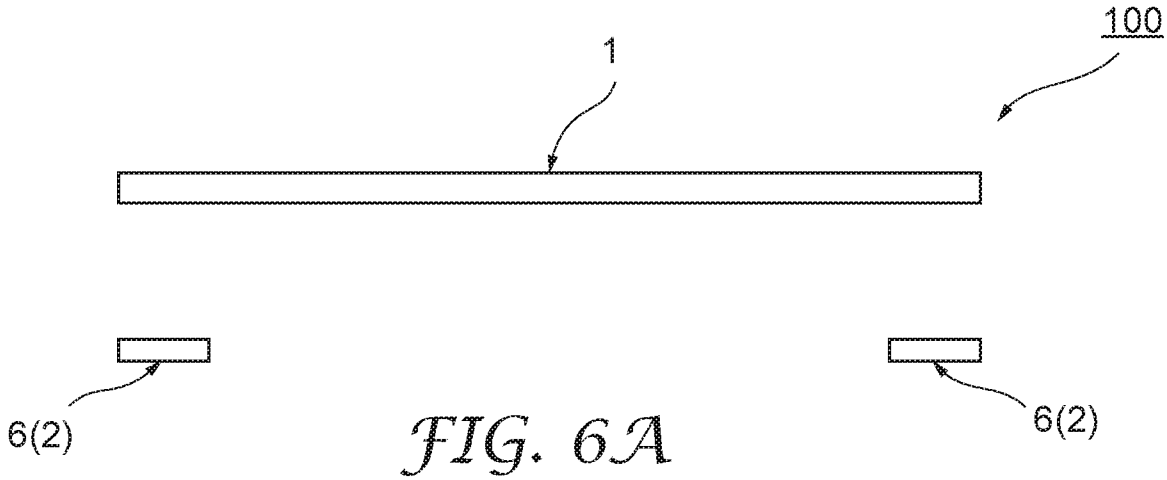


FIG. 6A

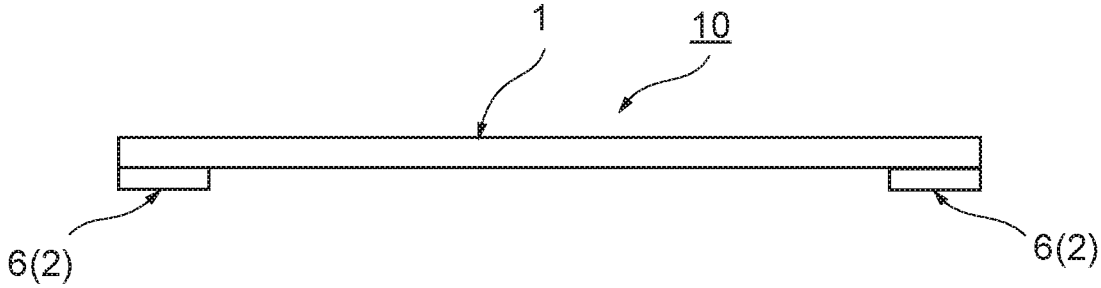


FIG. 6B

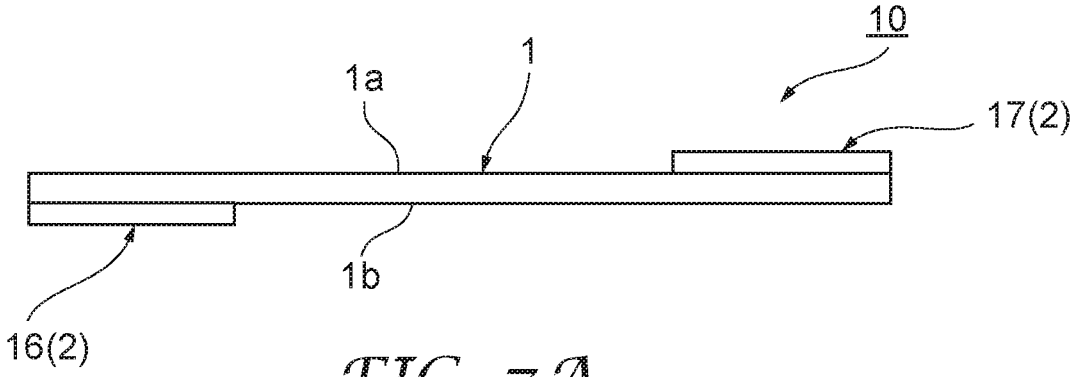


FIG. 7A

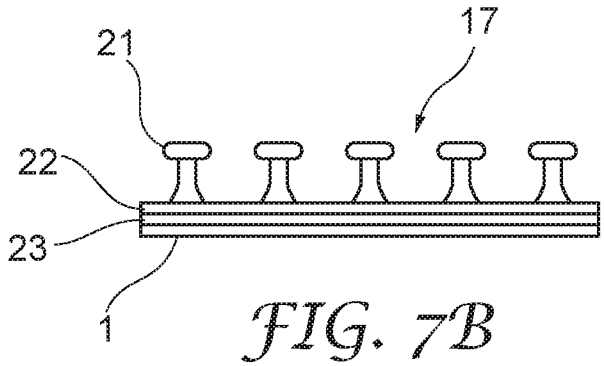


FIG. 7B

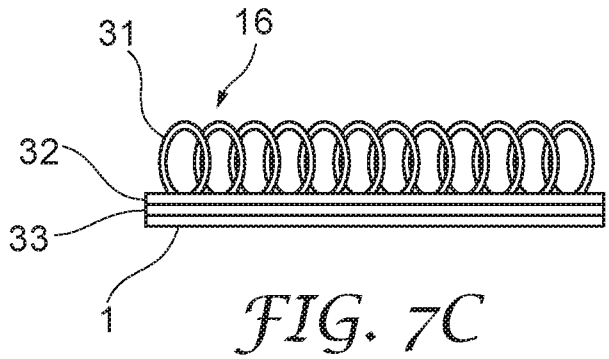


FIG. 7C

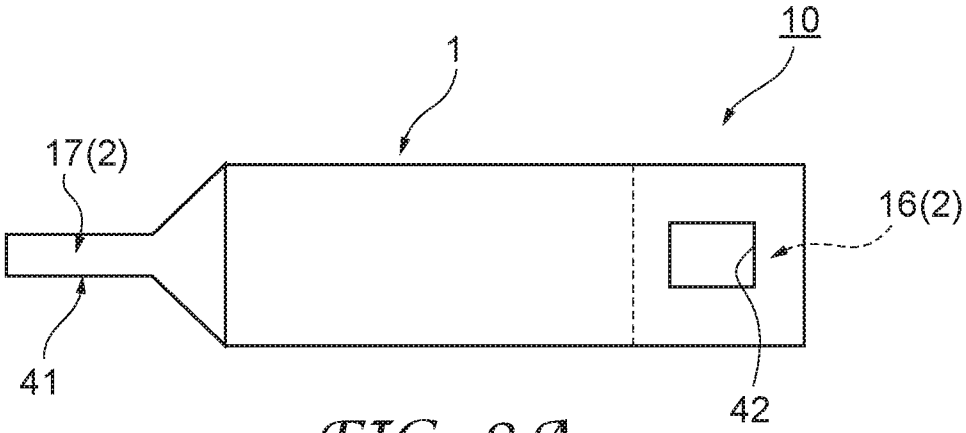


FIG. 8A

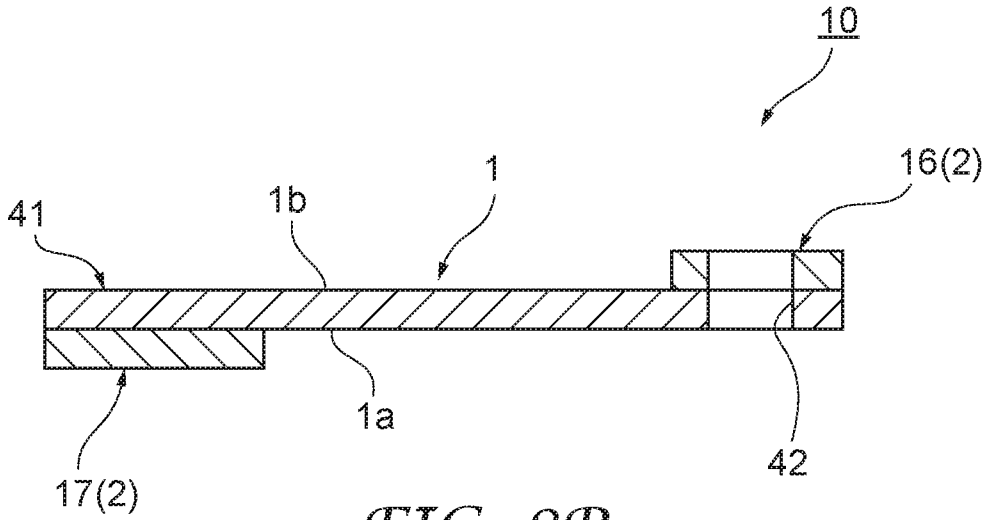


FIG. 8B

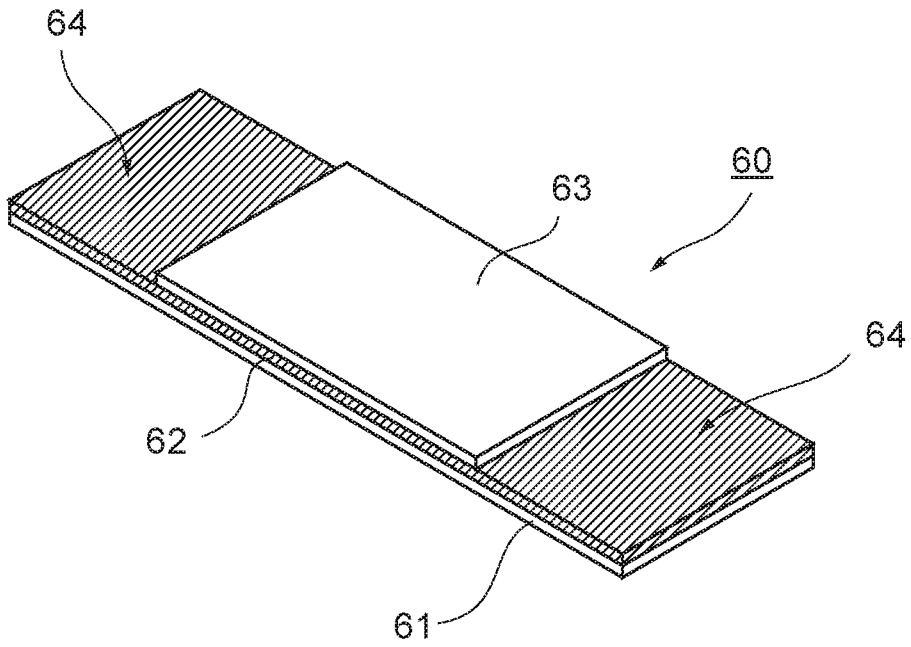


FIG. 9

