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(54) **HAIR STYLE TREATMENT DEVICE**

FRISURBEHANDLUNGSVORRICHTUNG

DISPOSITIF DE LISSAGE DE CHEVEUX

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## Description

Technical Field

**[0001]** The present invention relates to a hair style treatment device.

Background Art

**[0002]** Conventionally, a treatment (permanent treatment) technique of giving a desired style to hair such as straight permanent or wave permanent is performed by dividing the whole hair into a plurality of sections before or after performing a softening treatment with applying or spraying a first liquid (also referred to as a softening agent, a reducing agent, or a cold liquid) onto the whole hair cleaned by shampooing, performing a heat or combing treatment or applying creamy substance to the divided hair, or wrapping the divided hair around hair rods or the like in the case of wave permanent, and then performing a hardening treatment by applying or spraying a second liquid (also referred to as a hardening agent, an oxidizing agent, or a cold liquid) onto the hair, removing the hair rods after an elapse of a predetermined time period if the hair is wrapped around the hair rods, and finally rinsing the hair with warm water or the like.

**[0003]** In other words, the conventional hair style treatment technique such as a permanent or a treatment has been performed only by the so-called chemical treatment such as applying the first liquid (reducing agent) to the hair after wrapping the hair around the rods or the like, cutting the cystine linkage of the hair, and bonding the linkage by using the second permanent liquid (oxidizing agent) with the hair transformed by the rods or the like. Accordingly, the hair style keeping effect of the straight permanent, wave permanent, treatment or the like has been very short lived. This may be caused by unsuccessful cutting of the cystine linkage as a result of poor penetration of the perm solution which does not penetrate into the depth of the hair or by weak cystine linkage due to damage of the hair during the hair style treatment.

**[0004]** Therefore, for example, an attempt has been made to adjust pH levels or the like of the cold liquid to various levels depending on the nature of hair of an individual person undergoing a permanent treatment in order to enable the hair style keeping effect by the aforementioned cold liquid to be kept for a long time. In fact, however, a sufficient style keeping effect is not achieved yet.

**[0005]** It is thought that a number of polypeptide chains (the main chains) constituting keratin, which is the main component of hair, are lined up in a vertical direction of a hair, and adjacent main chains make a mesh structure by being connected with each other by means of side chains of cystine linkage, salt linkage, hydrogen linkage, and the like, and that, by means of these linkages, hair has high elasticity and has resilience to return in a former form immediately after a hand is released from the hair even if it is bent.

**[0006]** To weaken the resilience by cutting side chains of the cystine linkage, salt linkage, hydrogen linkage and the like, which apply this resilience to hair is the action of the first permanent liquid to the hair. On the other hand, to restore the linkage of the side chains at a new position where the hair is bent is the action of the second liquid. It is thought that a durable wave or the like is formed by means of this serial reaction. Naturally the same applies to a principle of curly hair correction for changing frizz hair to straight and a principle of changing wavy hair to straight.

**[0007]** Moreover, in a hair style treatment process, it is generally performed in addition to the above hair treatment to subject the hair to a heat treatment (physical treatment) at a constant temperature for a given length of time. This heat treatment effectively utilizes, for changing the hair style, thermoplasticity of a medulla, cortex, matrix, cuticle, and the like, which constitute hair, and aims to achieve a synergistic effect with the actions of the aforementioned agents (chemical treatment) to the hair.

**[0008]** Since, however, the agent and heat are used in the hair style treatment such as the aforementioned permanent treatment or the like, it is necessary to treat the agents carefully by strictly making a correct use and amount of each agent, for example, in the hair style treatment with the agent. In addition, there is a problem that damage to hair increases if cutting is advanced by the first liquid to such a degree that revitalization of cystine linkage in keratin is impossible, and on the other hand, hair is damaged and the treatment to give a predetermined hair style cannot be performed if the treatment with the second liquid is incomplete.

**[0009]** Moreover, it is thought to be an effective method to effectively use the stretchability inherent in the hair, by applying a force in the stretching direction to the hair repeatedly in an almost natural state in order to exert the cutting of cystine linkage, salt linkage, hydrogen linkage, and the like in keratin of the hair into the details of the hair. In the conventional hair style treatment device, however, the force is applied to the whole hair, which causes a problem of applying damage to the hair, particularly heavy damage to hair roots.

**[0010]** In order to solve the plurality of problems, the following Patent Documents 1 to 4 are disclosed.

**[0011]** Patent Document 1 discloses a method of treating a hair style by applying ultrasonic vibration to hair without using an agent or heat and a device for the method. In Patent Document 1, however, there is no disclosure on how long period the style of the treated hair is kept without damaging the hair.

**[0012]** In addition, Patent Documents 2 and 3 disclose a method of treating hair with ultrasonic vibration. Particularly, Patent Document 3 describes that it is preferable to use relatively strong vibration to such a degree that sufficient high contact pressure can be applied to hair. The generation of such a strong vibration, however, could

lead to damage to hair more than required, and thus it is not enough to solve the problem.

**[0013]** Patent Document 4 discloses a hair style treatment device for applying vibration of low frequencies in a range of 1 Hz to 20000 Hz to hair via a vibrator which slides in the longitudinal direction of an arm. In the hair style treatment device in Patent Document 4, hair is vibrated from the side (in the longitudinal direction of the arm) and thus the hair moves in a reciprocating rotational motion on the arm. Therefore, hair does not collapse in the vertical direction and the circular cross section can be maintained without damage, and therefore the elasticity and texture can be maintained and good evaluation is achievable. In Patent Document 4, however, attention is not focused on the use of stretchability inherent in the hair, and no sufficient solution is provided in respect of performing hair style treatment in an almost natural state.

**[0014]**

Patent Document 1: JP-A-8-299046
Patent Document 2: JP-A-9-262120
Patent Document 3: JP-A-9-262123
Patent Document 4: JP-B-4069157

Disclosure of the Invention

**[0015]** The present invention has been made in view of the above problems of the conventional techniques. It is an object of the present invention to provide a hair style treatment device capable of smoothly giving the hair style so as to reduce the treatment time and capable of keeping the hair style for a long term after the treatment with exerting a strong styling effect on the hair, by restrictedly and repeatedly applying a force in the stretching direction to hair in an almost natural state without applying stress to hair roots, thereby enabling the exertion of cutting of cystine linkage, salt linkage, hydrogen linkage, and the like in keratin of the hair into the details thereof by utilizing the stretchability inherent in the hair. Particularly, the present invention enables the treatment at relatively low temperatures and thus prevents hair damage.

**[0016]** According to the present invention, there is provided a hair style treatment device described below.

**[0017]** [1] A hair style treatment device according to claim 1.

**[0018]** [2] The hair style treatment device described in [1], wherein at least two of the vibrators are disposed in parallel in the width direction in one or both of the arms.

**[0019]** [3] The hair style treatment device described in [1] or [2], wherein the vibration generated by the vibration means is able to be selectively applied to arbitrary one or more of the vibrators.

**[0020]** [4] The hair style treatment device described in one of [1] to [3], wherein a temperature heater is disposed in one or the other arm or in the device body and heat is able to be applied to the hair when the hair is held.

**[0021]** [5] The hair style treatment device described in one of [1] to [4], wherein the amplitude of vibration of the vibrator is in the range of 0.0001 mm to 10 mm.

**[0022]** [6] The hair style treatment device described in one of [1] to [5], wherein the frequency of the vibration means is switchable.

**[0023]** [7] The hair style treatment device described in one of [1] to [6], wherein the part in contact with the hair of the hair style treatment device is made of an elastic material.

**[0024]** [8] The hair style treatment device described in one of [1] to [7], wherein a first vibrator which vibrates in the width direction is disposed in the one arm and a second vibrator which vibrates in the longitudinal or thickness direction is disposed in the other arm.

**[0025]** [9] The hair style treatment device described in [8], wherein the vibration from the first vibrator and the second vibrator to the hair is able to be applied by only one of the vibrators, by the vibrators alternately, or by both of the vibrators at a time.

**[0026]** According to the present invention, it is possible to exert the cutting of cystine linkage, salt linkage, hydrogen linkage, and the like in keratin of the hair into the details thereof by utilizing the stretchability inherent in the hair, by restrictedly and repeatedly applying a force in the stretching direction to the hair in an almost natural state without applying stress to hair roots. Moreover, the hair styling treatment is able to be smoothly performed, thereby reducing treatment time and facilitating the rebonding of the cystine linkage and the hydrogen linkage thereafter. Further, a strong styling effect is exerted on the hair, thereby providing an excellent advantageous effect of the hair style treatment device capable of keeping the hair style for a long term after the treatment. Particularly, the present invention enables the treatment at relatively low temperatures and thus prevents hair damage.

