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(54) **Ultrasonic transducer and skin care device with same**

Ultraschallwandler und Hautpflegegerät damit

Transducteur ultrasonique et dispositif de soin dermatologique en étant équipé

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(56) References cited:
EP-A- 0 283 823 WO-A1-2004/110558
GB-A- 684 165 JP-A- 2006 181 292
US-B1- 6 196 059

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Description

TECHNICAL FIELD

[0001] The invention relates generally to ultrasonic transducers and skin care devices with same, and more particularly to technology which restricts adhesive flash in the structure that an ultrasonic vibrator is stuck to a horn with adhesive.

BACKGROUND ART

[0002] Ultrasonic transducers have been conventionally used for skin care devices for transmitting ultrasonic vibration to skin (skin surface), or the like. This sort of ultrasonic transducer is formed of an ultrasonic vibrator and a horn. The ultrasonic vibrator is configured to convert electrical vibration into mechanical vibration to generate ultrasonic vibration. The ultrasonic vibrator is stuck to the horn. That is, the ultrasonic vibrator and horn are joined together with adhesive. A skin care device comprising this ultrasonic transducer is also provided with a control circuit and various operational switches. The control circuit is configured to supply the ultrasonic vibrator with electrical vibration. This device is arranged to obtain beauty effect by efficiently transmitting the ultrasonic vibration to skin through the horn when an ultrasonic wave emitting surface formed on the horn is in contact with the skin.

[0003] Incidentally, in the ultrasonic transducer, the adhesive intervened between the ultrasonic vibrator and horn becomes a cause of transmission loss of the ultrasonic vibration. Because of this, Japanese Patent Application Publication Number 2006-247251 issued September 21, 2006 discloses technology to attempt to adjust adhesive layer (i.e., sticking layer) to reduce the loss. However, the technology can be used to adjust the thickness of the sticking layer but cannot control the extrusion and outflow (expanding outflow) of adhesive.

[0004] When the adhesive is actually applied, it is necessary to evenly spread the adhesive while adding pressure on the ultrasonic vibrator in order to avoid occurrence of air layer and air holes between the ultrasonic vibrator and horn. But, in almost cases, excess adhesive is then extruded. In addition, since thermosetting adhesive is utilized as the adhesive in general, the adhesive may flow out owing to the expansion. Such the extrusion, outflow (expanding outflow) and so on are hereinafter referred to as "adhesive flash (adhesive overflow)". And if the excess adhesive around the ultrasonic vibrator is dried and hardened, the excess adhesive causes the transmission loss of ultrasonic vibration and also disturbs power supply. GB 684,165 discloses an ultrasonic transducer being cemented to the horn and essentially in line with the introductory portion of claim 1. Furthermore, document EP 0 283 823 A1 discloses an ultrasonic transducer with a small groove next to the transducer according to the preamble of claim 1. Finally, document WO

2004/110558 A1 describes an ultrasonic applying skin care device, wherein a cavity within the horn guiding the sound waves next to the transducer is disclosed.

5 DISCLOSURE OF THE INVENTION

[0005] It is an object of the present invention to restrict adhesive flash in the structure that an ultrasonic vibrator is stuck to a horn with adhesive and to efficiently transmit ultrasonic vibration.

[0006] This object is solved by an ultrasonic transducer according to claim 1, claims 2 and 3 are related to specific advantageous realizations of the ultrasonic transducer according to claim 1. Furthermore, the object is solved by a skin care device comprising such an ultrasonic transducer.

[0007] An ultrasonic transducer of the present invention comprises an ultrasonic vibrator and a horn. The ultrasonic vibrator is configured to convert electrical vibration into mechanical vibration to generate ultrasonic vibration. The horn has a join surface to which the ultrasonic vibrator is joined, and an ultrasonic wave emitting surface from which ultrasonic waves are emitted toward a target place. In the invention, adhesive is intervened between the join surface and the ultrasonic vibrator. According to an aspect of the invention, the horn further comprises a stopper for restricting adhesive flash caused by the adhesive.