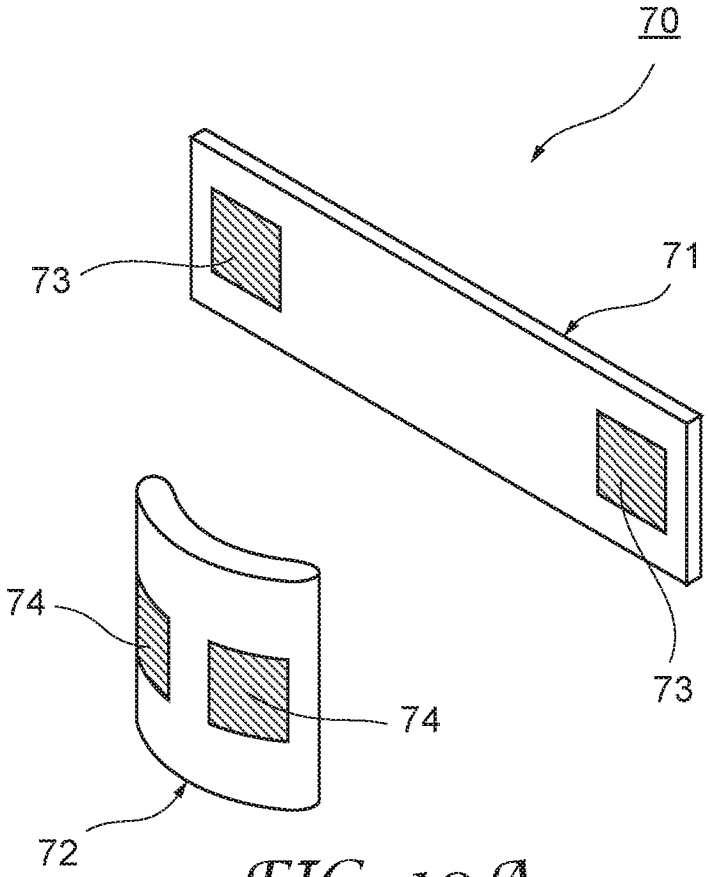


FIG. 10A

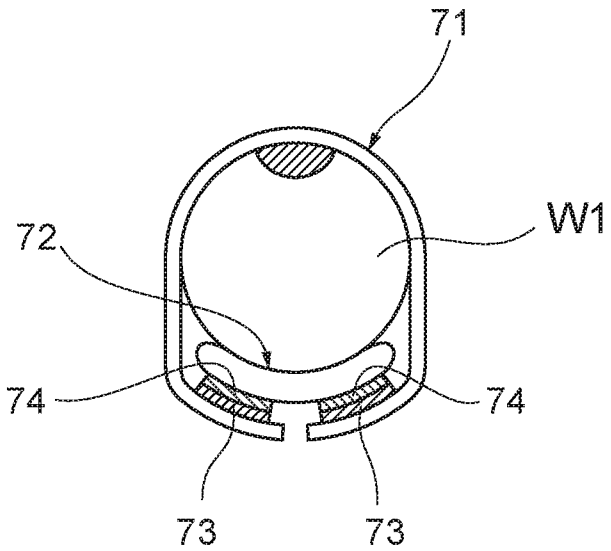


FIG. 10B

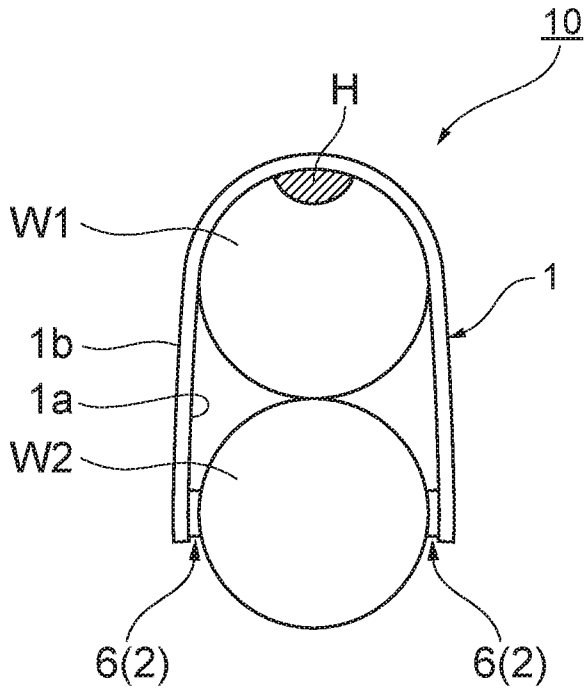


FIG. 11A

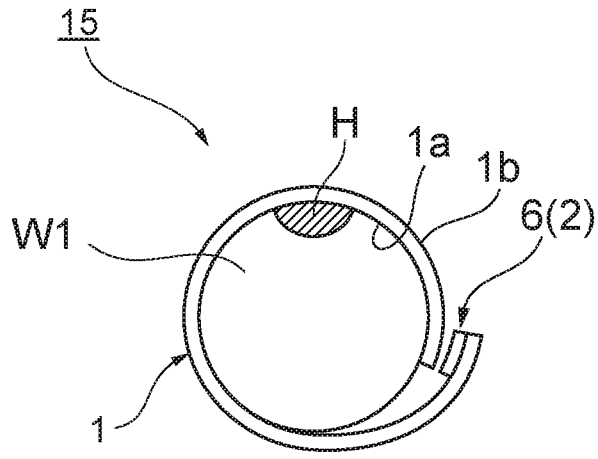


FIG. 11B

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2017/047777

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61C5/85 B32B7/02
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 B32B

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	US 3 082 531 A (JACOBSON ROBERT J) 26 March 1963 (1963-03-26) abstract; figures 1-4 column 1, lines 20-23,39-57	1,6,7
A	DE 10 2006 005276 A1 (HARLASS HARALD E) 9 August 2007 (2007-08-09) abstract; figures 1,5	1
A	US 2009/233070 A1 (MICHEL UWE) 17 September 2009 (2009-09-17) abstract; figures 1-2 paragraphs [0004], [0005]; claim 1	1
A	US 4 167 234 A (GORDON GERALD A) 11 September 1979 (1979-09-11) abstract; figures 1-4 column 1, lines 23-55	1

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

☒ See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 November 2017	13/11/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Tempels, Marco

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2017/047777

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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