Brief Description of the Drawings

**[0027]**

Fig. 1A is a schematic diagram and also a perspective diagram illustrating one embodiment of a hair style treatment device according to the present invention.
Fig. 1B is a diagram illustrating the cross section of Fig. 1A, which is partially omitted and schematically illustrated.
Fig. 2 is a diagram schematically illustrating a state in which the hair style treatment device in Fig. 1A is caused to hold hair.
Fig. 3A is a front view of the hair style treatment device in Fig. 2, which is partially omitted and schematically illustrates a fixing member and a vibrator.
Fig. 3B is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 2, which is partially omitted.
Fig. 3C is a diagram schematically illustrating a state

in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 2, which is partially omitted.

Fig. 3D is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 2, which is partially omitted.

Fig. 3E is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 2, which is partially omitted.

Fig. 4 is a perspective diagram illustrating another embodiment of the hair style treatment device according to the present invention and also a diagram schematically illustrating a state before the hair style treatment device holds hair.

Fig. 5A is a front view of the hair style treatment device in Fig. 4, which is partially omitted and schematically illustrates a fixing member and a vibrator.

Fig. 5B is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 4, which is partially omitted.

Fig. 5C is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 4, which is partially omitted.

Fig. 5D is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 4, which is partially omitted.

Fig. 5E is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 4, which is partially omitted.

Fig. 6 is a perspective diagram illustrating still another embodiment of the hair style treatment device according to the present invention and also a diagram schematically illustrating a state before the hair style treatment device holds hair.

Fig. 7A is a front view of the hair style treatment device in Fig. 6, which is partially omitted and schematically illustrates a fixing member and a vibrator.

Fig. 7B is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 6, which is partially omitted.

Fig. 7C is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 6, which is partially omitted.

Fig. 7D is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 6, which is partially omitted.

Fig. 7E is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 6, which is partially omitted.

Fig. 8A is a perspective diagram illustrating still another embodiment of the hair style treatment device according to the present invention and also a diagram schematically illustrating the embodiment.

Fig. 8B is a diagram illustrating the hair style treatment device shown in Fig. 8A and also a diagram schematically illustrating the state before the hair style treatment device holds hair.

Fig. 9A is a front view of the hair style treatment device in Fig. 8A, which is partially omitted and schematically illustrates a fixing member and a vibrator.

Fig. 9B is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 8A, which is partially omitted.

Fig. 9C is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 8A, which is partially omitted.

Fig. 9D is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 8A, which is partially omitted.

Fig. 9E is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 8A, which is partially omitted.

Fig. 10 is a perspective diagram illustrating still another embodiment of the hair style treatment device according to the present invention and also a diagram schematically illustrating a state before the hair style treatment device holds hair.

Fig. 11A is a front view of the hair style treatment device in Fig. 10, which is partially omitted and schematically illustrates a fixing member and a vibrator.

Fig. 11B is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 10, which is partially omitted.

Fig. 11C is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 10, which is partially omitted.

Fig. 11D is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 10, which is partially omitted.

Fig. 11E is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 10, which is partially omitted.

Fig. 12 is a perspective diagram illustrating still another embodiment of the hair style treatment device according to the present invention and also a diagram schematically illustrating a state before the hair style treatment device holds hair.

Fig. 13A is a front view of the hair style treatment

device in Fig. 12, which is partially omitted and schematically illustrates a fixing member and a vibrator.
Fig. 13B is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 12, which is partially omitted.
Fig. 13C is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 12, which is partially omitted.
Fig. 13D is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 12, which is partially omitted.
Fig. 13E is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 12, which is partially omitted.
Fig. 14 is a perspective diagram illustrating still another embodiment of the hair style treatment device according to the present invention and also a diagram schematically illustrating a state before the hair style treatment device holds hair.
Fig. 15A is a front view of the hair style treatment device in Fig. 14, which is partially omitted and schematically illustrates a fixing member and a vibrator.
Fig. 15B is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 14, which is partially omitted.
Fig. 15C is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 14, which is partially omitted.
Fig. 15D is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 14, which is partially omitted.
Fig. 15E is a diagram schematically illustrating a state in which the vibrator is caused to slide with hair held by the hair style treatment device in Fig. 14, which is partially omitted.
Fig. 16 is a plan view of the hair style treatment device in Fig. 1A and also a diagram schematically illustrating a state in which the vibrator is detached from the hair style treatment device.
Fig. 17 is a front view of still another embodiment of the hair style treatment device according to the present invention, which is partially omitted and schematically illustrated.
Fig. 18A is a schematic diagram of a cam mechanism which converts a rotational motion to a reciprocating motion.
Fig. 18B is a schematic diagram of a cam mechanism which converts the reciprocating motion to another reciprocating motion different in direction.
Fig. 18C is a diagram schematically illustrating an enlarged part of the cam mechanism shown in Fig. 18B.
Fig. 19 is a cross section illustrating another embodiment of the hair style treatment device according to the present invention and also a schematic diagram.
Fig. 20A is a diagram schematically illustrating an enlarged part of another embodiment of the hair style treatment device according to the present invention.
Fig. 20B is a diagram schematically illustrating a state in which the hair style treatment device shown in Fig. 20A holds hair.
Fig. 21 is a diagram schematically illustrating still another embodiment of the hair style treatment device according to the present invention.
Fig. 22 is a diagram schematically illustrating still another embodiment of the hair style treatment device according to the present invention.
Fig. 23 is a diagram schematically illustrating a condition in which the hair style treatment is carried out by means of one embodiment of the hair style treatment device according to the present invention.
Fig. 24 is a diagram schematically illustrating still another embodiment of the hair style treatment device according to the present invention, which is partially omitted.

Description of Reference Numbers

**[0028]** 1: Hair style treatment device (hair iron), 2: Arm body, 2A: One arm (upper arm), 2B: The other arm (lower arm), 3: Vibration means, 4A: Device body (first gripper), 4B: Second gripper, 5: Connecting mechanism, 5a: Rivet portion, 6: Ceramic actuator, 7: Power cord, 9: Vibrator, 10: Cam mechanism, 11: Connection structure, 11a: Connecting portion, 11b: L-shaped portion, 12: Opening, 12a, 12b: Opening end, 13: Recess, 14a, 14b: Abutment end, 15: Fixing member, 16: Vibrator holding portion, 20A: Upper arm, 20B: Lower arm, 31: Hair iron, 22: Motor, 23: Eccentric cam, 24: Cam, 25: Vibration transmitter, 40: Vibration absorber (vibration isolator), 47a: Projection, 47b: Recess, 49: Vibrator-embedded heater, 51: First vibrator, 53: Second vibrator, 60: Cam mechanism, 63: Eccentric cam, 64: Cam, 99: Hair

Best Mode for Carrying out the Invention

**[0029]** Hereinafter, the best mode for carrying out a hair style treatment device according to the present invention will be described specifically with reference to accompanying drawings. It, however, goes without saying that the present invention widely includes hair style treatment devices having particular matters of the invention and the present invention is not limited to the embodiments described below.

[1] Configuration of the hair style treatment device of the present invention:

**[0030]** The hair style treatment device according to the

present invention is a hair style treatment device which gives a desired style to hair softened by applying or spraying a softening agent or to hair treated by applying a hair-treating agent as shown in Fig. 1A, Fig. 1B, Fig. 2, and Fig. 19. The hair style treatment device includes an arm body 2 in which one arm 2A and the other arm 2B are rotatably connected to each other via a connecting mechanism 5, at least one vibration means 3 disposed in one arm 2A or the other arm 2B or in a device body 4A connected to sail arm body 2 and generating vibration of a predetermined frequency, and at least one vibrator 9 disposed in one arm 2A or the other arm 2B. The arm body 2 is adapted to be able to hold or release the hair via the vibrator 9 by the rotation of the connecting mechanism 5, and the vibrator 9 is adapted to be slidable in the width direction of the arm body 2 and to transmit vibration from the vibration means 3 to the hair thus held.

[1-1] Hair to be treated in the present invention:

**[0031]** The hair style treatment device according to the present invention can be preferably used for hair softened by applying or spraying a softening agent or to hair treated by applying a hair-treating agent (hereinafter, appropriately referred to as "hair after softening or other treatment"). In other words, the hair style treatment device according to the present invention is preferably used for a head hair style treatment. In a method of this softening or other treatment, hair is shampooed first, and then a first liquid (softening agent) is applied or sprayed carefully onto the hair. Naturally, while the hair style treatment device according to the present invention can be preferably used for hair after softening or other treatment as described above, the hair style treatment device is not limited to the hair after softening or other treatment, but the hair style treatment device also has an excellent advantageous effect on hair not treated with softening or other treatment.