[0008] Thus, the ultrasonic transducer is provided with the stopper, and thereby even if the adhesive is evenly spread while pressure is added on the ultrasonic vibrator, the adhesive is prevented from being extruded more than is acceptable owing to the pressure. In addition, even if the adhesive expands with heating, the adhesive is prevented from flowing out more than is acceptable. Therefore, the transmission loss of ultrasonic vibration caused by dried and hardened excess adhesive as well as power supply disturbance are restricted effectively. Consequently, ultrasonic vibration can be transmitted efficiently.

[0009] According to the invention, the stopper comprises a concave groove formed around the join surface along the outline of the ultrasonic vibrator. Thus, the concave groove is formed along the outline of the ultrasonic vibrator, and thereby the groove functions as a mark for adhesive region. As a result, a worker can easily keep fixed position relationship between the ultrasonic vibrator and horn. Even if the adhesive exceeds the concave groove, the adhesive exceeding the groove can be seen and accordingly the worker can easily wipe off and remove the exceeding adhesive. Since the stopper comprise a concave groove, the ultrasonic vibrator can be moved in all directions outside the groove while being pressed when it is stuck on the horn. Accordingly, the adhesive can be easily spread all over the join surface.

[0010] In an embodiment, the stopper is spaced a specified distance apart from the outline of the ultrasonic vibrator. In order to spread the adhesive evenly so that

occurrence of air layer and air holes between the ultrasonic vibrator and horn is avoided, slight adhesive flash around the ultrasonic vibrator needs to be visible. The specified distance is kept between both of them, and thereby adhesive flash more than is acceptable, namely the specified distance can be seen.

[0011] According to the invention, the horn exhibits conductivity, and either of a pair of electrical contacts for energizing the ultrasonic vibrator is electrically connected to a part of the horn outside the stopper. In this way, the adhesive is prevented from reaching the electrical contact connected to the horn to cause contact fault. For example, even in case that the horn is in the shape of a flat plate and is provided with the electrical contact, the contact can energize the ultrasonic vibrator certainly without contact fault.

[0012] Even if such a flat plate shaped horn is provided, certain power supply is made possible, and thereby the flat plate shaped horn is easily manufactured and is compact, so that compact ultrasonic transducer with high reliability is realized.

[0013] A skin care device of the present invention comprises said ultrasonic transducer, and the target place is skin. It is possible to provide the skin care device capable of transmitting ultrasonic vibration high efficiently.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] Preferred embodiments of the invention will now be described in further details. Other features and advantages of the present invention will become better understood with regard to the following detailed description and accompanying drawings where:

FIGS. 1A-1C show an ultrasonic transducer" particularly, FIG. 1A is a plan of the ultrasonic transducer; FIG. 1B is a sectional view of the ultrasonic transducer connected with terminals for power supply; and FIG. 1C is an enlarged sectional view of the essential parts of FIG. 1B;

FIG. 2 is a sectional view of a skin care device comprising the ultrasonic transducer;

FIGS. 3A-3E are sectional views of variation examples of concave groove; and

FIGS. 4A and 4B show an ultrasonic transducer, in accordance with an embodiment of the present invention; particularly, FIG. 4A is a sectional view of the ultrasonic transducer; and FIG. 4B is a sectional view of the ultrasonic transducer connected with terminals for power supply.

BEST MODE FOR CARRYING OUT THE INVENTION

[0015] FIGS. 1A-1C show an ultrasonic transducer 1, which is essentially according to the present invention,

however, Fig. 1A does not show the features according to which either of a pair of electrical contacts for energizing the ultrasonic vibrator is located on a flat surface of the horn and according to which the electrical contact of the horn is brought into elastic contact with a metal body as a terminal for power supply from a lead. These feature are especially shown in Fig. 4B, showing one possible realization for these features.

[0016] Fig. 2 shows a skin care device 2 comprising the ultrasonic transducer 1.