[1-1-1] Hair softening agent (hair-treating agent):

**[0032]** The hair softening agent (hair-treating agent) includes, for example, a hair dye, a treatment agent, a setting lotion agent, and the like, and more specifically a hair manicure agent, a hair treatment agent, a hair styling agent, a hair rinse agent, a hair cream agent, a hair mousse agent, a hair gel agent, a hair pack agent, and the like.

[1-1-2] Desired styles:

**[0033]** While desired styles which can be given by using the hair style treatment device according to the present invention are not particularly limited, the hair style treatment device can be preferably used for a hair style treatment which gives a hair style such as, for example, a wave permanent, straight permanent, or the like to hair softened by applying or spraying a softening agent or to hair treated by applying a hair-treating agent.

[1-1-2-1] Wave permanent:

**[0034]** When the wave permanent is applied to hair, hair can be arranged to a desired hair style by using the hair style treatment device according to this embodiment by shampooing the hair, holding a given quantity of the hair while combing the hair softened by means of the first liquid, aligning the bunch of the hair from the hair base to the hair tip, and, for example, giving a wave (a curl) in a specific direction with a hair iron or wrapping the hair around a hair rod so that about uniform tension is applied to the hair from the hair base to the hair tip.

[1-1-2-2] Straight permanent:

**[0035]** When the straight permanent is applied to hair, hair can be arranged to a desired hair style by using the hair style treatment device according to this embodiment by aligning a bunch of shampooed and combed hair from the hair base to the hair tip with being held by a given quantity, softening the hair by applying or spraying the first liquid to the hair, and then aligning the bunch of the hair held by the given quantity from the hair base to the hair tip while combing the hair so that the hair is turned to, for example, straight.

[1-2] Vibration means:

**[0036]** The vibration means in this embodiment has a function of, so to speak, a power source which gives (applies) vibration to the hair after softening by vibrating the vibrator. Although the vibration means 3 is disposed in the arm body 2 (the arm 2A, the arm 2B) in Fig. 1B, the location is not limited to the arm body 2, but, for example, in the case of a hair style treatment device having a device body 4A as shown in Fig. 19, the vibration means 3 may be disposed in the device body.

**[0037]** More preferably, however, the aforementioned vibration means is disposed in the arm body. For example, the vibration means 3 such as a ceramic actuator is disposed in the arm 2B of the arm body 2 like the hair style treatment device shown in Fig. 1B, thereby enabling a reduction in the vibration transmission distance to the vibrator and thus enabling desired vibration to be applied (transmitted) to the hair reliably. In other words, loss of vibration transmission to the hair is reduced and the applied vibration is able to be adjusted reliably and smoothly, and therefore it is thought to be one of the preferable modes.

**[0038]** The vibration means may be, for example, an electric motor such as a small motor or a flat motor, an electromagnetic actuator, a ceramic actuator, or the like, including those connectable to the mains power supply at home via a power cord 7. If the ceramic actuator or the like constitutes the vibration means, electric energy is directly convertible to mechanical translatory move-

ment energy, thereby enabling improvement in an energy efficiency and power saving. The operation of the vibration means is started or ended by using a known power switch or the like, which has been provided. If an electric motor or the like which outputs a rotational motion is used as the vibration means, the vibrator described later may be vibrated, for example, by converting the rotational motion to a translatory movement by using a cam mechanism 10 as shown in Fig. 18A and further converting the aforementioned translatory movement to a sliding (reciprocating) motion in the width direction of the arm by using a cam mechanism 60 as shown in Figs. 18B and 18C. The vibration means thus adapted is preferably as light in weight as possible because an excessively heavy vibration means may impose a burden on the hair style treatment work.

**[0039]** The vibration means is preferably adapted to be able to generate vibration of a predetermined frequency. The generation of vibration of the predetermined frequency to apply a force in the stretching direction of the hair within a desired range enables the exertion of cutting of cystine linkage, salt linkage, hydrogen linkage, and the like in keratin of the hair into the details thereof by utilizing the stretchability inherent in the hair.

**[0040]** More preferably, the vibration means is adapted to be able to generate vibration having a predetermined frequency in a range of 1 Hz to 200000 Hz. The vibration means thus adapted is able to repeatedly and reliably apply a stretching or shrinking force to a restricted part of the hair in the width direction of the arm, for example, if the vibration has a predetermined frequency of the minimum value. Moreover, for example, if the vibration has a predetermined frequency of the maximum value, the vibration is able to be repeatedly and delicately applied to the hair in the width direction of the arm. In other words, the stretching and shrinking force is repeatedly and reliably applied to a restricted part of the hair in an almost natural state. Particularly, this feature is convenient to carry out the hair treatment in a short period of time or to fine-tune the amplitude of the applied vibration according to the nature of individual hair. More preferably, the vibration means is adapted to be able to generate vibration of a predetermined frequency in a range of 1 Hz to 20000 Hz. If the vibration of a predetermined frequency is adapted to have the maximum value of 20000 Hz, the vibration means for generating vibration is not excessively complicated or upsized, though the region of selectable amplitudes is reduced in respect of applying vibration more delicately than in the case of 200000 Hz, and thus this feature is more convenient in respect of manufacturing and enables a reduction in production cost. Thus, the application of a force to the hair in the stretching direction thereof within the desired range enables the exertion of cutting of cystine linkage, salt linkage, hydrogen linkage, and the like in keratin of the hair into the details thereof by utilizing the stretchability inherent in the hair.

**[0041]** More preferably, the vibration means is adapted to be able to generate vibration of a frequency in a range of 10 Hz to 100 Hz, because it is thought that low-frequency vibration of frequencies ranging from 10 Hz to 100 Hz is more effective to apply a force repeatedly to a restricted part in an almost natural state than ultrasonic vibration. Therefore, the low-frequency vibration is given to hair along the width direction of the arm 2B as shown in Figs. 1A and 2, which enables the force in the stretching direction to be repeatedly applied to a restricted part of the hair more easily, enables the use of the stretchability inherent in the hair, and enables damage to hair roots to be reduced as much as possible with keeping the natural texture of the hair. In addition, applying the low-frequency vibration to hair enables the exertion of cutting of cystine linkage, salt linkage, hydrogen linkage, and the like in keratin of the hair into the details thereof.

**[0042]** Further, it is thought to be preferable as a hair style treatment to carry out the hair style treatment while applying vibration in a predetermined range from a predetermined direction, because it promotes penetration of the first liquid to the hair to soften the hair and thereby enhances the effect of the first liquid. Thus, it becomes possible to keep the elasticity and texture of the hair by controlling the frequency of the vibration means to fall within a desired value range.

**[0043]** Moreover, the frequency of the vibration means is preferably switchable. The stiffness, thickness, and the like of hair vary between individuals, and therefore the switchable predetermined frequency enables the hair style treatment to be performed according to the individual properties of hair. Thus, it is one of the preferable modes.

[1-3] Arm body:

**[0044]** The arm body 2 in this embodiment is composed of one arm 2A and the other arm 2B, and one arm 2A and the other arm 2B are rotatably connected to each other via the connecting mechanism 5. Further, one arm 2A and the other arm 2B are adapted to be rotatable enough to be able to hold hair. Note here that a strong contact between the arms during hair treatment may collapse the hair sandwiched between the arms. Therefore, such a strong contact between the arms is unfavorable. Thus, in this embodiment, it is preferable to suppress the strength of contact to a level only enough to hold the hair, with respect to the contact between the arms, the contact between the vibrator disposed in one of the arms and the other arm, the contact between the vibrator disposed in one of the arms and the fixing member disposed in the other arm, the contact between the vibrators disposed in both arms, or the like.

**[0045]** Here, how the arm body holds the hair is an important issue for the hair style treatment device. For example, if the hair is sandwiched between the arms with a strong pressing force (strong pressure) and the hair style treatment is carried out with the strong pressure maintained, the cross section of the hair is collapsed in the stage of the strong pressure and still further the hair

style treatment is applied to the collapsed hair, and therefore double or triple damage is done to the hair. In other words, even if the arm body were adapted to be able to apply predetermined vibration from a predetermined direction to the hair, the pressed and damaged hair is continued to be further pressed with a strong force during the hair style treatment work. Thus, even if the vibrator slides repeatedly, the hair does not stretch or shrink or cannot stretch or shrink sufficiently, but the hair is pressed with a strong force, by which the hair is kept to be stretched to its maximum length or shrunk and the hair is damaged. Under such circumstances, it is unable to maintain the elasticity and texture of hair and to perform a satisfactory hair treatment. Therefore, in this embodiment, one arm and the other arm gently hold the hair so as not to collapse the hair via the connecting mechanism, and the hair is caused to stretch and shrink with the hair held by the two arms.

**[0046]** Further, in order to prevent damage to the hair caused by an excessive pressing force from one and the other arms when the hair is held by one arm and the other arm, preferably, for example, a projection 47a as shown in Fig. 22 is disposed in the arm 2B and a recess 47b is disposed in the arm 2A. This configuration prevents the excessive pressing force since, even if one arm and the other arm are going to excessively press each other (one arm or the other arm), the projection 47a and the recess 47b serve as a stopper before an excessive pressing force is applied. Therefore, the pressing force to the hair is avoided. In other words, vibration is able to be applied in an almost natural state.

**[0047]** The shape of the arm body may include, for example, a cylindrical, rectangular, rod-like shape and the like. The shape, however, is not limited thereto, but preferably the arm body has a shape facilitating the arms to hold and release the hair and facilitating the rotation of the arms via the connecting mechanism. Moreover, if the vibrator 9 shown in Figs. 1A and 1B, the vibration transmitter 25 shown in Fig. 1B, and the like are disposed, the arm body preferably has a hollow shape. The shape of the arm body, however, is not limited to the hollow shape, but the arm body in this embodiment includes those having a shape facilitating the disposition of the vibrator in the arm body, facilitating the application of vibration to the hair when the vibrator is disposed, or facilitating the disposition of any other peripheral member.

**[0048]** Moreover, the arm body is made of a known metal material such as titanium alloy, duralumin, aluminum alloy, or steel. The material is not limited thereto, but the arm body may be made of a material which is light in weight, impervious to vibration, and durable. Moreover, the arm body is preferably made of a material having excellent heat resistance in addition to the above properties.

[1-3-1] Connecting mechanism:

**[0049]** The arm body is, as shown in Fig. 1A, rotatably connected via the connecting mechanism 5. Specifically, one arm 2A and the other arm 2B are rotatably connected to each other with a rivet portion 5a as a base shaft, so that the arms are rotatable up and down when viewed in the paper plane direction in Fig. 1A. The connecting mechanism, however, is not limited thereto, but the connecting mechanism in this embodiment includes a known connection structure in which the arm body is rotatable. By rotating one arm 2A and the other arm 2B freely via the connecting mechanism 5, one arm 2A and the other arm 2B can hold or release the hair smoothly.

**[0050]** Moreover, the arm body is preferably provided with a biasing member such as a spring which facilitates rotation (opening or closing between one arm and the other arm), because it enables the hair to be held smoothly, so that the hair treatment can be smoothly performed.

[1-4] Vibrator:

**[0051]** At least one vibrator is disposed in one or the other arm and is adapted to be able to hold or release the hair via the vibrator. Further, the vibrator is adapted to be able to apply vibration in the width direction of the arm body and to transmit the vibration from the vibration means to the held hair. The vibrator is thus adapted because the vibrator serves as a transmitter of the vibration generated by the vibration means to the hair. Specifically, the vibrator thus adapted enables a force in the stretching direction to be restrictedly and repeatedly applied to the hair in an almost natural state without applying stress to hair roots and enables the exertion of cutting of cystine linkage, salt linkage, hydrogen linkage, and the like in keratin of the hair into the details thereof by utilizing the stretchability inherent in the hair, thus providing an advantageous effect of the present application.

**[0052]** Moreover, the vibrator is preferably adapted to be slidable in the width direction of the arm body, because the vibrator sliding in the width direction of the arm body facilitates the transmission of vibration to the hair and the repetitive application of a force in the stretching direction to a restricted part of the hair in an almost natural state without applying stress to hair roots.

**[0053]** Here, the term "at least one vibrator is disposed in one or the other arm" means that, as long as one vibrator is disposed in at least one arm, one vibrator may be disposed in the other arm or may be omitted in the other arm. Alternatively, the term means that one vibrator may be disposed in each of the arms or a plurality of vibrators may be disposed in both arms. It is because one vibrator disposed in at least one arm provides the advantageous effect of the present application. In the case where at least one vibrator is disposed in one arm and no vibrator is disposed in the other arm, for example, a fixing member or the like is provided to enable the hair to be held or released, so that the hair can be held or released via the fixing member and the vibrator. It is because the provision of the fixing member or the like enables the region of the hair to which the vibration is ap-

plied to be limited to a restricted part, thereby providing an advantageous effect of the present application.

**[0054]** Moreover, "the force is applied in the stretching direction of the hair" because normally hair stretches or shrinks according to the weather, temperature, humidity, or the like and it is possible to reduce the damage to the hair by utilizing the stretchability inherent in the hair. Further, the force in the stretching direction is "repeatedly" applied to the hair, because, if vibration is applied to the hair in only one direction relative to the longitudinal direction of the hair, the hair is continuously in the stretched or shrunk state, by which the hair is easily damaged or stressed. Therefore, the vibrator is adapted to be able to apply vibration repeatedly to the hair, so to speak, in two directions along the longitudinal direction of the hair.

**[0055]** Moreover, "the force is applied in an almost natural state" because an excessive force, if applied immoderately from a direction in which the hair does not have the stretchability, could damage the hair. Specifically, even if the stretchability of the hair is used, the stretchability of the hair is limited and thus, when a force exceeding the limit is applied or a force is applied immoderately from the direction in which the hair does not stretch or shrink, stress is applied to the hair and the hair is damaged. In addition, the term "restrictedly" is used because, when vibration is applied, for example, so that the hair between (held by) the arms is pulled in one direction, hair roots are pulled accordingly and excessive stress is also applied to the hair roots. Therefore, vibration is applied only to the pinched part of the hair sandwiched between (held by) the arms via the vibrator, so that the partial hair treatment is achieved by "repeatedly" applying the force in the stretching direction to the part by means of the vibrators, in other words, applying the force so as to make, so to speak, a reciprocating motion. Thus, the present invention eliminates the risk of applying stress or damage to hair roots.

**[0056]** The vibrator will be concretely described below with reference to Fig. 1A and Figs. 2 to 3E. Here, Fig. 2 is a schematic diagram illustrating a state before the hair style treatment device 1 of this embodiment shown in Fig. 1 is caused to hold hair 99, and it is also a perspective diagram illustrating the hair style treatment device 1 in which the vibrator 9 is disposed in the arm 2B of the hair style treatment device 1 and a fixing member 15 is disposed in the arm 2A and which is partially omitted. Fig. 3A is a diagram schematically illustrating only the fixing member 15 and the vibrator 9 shown in Fig. 1A, where the sliding direction of the vibrator is indicated by an arrow A. Furthermore, Figs. 3B to 3E are diagrams schematically illustrating a state in which the vibrator 9 slides with the hair 99 held and also diagrams illustrating a state in which the sliding vibrator 9 moves (slides) in the width direction of the arm (in the left or right direction from the center of the paper (the direction of the arrow of Fig. 3A)) with reference to the fixing member 15.

**[0057]** The double lines in the hair 99 shown in Figs. 3B to 3E are drawn to facilitate understanding of the stretching and shrinking motion of the hair to which vibration is to be applied. Hereinafter, the same applies to Figs. 5B to 5E, Figs. 7B to 7E, Figs. 9B to 9E, Figs. 11B to 11E, Figs. 13B to 13E, and Figs. 15B to 15E.

**[0058]** As shown in Fig. 3A, the vibrator 9 applies vibration (slides) in the width direction of the arm 2B (shown in Fig. 2), namely in the lateral direction (the width direction of the arm) with reference to the fixing member 15. When vibration is applied with the hair 99 held by the vibrator 9 and the fixing member 15 as shown in Fig. 3B, the hair 99 is stretched in the left direction as shown in Fig. 3C. The application of vibration is repeated reciprocally and therefore, as shown in Fig. 3D, the stretching of the hair disappears when the vibrator 9 returns to the position before starting the application of the vibration (the former position which is the same as in Fig. 3B). Specifically, the hair shrinks in comparison with the stretched hair and returns to the former state (length) inherent in the hair before the stretching. Further, when the vibrator slides in the right direction as shown in Fig. 3E, the hair is stretched in the right direction in concert with the sliding motion. Thereafter, the aforementioned series of motions are repeated. In this manner, while vibration is applied to the hair, the vibrator slides repeatedly in the width direction of the arm, and therefore the reciprocating stretching and shrinking motion of the hair is made in concert with the sliding motion. Particularly, the repetition of the sliding motion of the vibrator in the width direction limits the vibration application region on the hair to a restricted region, instead of the whole hair, and therefore it leads to a repetition of a cycle in which the hair is restrictedly pulled or the pulling force is released. Therefore, this kind of partial pulling force applies vibration to the hair in an almost natural state without applying stress to hair roots, thereby preventing stress or damage to the hair.