[0017] The skin care device 2 comprises a body housing 20 and a control circuit 3. The body housing 20 has a long and narrow shape so that it can be held with one hand. The control circuit 3 is put in the body housing 20. The ultrasonic transducer 1 is installed at one end side in the length direction of the body housing 20. The ultrasonic transducer 1 is formed of an ultrasonic vibrator 4 and a horn 5. The ultrasonic vibrator 4 is in the shape of a flat plate, and converts electrical vibration (e.g., AC (alternating current) voltage) into mechanical vibration to generate ultrasonic vibration. The electrical vibration is supplied from the control circuit 3 through a lead 30. The horn 5 transmits the ultrasonic vibration toward a target place such as skin 50 or the like. The ultrasonic transducer 1 is stuck to the horn 2 with one or two liquid type epoxy resin adhesive 6 (see FIGS. 1B and 1C).

[0018] The ultrasonic vibrator 4 is formed of a pair of electrodes 8 and a plate-shaped piezoelectric materials 7 intervened between the electrodes 8. The horn 5 is in the shape of a cylinder with a bottom, and is made of metal materials such as aluminum or the like. The horn 5 is attached to the one end side of the body housing 20 so that the outer surface of the bottom of the horn 5 (5a) protrudes outward. One of the electrodes 8 of the ultrasonic vibrator 4 is stuck on the inner surface of the bottom of the horn 5 (5b) with adhesive 6.

[0019] That is, in the horn 5, the inner surface of the bottom 5b includes a join surface 9 to which the ultrasonic vibrator 4 is joined. The outer surface of the bottom 5a includes an ultrasonic wave emitting surface 10 from which ultrasonic waves are emitted toward a target place such as skin (skin surface) 50 or the like. The thickness between the join surface 9 and ultrasonic wave emitting surface 10 is set to be equal to, for example, one wavelength of the ultrasonic vibration emitted from the ultrasonic vibrator 4 in order to form standing wave.

[0020] As shown in FIG. 1B, a stopper 11 for restricting the extrusion, outflow and so on of adhesive 6 intervened between the join surface 9 and the ultrasonic vibrator 4 is formed of a concave groove 12 located at the join surface 9 side. This concave groove 12 is formed outside the outline of the ultrasonic vibrator 4 stuck in the join surface 9 along the outline to be spaced a specified distance apart from the outline. In the example of the Figure, since the ultrasonic vibrator 4 is in the shape of a disk, the concave groove 12 is in the shape of a circle similar to the circular outline of the ultrasonic vibrator 4. For example, if the outline of the ultrasonic vibrator 4 is elliptical,

the concave groove 12 becomes elliptical along the elliptical outline. If the outline of the ultrasonic vibrator 4 is rectangular, the concave groove 12 becomes rectangular along the rectangular outline.

[0021] The specified distance "d" between the outline of the ultrasonic vibrator 4 and the concave groove 12 is set to distance such that existence of the adhesive 6 can be seen and vibration is not obstructed. Preferably, the specified distance "d" is uniformly set to distance such as 0.5mm. Preferably, the width and depth of the concave groove 12 are also set to distance such as 1mm or less each.

[0022] In the ultrasonic transducer 1 of the embodiment, one of the electrodes 8 of the ultrasonic vibrator 4 is directly connected with a terminal 31 for power supply from the lead 30. A terminal 32 for power supply from the lead 30 is directly connected with the internal cylindrical surface of the horn 5 (5c), and thereby the other of the electrodes 8 is electrically connected with the terminal 32 through the horn 5 exhibiting high conductivity and the adhesive 6.