**[0059]** Moreover, as a hair style treatment device in which one or more vibrators are disposed in each of the arm bodies, there is an example in which one vibrator is disposed in each of the upper and lower arms (one and the other arms) such as, for example, the hair style treatment device shown in Fig. 4.

**[0060]** Specifically, in the hair style treatment device shown in Fig. 4, the vibrator 9 (9a, 9b) is disposed in each of the upper arm (one arm 2a) and the lower arm (the other arm 2b) and these vibrators 9 are adapted to slide in the opposite direction (between the upper and lower vibrators) as shown in Fig. 5A. Then, as shown in Fig. 5B, when vibration is applied with the hair held by the vibrators 9 (9a, 9b) in the upper arm 2a and the lower arm 2b, sliding in the right direction of the vibrator 9a in the upper arm 2a is performed simultaneously with sliding in the left direction of the vibrator 9b in the lower arm 2b, and the hair is stretched in the left or right direction at each sliding motion (See Fig. 5C). Subsequently, sliding in the left direction of the vibrator in the upper arm 2a is performed simultaneously with sliding in the right direction of the vibrator in the lower arm 2b, and when the

vibrators return to the former positions before the vibration is applied in the same manner as in Fig. 5B, the stretching of the hair disappears (See Fig. 5D). Further, the vibrator in the upper arm slides in the left direction from the former position (the former position before the vibration is applied) shown in Fig. 5E, and at the same time the vibrator in the lower arm slides in the right direction, by which the upper arm and the lower arm apply forces to the hair in different directions, respectively. In this manner, the hair style treatment device is able to stretch the hair moderately. Therefore, the vibrators in the upper and lower arms slide in the left and right directions, respectively, by which vibration is repeatedly applied to the hair held by the upper and lower arms via the vibrators in the left and right directions. In other words, with the repetition of the cycle in which the hair is restrictedly pulled or the pulling force is released, the force in the stretching direction is repeatedly applied to a restricted part of the hair in an almost natural state.

**[0061]** The sliding of the vibrators is not limited to the sliding pattern in which the vibrators slide in the direction opposite to each other as described above, but the vibrators may be adapted to slide in the same direction at a time, instead of sliding in the direction opposite to each other. More specifically, the vibrators disposed in the upper arm and the lower arm may be adapted to apply vibrations in the left or right direction at the same time. In other words, as long as the vibrators slide repeatedly in the left and right directions (in the width direction of the arm), the hair style treatment device is able to provide at least the advantageous effect of the present application. Note that, however, in terms of causing the hair to stretch or shrink restrictedly, it is more preferable to slide the vibrators in the direction opposite to each other as described above since the hair is caused to stretch or shrink more easily.

**[0062]** Fig. 4 is a perspective diagram schematically illustrating a hair style treatment device, which is partially omitted. Fig. 5A is a front view schematically illustrating the vibrators disposed in the upper arm (one arm) and the lower arm (the other arm) viewed from the direction of the tip of the arm (from the side indicated by the arrow A), in which other members are omitted. Moreover, Figs. 5B to 5E are diagrams each schematically illustrating a state in which the hair is held by the vibrators disposed in the upper arm and the lower arm.

**[0063]** Furthermore, as another example in which one vibrator is disposed in each of the arms, there is a hair style treatment device shown in Fig. 6. In the hair style treatment device in Fig. 6, one vibrator 9a and one fixing member 15a are disposed in the upper arm 2a and one vibrator 9b and one fixing member 15b are disposed in the lower arm 2b. By disposing at least one vibrator in each arm in this manner, stress for holding the hair is applied to the contact surface between each vibrator and the hair. When the vibrators slide in the width direction of the arm and in the direction opposite to each other at the same time, stress generated along with the sliding of the vibrators is further applied to the hair, by which the hair is pulled in the sliding direction along with the sliding of the vibrators. Then, the vibrators slide in the direction opposite to each other at the same time as described above, and therefore when the vibrators slide respectively, stress in the direction opposite to each other is applied to the contact surfaces of the hair in contact with the vibrators, respectively. In other words, the stress in the direction opposite to each other acts on one and the other sides of the hair, thereby enabling the hair to stretch and shrink repeatedly and limiting the region for stretching and shrinking motion to a restricted part.

**[0064]** More specifically, as shown in Fig. 7A, when the vibrator 9a in the upper arm 2a and the vibrator 9b in the lower arm 2b are caused to apply vibration, the vibrator 9a in the upper arm slides with getting closer to or farther away from the fixing member 15a disposed in the width direction of the same upper arm 2a and the vibrator 9b in the lower arm slides with getting closer to or farther away from the fixing member 15b disposed in the width direction of the same upper arm 2b. Specifically, when the vibrators are caused to apply vibration to the hair with the hair held by the vibrators and fixing members as shown in Fig. 7B, the vibrators repeat sliding as shown in Figs. 7C to 7E, and the fixing members 15a and 15b disposed in the respective arms hold the hair during the sliding of the vibrators 9a and 9b, which causes a repetition of the cycle in which the hair between the fixing members and the vibrators is restrictedly pulled and the pulling force is released. Therefore, the hair style treatment device is able to restrictedly and repeatedly apply a force in the stretching direction to the hair in an almost natural state.

**[0065]** Accordingly, the hair stretches or shrinks only in a range of the length of the hair in the contact region between the vibrators, in other words, the range in which the hair stretches or shrinks is limited to a restricted region from before the vibrators slide to after the vibrators slide at the maximum sliding distance, thereby enabling the hair treatment without load such as stress or damage to hair roots as well as to the whole hair.

**[0066]** Although two vibrators slide in the same direction at a time in the above example, naturally this embodiment includes the hair style treatment device in which vibrators sliding in the direction opposite to each other since the vibrators slide repeatedly, as long as the hair style treatment device provides the advantageous effect of the present application. It is because the vibrators facilitate the stretching and shrinking motion of a restricted part of the hair, thereby providing the advantageous effect of the present application. Note that, however, the latter vibrators sliding in the direction opposite to each other are more preferable since they are able to stretch or shrink more easily, in terms of causing the restricted part of the hair to stretch or shrink.

**[0067]** Moreover, as the shape of the vibrator, the vibrator may be, for example, a plate-like member as shown in Figs. 1A to 4, but the shape is not limited thereto.

As long as a member is able to repeatedly apply a force in the stretching direction of the hair to a restricted part of the hair in an almost natural state along the width direction of the arm 2B (or the arm 2A) with the hair held by the arm body 2, the member is thought to be suitable for the vibrator in this embodiment and therefore the vibrator in this embodiment may be formed of the member (shape or the like).

**[0068]** Moreover, the size of the vibrator is not particularly limited. For example, the vibrator may be formed in a size so as to occupy the full width of the arm (See Fig. 1A) or may be formed in size so as to occupy only a part of the width of the arm. If the vibrator is formed in the size shown in Fig. 1A, a wide area can be maintained to hold the hair. If the vibrator is formed in the size shown in Fig. 8A, the vibrator is able to apply vibration to a more restricted part of the hair so as to be preferable. Hereinafter, the hair style treatment device shown in Fig. 8A will be described.

**[0069]** In the hair style treatment device shown in Figs. 8A and 8B, at least one vibrator and at least one fixing member are disposed in parallel in the width direction of the arm body. Specifically, the vibrator 9 and the fixing member 15 are disposed in parallel in the width direction in the lower arm 2b and one fixing member 15 is disposed in the upper arm 2a. In addition, the vibrator is disposed so as to slide in the width direction in a part of the lower arm as shown in Fig. 9A. When the vibrator and the fixing member are disposed in the arm and thereby the vibrator and the fixing member are caused to hold hair so as to apply vibration to the hair as shown in Fig. 9B, the vibrator slides in a part of the lower arm as shown in Figs. 9C to 9E and therefore the hair stretches and shrinks on a widthwise part of the arm. Specifically, the vibration is restrictedly applied to the hair so as to limit the applied range to a part between the fixing member and the vibrator, thereby facilitating the hair to restrictedly stretch in the lateral direction. In other words, vibration is repeatedly applied only to this part of the hair, which prevents the hair from being pulled excessively and thus enables a further reduction in the stress on hair roots. This causes the repetition of the cycle in which the hair is restrictedly pulled or the pulling force is released, and therefore the hair style treatment device is able to restrictedly and repeatedly apply a force in the stretching direction to the hair in an almost natural state.

**[0070]** The above embodiment is illustrative only and is not limited to the disposition or the like of the sliding body and the fixing member shown in Fig. 8A. As long as at least one vibrator and at least one fixing member are disposed in parallel in the width direction of the arm body such that, for example, a vibrator and a fixing member are disposed in the upper arm and only a fixing member is disposed in the lower arm, the hair style treatment device having the configuration is included in this embodiment.

**[0071]** In addition, in the case where at least one vibrator and at least one fixing member are disposed in parallel in the width direction of the arm body, preferably the vibrator and the fixing member are disposed spaced apart from each other in the width direction of the arm body. It is because, if the vibrator and the fixing member are disposed spaced apart from each other in the width direction of the arm body, it is possible to moderately maintain the region in which the vibration is applied and to slide the vibrator smoothly without hindering the sliding. Moreover, the disposition facilitates the securing of a space in which the vibrator and the fixing member are placed and facilitates the placement of other members or the like around the vibrator and the fixing member.

**[0072]** In addition, the term "the vibrator and the fixing member are disposed spaced apart from each other in the width direction of the arm body" means that the vibrator and the fixing member disposed in the arm are placed in the width direction of the same arm without being in contact with each other. If the vibrator and the fixing member are placed in contact with each other, instead of being spaced apart, the vibrator cannot slide enough to fully stretch or shrink the hair in some cases.

**[0073]** Furthermore, it is preferable that at least two vibrators are disposed in parallel in the width direction in one or both of the arm bodies. This disposition enables the hair to reliably stretch in the lateral direction more easily with the region for stretching and shrinking motion limited only to the part in which two vibrators are disposed. Specifically, it is possible to apply vibration so as to stretch the hair repeatedly only by the length of the hair in contact with the two vibrators, and therefore the vibrators slide repeatedly in the lateral direction, thereby stretching the hair. In addition, since the region for the stretching and shrinking motion is limited, it is possible to reduce stress on hair roots and to provide the advantageous effect of the present application.

**[0074]** Assuming that at least two vibrators are disposed in parallel in the width direction in one or both of the arm bodies, there are, for example, the following cases: (1) two or more vibrators are disposed in one of the arm bodies; and (2) two or more vibrators are disposed in both of the arm bodies.

**[0075]** In the case (1) where two or more vibrators are disposed in one of the arm bodies, preferably the vibrators are adapted to slide repeatedly in the width direction of the arm (the vibrators slide in the lateral direction with reference to the fixing member) with the hair held between the vibrators and the fixing member disposed in the other arm body. This fixing member holds the hair as a so-called fixing plate or holding plate of the hair in cooperation with the vibrators. Thus, when holding the hair, the fixing member and the vibrators disposed so as to be opposed to the fixing member apply stress (for holding the hair) to at least both side surfaces of the hair. Then, when the vibrators slide in the width direction of the arm, the vibrators apply moderate stress to the side surface of the hair on the side which contacts the fixing member and the hair attempts to stay at the contact area. On the other hand, on the side surface of the hair on the side

which contacts the vibrators, the sliding of the vibrators apply stress also to the fixing member side, but a force applied in the sliding direction of the vibrators is larger than the stress and therefore the other contact surface (area) of the hair is pulled in the sliding direction along with the sliding of the vibrators. Accordingly, the hair stays in the surface contacting the fixing member on one side of the hair, while the hair is pulled in the width direction of the arm on the other side of the hair, by which the hair restrictedly stretches and shrinks. In other words, by arranging the fixing member, the region in which the hair stretches or shrinks is limited only to the length of the hair corresponding to the contact region between the fixing member and the vibrators, that is, limited to a restricted region in which the vibrators slide with reference to the fixing member. In this manner, the vibration application region in which the hair is stretched or shrunk is limited to the sliding region of the vibrators, thereby enabling the hair treatment without load such as stress or damage to hair roots as well as to the whole hair.

**[0076]** In particular, there is an example of a hair style treatment device shown in Fig. 10. As shown in Fig. 10, a fixing member 15a is disposed in an upper arm 2a and two vibrators 9b and 9b are disposed spaced apart from each other in the width direction on a lower arm 2b, and the vibrators are adapted to slide in the opposite direction. In this arrangement in which the two vibrators sliding in the opposite direction are disposed, the vibrators 9b and 9b slide in the directions opposite to each other in the width direction of the lower arm 2b as shown in Fig. 11A. Thus, with the hair held by the fixing member 15a and the two vibrators 9b and 9b, the vibrators slide in the width direction of the arm repeatedly as shown in Figs. 11B to 11E. Specifically, it is possible to facilitate the stretch of the hair reliably in the lateral direction while the part in which the hair is stretched or shrunk is limited only to a portion of the hair held by the two vibrators and the fixing member disposed in parallel in the width direction of the arm. Concretely, the fixing member serves as a so-called fixing plate or holding plate of the hair to be stretched or shrunk via the vibrators, and even if the two vibrators slide in the width direction of the arm, the vibrators apply moderate stress to the hair surface on the side which contacts the fixing member, by which the hair attempts to stay in the contact area. On the other hand, the two vibrators disposed so as to be opposed to the fixing member apply stress for holding the hair to at least the hair surface on the vibrator side. When the two vibrators slide in the width direction of the arm, however, a force applied in the sliding direction of the vibrators is greater than the stress on the hair surface on the vibrator side, and therefore the hair is pulled in the sliding direction along with the sliding of the two vibrators. Thus, while the hair stays in the surface contacting the fixing member on one side of the hair, the hair stretches or shrinks on the other side because the hair is pulled or released so as to stretch in the width direction of the arm by the sliding of the vibrators in the opposite direction. Further, the region in which the hair stretches or shrinks is limited only to the length of the hair corresponding to the contact region between the fixing member and the vibrators, that is, limited to a restricted region in which the vibrators slide with reference to the fixing member. Therefore, it is possible to apply vibration so as to stretch the hair repeatedly only by the length of the hair which contacts the two vibrators in the upper arm (or two vibrators in the lower arm) and to stretch the hair reliably since the sliding bodies slide in the opposite and lateral direction repeatedly. In addition, the region for stretching and shrinking motion is restricted, and therefore it is possible to reduce stress on hair roots and to provide the advantageous effect of the present application.

**[0077]** Moreover, as an example (2) in which two or more vibrators are disposed in both of the arm bodies, a hair style treatment device shown in Fig. 12 can be taken as an example. In Fig. 12, two vibrators are disposed in each of the upper arm 2a and the lower arm 2b. If the vibrators are disposed in this manner, the four vibrators slide in the direction opposite to each other along the width direction of the arms as shown in Fig. 13A. More specifically, a pair of vibrators, namely a vibrator 9c disposed in the upper arm 2a and a vibrator 9e disposed in the lower arm slide with holding the hair, and a pair of vibrators, namely a vibrator 9d disposed in the upper arm 2a and a vibrator 9f disposed in the lower arm slide with holding the hair. Further, the sliding motion is carried out with the hair held by the pair of the vibrator 9c and the vibrator 9e and the pair of the vibrator 9d and the vibrator 9f while getting closer to or farther away from each other.

**[0078]** If the vibrators 9c, 9d, 9e, and 9f are caused to slide with holding the hair, the respective vibrators repeatedly and reliably stretch the hair in the longitudinal direction thereof (in the lateral direction on the paper plane of Figs. 13B to 13E) while limiting the region for stretching and shrinking motion only to a restricted region in the width direction of the arm as shown in Figs. 12B to 12E. Specifically, a cyclic vibration for pulling the hair so as to be restrictedly stretched or shrunk repeatedly or for releasing the pulling force is applied only to the part of the hair which contacts the two vibrators in the upper arm (or the two vibrators in the lower arm). Moreover, the vibrators repeatedly slide in the direction opposite to each other and in the longitudinal direction of the hair, thus enabling the hair to stretch reliably. In addition, the region for stretching and shrinking motion is limited, thereby enabling the stress on hair roots to be reduced and providing the advantageous effect of the present application. Further, vibration can be applied to both of the upper and lower surfaces, thereby enabling the hair to stretch reliably.