[0023] Thus, the skin care device 2 is provided with the ultrasonic transducer 1, and thereby it can be used to press the ultrasonic wave emitting surface 10 against the skin 50 while holding the body housing 20. In this case, various switches (not shown) are operated and then the ultrasonic vibrator 4 is supplied with electrical vibration from the control circuit 3 and generates mechanical vibration (ultrasonic vibration). That is, since the ultrasonic wave emitting surface 10 is utilized as a skin contact surface, the ultrasonic vibration can be transmitted to the skin 50 of a body (human body) and even to a target place inside the body, so that a desired beauty effect can be obtained. Preferably, suitable couplant 40 for ultrasonic transmission such as gel or the like is used between the ultrasonic wave emitting surface 10 and the skin 50.

[0024] In the embodiment, the ultrasonic transducer 1 is provided with the concave groove 12 as the stopper 11 according to an aspect of the invention. Therefore, when the ultrasonic vibrator 4 and horn 5 are stuck together with the adhesive 6 to form the ultrasonic transducer 1, even if the extrusion and outflow of the adhesive 6 occur owing to pressurization and heating expansion, the excess adhesive collects in the concave groove 12. Thereby, the extrusion and outflow are obstructed at the concave groove 12. Therefore, since the extrusion and outflow ranges of the excess adhesive are restricted, the transmission loss of ultrasonic vibration can be reduced, and the excess adhesive can be prevented from disturbing power supply.

[0025] The concave groove 12, namely the stopper 11 is formed along the outline of the ultrasonic vibrator 4 to be spaced the specified distance "d" apart from the outline. In other words, the extrusion and outflow of the excess adhesive can be permitted up to the specified distance "d". Herein, since the ultrasonic vibrator 4 and horn 5 are not transparent, slight adhesive flash around the

ultrasonic vibrator 4 needs to be seen in order to spread the adhesive 6 evenly so that occurrence of air layer and air holes between the ultrasonic vibrator 4 and horn 5 is avoided. The specified distance "d" makes it possible.

5 The stopper 11 functions as a mark for adhesive region, and accordingly a worker can easily keep fixed position relationship between the ultrasonic vibrator 4 and horn 5. Even though the excess adhesive exceeds the stopper 11, the adhesive exceeding the stopper 11 can be seen and therefore the worker can easily wipe off and remove the adhesive exceeding the stopper 11.

10 **[0026]** Since the stopper 11 is formed of the concave groove 12, the ultrasonic vibrator 4 can be moved in all directions outside the concave groove 12 while being pressed when it is stuck on the horn 4. Because of this, the adhesive 6 can be easily spread all over the join surface 9.

15 **[0027]** In an embodiment, the concave groove 12 is formed as shown in FIG. 3A, 3B, 3C, 3D or 3E. For example, the concave groove 12 may be rectangular in section as shown in FIG. 3A, or may have a smooth round edge as shown in FIG. 3B or 3C. As shown in FIG. 3D or 3E, the horn 5 is formed with double concave grooves 12 as the stopper 11. In this case, since the outside concave groove 12 functions as a preliminary stopper, it is possible to effectively restrict adhesive flash more than is acceptable.

20 **[0028]** Referring to FIGS. 4A and 4B, an ultrasonic transducer 1 and a skin care device 2 with same, in accordance with an embodiment of the present invention is explained. For the purpose of clarity, like kind elements are assigned the same reference numerals as depicted in the embodiment of FIGS. 1A-1C and 2.

25 **[0029]** In the ultrasonic transducer 1 of the embodiment, a horn 5 is in the shape of a flat plate. An ultrasonic vibrator 4 is stuck on one flat surface of the horn 5, which is further provided with a concave groove 12 and either of a pair of electrical contacts for energizing the ultrasonic vibrator 4 through the horn 5 and adhesive 6. The electrical contact of the horn 5 is located at the flat surface of the horn 5 outside the concave groove 12 surrounding the ultrasonic vibrator 4. As shown in FIG. 4B, the electrical contact of the horn 5 is brought into elastic contact with a metal elastic body 35 as a terminal 32 for power supply from a lead 30. Therefore, in the electrodes 8 of the ultrasonic vibrator 4, the electrode 8 connected with the horn 5 is electrically connected with the metal elastic body 35 through the horn 5 and adhesive 6. Similarly, a metal elastic body 36 is utilized as a terminal 31 for power supply, which is connected with the other electrode 8. This electrode 8 is brought into elastic contact with the metal elastic body 36 directly.