**[0079]** Moreover, preferably the amplitude of the vibration of the vibrators is within a range of 0.0001 mm to 10 mm, and more preferably within a range of 0.2 mm to 1 mm. Specifically, the application of the amplitude within the predetermined range facilitates the force in the stretching direction to be restrictedly and repeatedly ap-

plied to the hair in an almost natural state without applying stress, thereby not only enabling the use of the stretchability inherent in the hair, but also facilitating the exertion of cutting of cystine linkage, salt linkage, hydrogen linkage, and the like in keratin of the hair into the details thereof. In other words, it is possible to maintain the elasticity and texture of the hair without damage caused by the application of an excessive force in the stretching direction. In addition, it is thought that the hair style treatment, if performed while applying vibration in a specific direction, promotes penetration of the first liquid to the hair to soften the hair and thereby enhances the effect of the first liquid. Therefore, it is one of the preferable modes to specify the amplitude value as described above.

**[0080]** Furthermore, it is also one of the preferable modes that the vibration generated by the vibration means can be applied to one or more, alternate, or all of the vibrators. Since it is possible to appropriately select the application of vibration in the hair treatment process, smooth treatment is able to be performed so as to be preferable. Moreover, there are great differences between individuals in the properties of hair and the individual differences often affect the hair treatment process. In this manner, vibration is made selectable so that the vibration can be applied appropriately, thereby achieving a flexible treatment based on the individual differences.

**[0081]** Further, the aforementioned hair style treatment device more preferably includes a first vibrator sliding in the width direction of the arm and a second vibrator slidable along the longitudinal direction of the arm or a perpendicular direction to the arm. With the provision of the first vibrator capable of applying vibration to hair along the width direction of the arm, the hair style treatment device is able to apply vibration to hair in the longitudinal direction of the hair repeatedly. Specifically, the hair style treatment device is able to apply the styling treatment in the stretching direction of the hair and therefore is able to give natural texture and to perform the hair style treatment without damaging the hair so as to be preferable. Further, with the provision of the second vibrator slidable along the longitudinal direction of the arm in addition to the first vibrator, the hair style treatment device causes the hair to perform a reciprocating rotational motion. Therefore, the hair style treatment device is able to apply the styling treatment to the hair without a collapse of the cross section of the hair. This configuration enables the styling treatment to be applied in the stretching direction of the hair, for example, after or before fixing the cross section of the hair into a circle by causing the hair to perform the reciprocating rotational motion, thereby facilitating a styling treatment suited for individual properties and enabling a hair treatment which brings out texture and beauty inherent in the hair.

**[0082]** Moreover, in the case where the second vibrator is slidable along the perpendicular direction of the arm in addition to the first vibrator, the hair style treatment device is able to maintain a constant contact pressure and thus able to perform a uniform hair treatment so as to be preferable. For example, when vibration is applied to the hair, it is sometimes preferable to bring the hair into contact with the vibrator at a strong contact pressure. In the case of a cylindrical hair iron, hair is wrapped around the outer peripheral surface of the vibrator, the hair is sandwitched between the vibrator and a supporting member, and the hair is then pushed to the vibrator for the above reason. Further, in the case of a flat iron, hair is sandwitched between the upper and lower arms and the arms are pushed strongly to the vibrators in some cases. In this case, the hair style treatment device includes a second vibrator capable of applying vibration in the thickness direction of the arm, thereby achieving the same effect by means of the vibration of the vibrator itself without pushing the vibrators or the arm strongly. In addition, the hair treatment is performed by pinching the hair at the bottom between the arms and moving the iron in the direction of the tip of the hair in many cases. In this case, however, the quantity of the hair decreases toward the tip, which leads to a problem that the contact pressure to the iron is lowered. Therefore, the hair style treatment device is provided with the second vibrator which is capable of applying vibration in the thickness direction, thereby enabling a constant contact pressure to be maintained and thus achieving the uniform hair treatment so as to be preferable.

**[0083]** Concretely, an arm is formed as shown in Fig. 1A by using cam mechanism 10 or 60 as shown in Figs. 18A to 18C, thereby enabling the application of vibration along the perpendicular direction.

**[0084]** More preferably, the application of vibration to hair can be performed by only one of the first and second vibrators, by the vibrators alternately, or by both of the vibrators at a time. The hair style treatment device thus adapted to be able to select the application of vibration to hair appropriately enables an appropriate smooth hair treatment and enables the texture and beauty inherent in the hair to be brought out, so as to be preferable. Further, the hair treatment can be performed in accordance with individual properties of the hair. Particularly, there are great differences between individuals in the hair before the hair style treatment, and there may well be a situation in which hair has already been damaged before styling treatment in some cases. For such hair, it is sometimes appropriate to apply vibration in an almost oblique direction relative to the longitudinal direction of the hair before and after causing the hair to perform the stretching and shrinking motion in the stretching direction of the hair or before and after causing the hair to perform the reciprocating rotational motion. Particularly, the application of vibration in the oblique direction might reduce the damage to the hair depending on the damaged hair. Therefore, the hair style treatment device is adapted to be able to apply vibration to the hair repeatedly in the oblique direction as described above.

**[0085]** Concretely, as shown in Fig. 14, one second vibrator sliding in the longitudinal direction of the arm is

disposed in the upper arm 2a and one first vibrator sliding in the width direction of the arm and one fixing member are disposed in parallel in the lower arm 2b. If the first vibrator and the second vibrator are disposed in the respective arms as described above, the first vibrator slides in the width direction of the lower arm and the second vibrator disposed in the upper arm slides in the longitudinal direction of the arm as shown in Fig. 15A. Specifically, if the sliding body disposed in the upper arm 2a and the sliding body disposed in the lower arm slide while holding the hair as shown in Fig. 15B, the held hair is subjected to a force for generating the stretching and shrinking motion in the width direction of the arm and a force for generating a rotational motion in the longitudinal direction of the arm repeatedly and restrictedly as shown in Figs. 15C to 15D. In this condition, stress in an oblique direction relative to the longitudinal direction of the hair is applied restrictedly and repeatedly due to the application of the forces to the hair in the respective directions. Therefore, the hair style treatment device is able to cause the stretching and shrinking motion and the rotational motion according to individual properties of the hair and to reduce the stress on hair roots due to the limitation of the region of the hair in which vibration is applied.

**[0086]** The above example, however, is illustrative only and not limited to these configurations. For example, even if the hair style treatment device includes one first vibrator disposed in the upper arm, instead of in the lower arm, and two second vibrators disposed in the lower arm, instead of in the upper arm, the hair style treatment device is included in this embodiment. Further, the number of first vibrators and second vibrators to be disposed or the like may be appropriately selectable.

[1-5] Fixing member:

**[0087]** The fixing member in this embodiment is used for holding hair together with the aforementioned vibrator or vibrators.

**[0088]** In addition, normally the fixing member is not used for applying vibration to hair like a vibrator, but is used for holding hair, that is, for fastening hair to the surface contacting the fixing member without collapsing the cross section of the hair on the upper surface of fixing member (or the lower surface of the fixing member).

**[0089]** More preferably, however, at lest one of the fixing members serve as vibrators, because it enables vibration to be appropriately applied more easily according to individual properties of the hair.

**[0090]** Moreover, the shape of the fixing member may include, for example, a plate-like, circular, elliptical, and the like. The shape, however, is not limited to these. As long as the fixing member has a shape enabling the fixing member to be disposed in the width direction of the arm and enabling the fixing member to hold hair easily, the shape can be preferably used in this embodiment.

**[0091]** Moreover, the material of the fixing member may be, for example, metal, ceramic, resin, or the like.

[1-6] Relationship between vibrator and its peripheral members:

**[0092]** The configuration of the vibrator, the configuration of its peripheral members, and the relationship between the vibrator and its peripheral members will be described below with reference to Figs. 1A, 1B, and 16.

**[0093]** In the hair style treatment device 1 shown in Figs. 1A and 1B, a motor 22 which is the vibration generation means 3 to be a power source is disposed in the lower arm 2b which is one arm, and the vibrator 9 is disposed in the lower arm 2b. Further, on the surface side of the vibrator 9 opposite to the surface on which the hair is held, there is disposed a connecting portion 11a for connecting the vibrator 9 and the vibration transmitter 25 to each other and there is disposed a joining portion 11b as a joint which constitutes a part of the vibration transmitter 25 and transmits the vibration of the vibration transmitter 25 to the vibrator via the connecting portion 11a. The connecting portion 11a and the joining portion 11b constitute the connection structure 11.