30 **[0030]** If adhesive flash reached the electrical contact brought into elastic contact with the metal elastic body 35, the adhesive flash would cause contact fault. However, in the embodiment, since adhesive flash around the concave groove 12 is restricted, such a problem can be eliminated. The flat plate shaped horn 5 can be easily

manufactured in comparison with the horn 5 that is in the shape of a cylinder with a bottom as shown in FIGS. 1B and 4A, and is compact. Even if the flat plate shaped horn 5 is used, one electrical contact can be located at the flat surface of the horn 5 outside the concave groove 12. The flat plate shaped horn 5 has an advantage of easily ensuring precision of dimensions such as thickness, flatness and so on.

[0031] In the embodiment, the structure of the skin care device 2 equipped with the ultrasonic transducer 1 is the same as that of FIG. 2. In addition, the ultrasonic transducer 1 may be used for an ultrasonic vibration device except such a skin care device. The ultrasonic vibration device may relate to, not limited to beauty, ultrasonic process such as diagnosis, process, joint (join), cleaning, enhancement of penetration of agents, diffusion, dispersion, emulsification, atomization or the like. Also in this case, like effect, needless to say, can be obtained.

[0032] Although the present invention has been described with reference to certain preferred embodiments, numerous modifications and variations can be made by those skilled in the art without departing from the true spirit and scope of this invention as defined in the claims.

Claims

1. An ultrasonic transducer (1), comprising
an ultrasonic vibrator (4) configured to convert electrical vibration into mechanical vibration to generate ultrasonic vibration; and
a horn (5) having a flat surface (5b) which comprises a join surface (9) to which the ultrasonic vibrator (4) is joined, and an ultrasonic wave emitting surface (10) from which ultrasonic waves are emitted toward a target place;
the horn (5) further comprising a stopper (11) for restricting adhesive flash caused by adhesive (6) intervened between the join surface (9) and the ultrasonic vibrator (4);
wherein the stopper (11) comprises a concave groove (12) formed in the flat surface (5b) around the join surface (9) along the outline of the ultrasonic vibrator (4),
wherein the horn (5) exhibits conductivity;
characterised in that
either of a pair of electrical contacts for energizing the ultrasonic vibrator (4) is located outside the stopper (11) on the flat surface of the horn, and **in that** the electrical contact of the horn (5) is brought into elastic contact with a metal elastic body (35) as a terminal (32) for power supply from a lead (30).
2. The ultrasonic transducer of claim 1, wherein the stopper (11) is spaced a specified distance apart from the outline of the ultrasonic vibrator (4).
3. A skin care device, comprising the ultrasonic trans-

ducer (1) of claim 1, wherein the target place is skin.

4. A skin care device, comprising the ultrasonic transducer (1) of claim 2, wherein the target place is skin.

Patentansprüche

1. Ultraschallwandler (1) mit:

einem Ultraschallschwinger (4), der ausgebildet ist, um elektrische Schwingungen in mechanische Schwingungen umzuwandeln, um Ultraschallschwingungen zu erzeugen;

und

einem Horn (5) mit einer flachen Oberfläche (5b), die eine Verbindungsoberfläche (9), mit welcher der Ultraschallschwinger (4) verbunden ist, aufweist, und einer Ultraschallaustrittsoberfläche (10), von der Ultraschallwellen zu einem Target emittiert werden; und wobei das Horn (5) weiter einen Stopper (11) umfasst, um ein Austreten von Haftmittel (6), welches zwischen der Verbindungsoberfläche (9) und dem Ultraschallschwinger (4) angeordnet ist, einzuschränken;

wobei der Stopper (11) eine konkave Einkerbung (12) umfasst, die in der flachen Oberfläche (5b), um die Verbindungsfläche (9) herum entlang der Kontur des Ultraschallschwingers (9) gebildet ist,

wobei das Horn (5) eine Leitfähigkeit aufweist;

dadurch gekennzeichnet, dass

ein Kontakt eines Paares von elektrischen Kontakten zum Anregen des Ultraschallschwingers (4) außerhalb des Stoppers (11) auf der flachen Oberfläche des Horns angeordnet ist, und in dem

der elektrische Kontakt des Horns (5) in einem elastischen Kontakt mit einem elastischen Metallkörper (35) als ein Terminal (32) gebracht wird, um eine Energieversorgung von einer Zuleitung (30) bereitzustellen.

2. Ultraschallwandler nach Anspruch 1, wobei der Stopper (11) von der Kontur des Ultraschallschwingers (4) durch einen bestimmten Abstand getrennt ist.

3. Hautpflegegerät mit einem Ultraschallwandler (1) nach Anspruch 1, wobei das Target die Haut ist.

4. Hautpflegegerät mit dem Ultraschallwandler (1) nach Anspruch 2, wobei das Target die Haut ist.

Revendications

1. Transducteur ultrasonore (1), comprenant :

un vibreur ultrasonore (4) configuré pour convertir une vibration électrique en une vibration mécanique pour générer une vibration ultrasonore ; et

un cornet (5) comportant une surface plate (5b) qui comprend une surface de jonction (9) à laquelle le vibreur ultrasonore (4) est joint, et une surface d'émission d'ondes ultrasonores (10) à partir de laquelle des ondes ultrasonores sont émises vers un lieu cible ;

le cornet (5) comprenant en outre un élément d'arrêt (11) pour limiter une bavure d'adhésif provoquée par un adhésif (6) s'étendant entre la surface de jonction (9) et le vibreur ultrasonore (4) ;

dans lequel l'élément d'arrêt (11) comprend une rainure concave (12) formée dans la surface plate (5b) autour de la surface de jonction (9) le long du contour du vibreur ultrasonore (4), dans lequel le cornet (5) présente une conductivité ;

caractérisé en ce que

l'un ou l'autre d'une paire de contacts électriques pour exciter le vibreur ultrasonore (4) est situé à l'extérieur de l'élément d'arrêt (11) sur la surface plate du cornet, et **en ce que**

le contact électrique du cornet (5) est amené en contact élastique avec un corps élastique métallique (35) en tant que borne (32) pour une alimentation à partir d'un conducteur (30).

2. Transducteur ultrasonore selon la revendication 1, dans lequel l'élément d'arrêt (11) est espacé d'une distance spécifiée du contour du vibreur ultrasonore (4).

3. Dispositif de soins pour la peau, comprenant le transducteur ultrasonore (1) selon la revendication 1, dans lequel le lieu cible est la peau.

4. Dispositif de soins pour la peau, comprenant le transducteur ultrasonore (1) selon la revendication 2, dans lequel le lieu cible est la peau.

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FIG. 1A

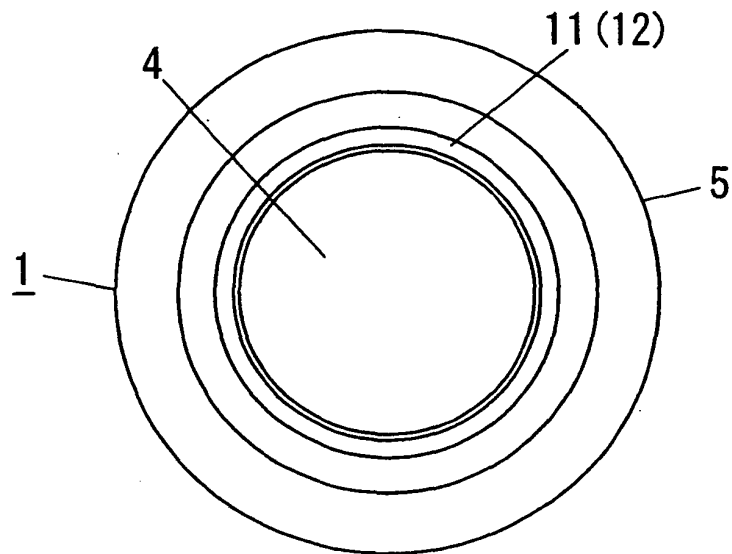


FIG. 1B

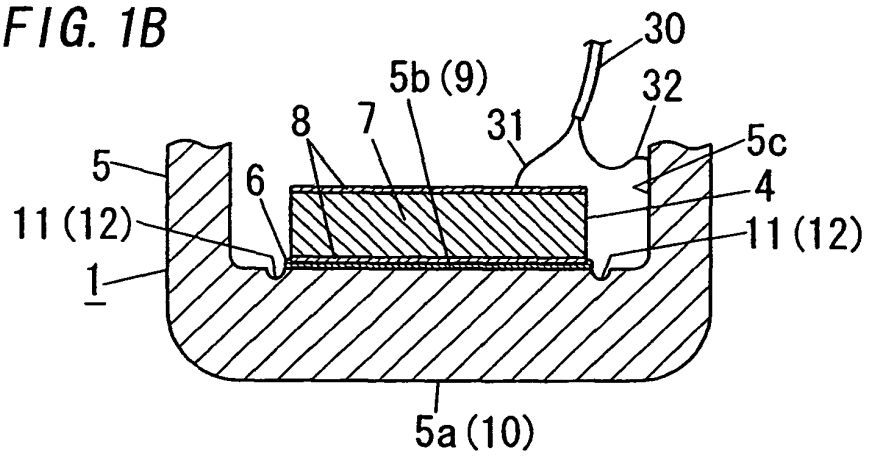


FIG. 1C

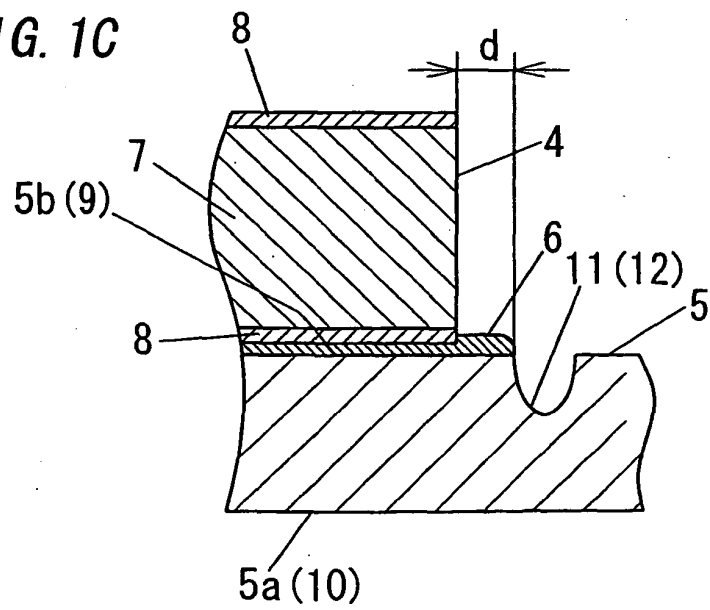


FIG. 2

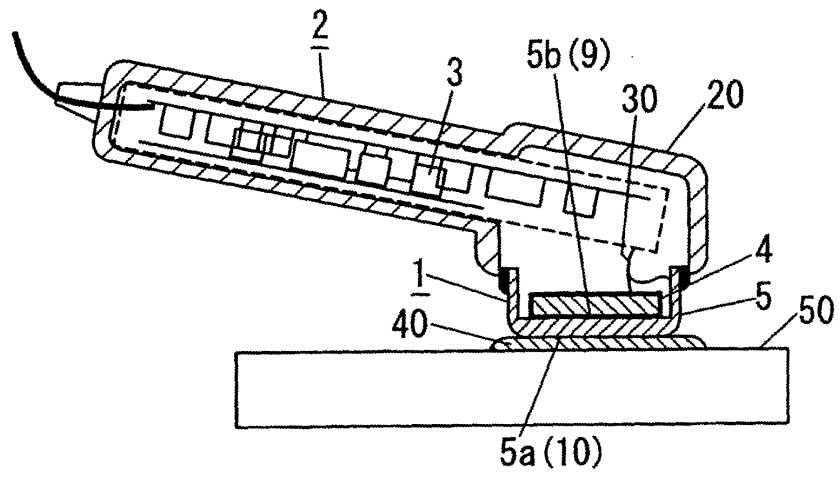


FIG. 3A

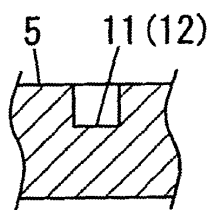


FIG. 3D

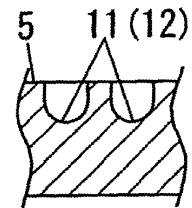


FIG. 3B

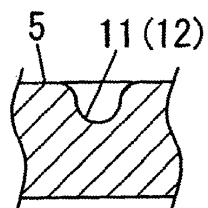


FIG. 3E

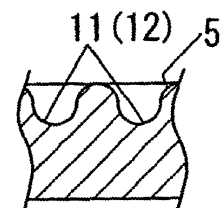


FIG. 3C

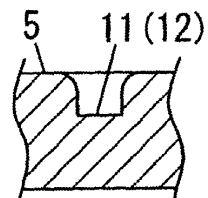


FIG. 4A

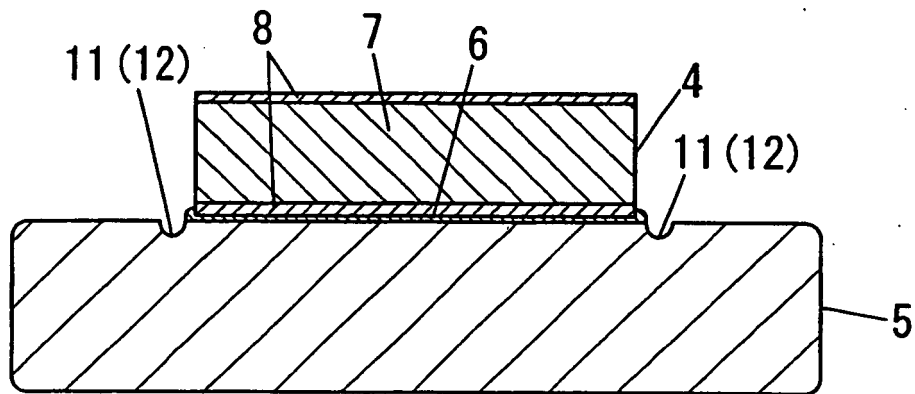
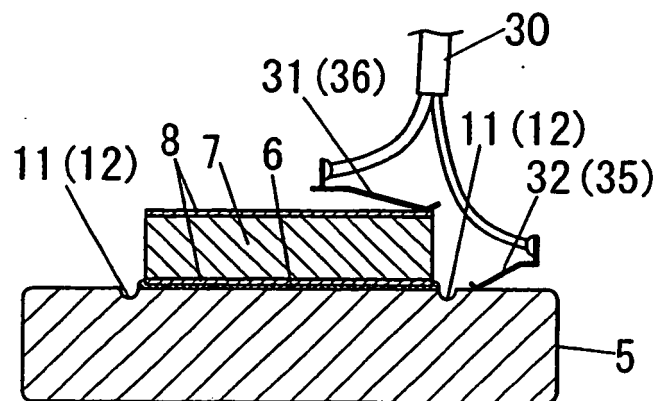


FIG. 4B



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2006247251 A [0003]
- GB 684165 A [0004]
- EP 0283823 A1 [0004]
- WO 2004110558 A1 [0004]