**[0094]** With this connection structure 11, the vibration generated by the vibration means 3 is transmitted to the vibration transmitter 25 via the cam mechanism 10 composed of an eccentric cam 23 and a cam 24 and further transmitted from the vibration transmitter 25 to the vibrator 9 via the cam mechanism 10 (See Fig. 18A) composed of the eccentric cam and the cam. In this manner, vibration is transmitted from the vibrator 9 to the hair. In other words, upon receiving the vibration from the motor 22 via the cam mechanism 10, the vibration transmitter 25 repeats sliding (vibration) along the width direction of the arm. Further, the vibration is transmitted from the vibration transmitter 25 to the vibrator 9 via the cam mechanism 60 (See Figs. 18B and 18C) composed of an eccentric cam 63 and a cam 64 and connection structure 11. Moreover, upon receiving the vibration, the vibrator 9 transmits the vibration to the hair in the width direction of the arm.

**[0095]** Moreover, as shown in Fig. 16, an opening 12 is formed in the vibrator holding portion of the arm. Opening ends 12a and 12b are formed at both ends of the opening 12 in the width direction of the opening 12.

**[0096]** The opening 12 is formed in this manner because the vibration transmitter 25 slides along the longitudinal direction of the arm and the L-shaped portion 11b (See Fig. 17) constituting the connection structure 11 via the cam mechanism slides between the opening ends 12a and 12b along the width direction of the arm. In this regard, the L-shaped portion 11b preferably slides so as not to abut against each of the opening ends 12a and 12b. Granted that the L-shaped portion 11b abuts against the opening ends, the abutment is preferably so small as to be negligible in contact. It is because a direct hit of the L-shaped portion 11b against the opening ends 12a and 12b makes it difficult to transmit the vibration of the vibration means 3 to the vibrator 9 accurately and to apply vibration to the hair repeatedly so that the hair restrictedly

stretches and shrinks in the longitudinal direction of the hair.

**[0097]** Moreover, in the case of occurrence of the abutment so small as to be negligible in contact between the L-shaped portion 11b and the opening end 12a or 12b, preferably the aforementioned cam mechanism is adjusted so that the L-shaped portion is slidable only by the width dimension of the opening 12, that is, by the width dimension between the aforementioned opening ends 12a and 12b.

**[0098]** The maximum movement of the vibrator 9 in the arm width direction in the case of moving along the width direction of the arm is available when the L-shaped portion 11b of the connection structure 11 abuts against the opening end 12a. In other words, the vibrator 9 is adapted to be slidable between both sides of the maximum movement distance in the arm width direction.

**[0099]** Moreover, in the case where the L-shaped portion 11b of the connection structure 11 abuts against the opening ends 12a and 12b, the L-shaped portion 11b (or the opening ends 12a and 12b) serves as, so to speak, a stopper, and therefore preferably the opening ends 12a and 12b and the connection structure 11 are made of a material having excellent pressure resistance, abrasion resistance, heat resistance, and the like in order to prevent excessive load (shock) on both ends.

**[0100]** Moreover, as shown in Fig. 17, the vibrator 9 is adapted to be slidable along the width direction of the arm in a recess 13 formed in the width direction of the arm. The configuration, however, is not limited thereto, but the vibrator may be adapted to be slidable on the arm 2B without the provision of the recess, for example. Further, as shown in Fig. 17, it is preferable to provide abutment ends 14a and 14b at the ends of the recess which exist in the width direction of the arm when the recess is formed, because the vibrator 9 slides only within the recess so as to facilitate the control of the vibration applied to the hair. In addition, if the vibrator slides more than desired, the vibrator might apply vibration to the hair more than required, and therefore it is preferable to control the vibration so that the vibrator slides within the desired range. Furthermore, if the abutment end 14a and the abutment end 14b are provided in the recess, it is preferable to adjust the width dimensions of the vibration transmitter 25 and the like so as not to impose excessive load on the abutment end 14a and the abutment end 14b. In addition, a vibrator holding portion 16 is preferably provided since the provision of the member having the abutment ends in the arm 2B facilitates the formation of the recess in the arm 2B.

**[0101]** While Fig. 17 shows the vibrator 9, which is held by the connection structure 11 and does not abut against the recess 13, the configuration is not limited thereto, but the vibrator may be adapted to be slidable with abutting against (contacting) the recess 13. In the case where the vibrator slides with abutting against (contacting) the recess 13, preferably the vibrator and the abutment (contacting) portion of the recess which abuts against (contacts) the vibrator are made of a material having excellent abrasion resistance.

**[0102]** In addition, it is also preferable to cover the recess in which the vibrator is disposed to prevent the hair from entering the gap between the vibrator and the abutment end 14a or the abutment end 14b of the recess. The covering member may be rubber or the like, but as long as the material has elasticity and vibration transmissibility, the recess may be covered by the material.

**[0103]** In addition, it is also preferable to form the device body 4A as a first gripper in the hair style treatment device 1 as shown in Fig. 19. Furthermore, it is also preferable to attach a second gripper 4B grippable by a hand to the arm 2A integrally with or in conjunction with the arm 2A as shown in Fig. 19, and to cause one arm 2A and the other arm 2B to rotate freely via the connecting mechanism 5 (with a rivet portion 8 as a base shaft) by bringing the first gripper 4A which is the device body close to or away from the aforementioned second gripper by the hand, because this configuration enables the arm body to hold or release the hair smoothly.

**[0104]** Furthermore, preferably a temperature heater is disposed in one or the other arm or in the device body so as to provide a temperature when the hair is held. As shown in Figs. 20A and 20B, it is also preferable to provide the hair iron 1 with a means for applying heat to the hair by incorporating a vibrator-embedded heater 49 into the upper and lower arms (one and the other arms). If the arms 2A and 2B are directly heated in this manner, the temperature is preferably able to be controlled in a range of 60°C to 280°C. In the hair style treatment device capable of performing a styling treatment for hair softened by applying or spraying a softening agent with minimum damage to the hair and capable of keeping the hair style after the treatment for a long term by exerting a strong styling effect to the hair, it is possible to perform a styling treatment stronger than conventional if the treatment is performed in a heating temperature range almost equivalent to that of the conventional treatment device.

**[0105]** Most preferably, the temperature in a range of 100°C to 120°C is applied in the above temperature application. Even in a low temperature treatment at 120°C or lower, it is possible to perform a more effective styling treatment than in the conventional device and thus to provide a strong styling treatment.

[1-7] Configuration of hair iron:

**[0106]** The hair style treatment device configured as a hair iron is also one of preferred embodiments. Further, the hair iron preferably has a configuration in which the vibrators 9 are disposed in the arms 2A and 2B, respectively, in the hair style treatment device, for example, as shown in Fig. 1 or 19 and vibration generated by the vibration means 3 is applied to one or both of the vibrators 9 or to these two vibrators alternately, because this configuration enables a specific part of the hair to stretch or shrink repeatedly and thus enables the advantageous

effect of the present application to be achieved.

**[0107]** In addition, it is also preferable to provide the hair style treatment device with a control switch in order to control the vibration and the magnitude of the amplitude thereof or a frequency selection switch in order to resonate the hair iron itself or to resonate the arms 2A and 2B directly contacting the hair and at the same time in order to use the hair iron with an enhanced amplitude or change its resonance frequency. The resonance frequency of the arms 2A and 2B can also be changed by changing the thickness, width, or shape of the arms 2A and 2B.

**[0108]** It is also preferable to form a portion of the hair iron to be brought into contact with the hair from an elastic material such as rubber. Such a hair iron is desired because it can reduce the contact pressure to the hair and therefore the hair can keep its soft circular cross section without being damaged.

**[0109]** Further, it is also one of the preferable modes that the contact surface brought into contact with the hair in one or both of the vibrators is formed into gentle waves, because not only it reduces the contact pressure to the hair but also facilitates curling of the hair. In addition, due to the surface treatment of the gentle waves, the hair is not damaged and can keep its soft circular cross section, thus it is preferable.

[1-7-1] Gripper of hair iron:

**[0110]** As shown in Fig. 19, if the vibration means 3 is disposed in the gripper 4A, it is preferable to dispose a vibration isolator. It is because, when the hair iron 1A itself vibrates, the vibration transmits also to the hand of a person who grips the grippers 4A and 4B. For example, as shown in Fig. 21, the hair iron is composed as a hair iron 31 including a vibration absorber 40 such as a dynamic vibration absorber disposed as a vibration isolator in the gripper 4A.

**[0111]** The gripper is preferably made of a metal material such as titanium alloy, duralumin, aluminum alloy, or steel and formed by cutting a columnar metal material. In addition, if the gripper is the device body, the vibration means 3 is often incorporated (disposed) therein. Therefore, in this case, it is preferable to form the gripper into a hollow shape. The material, however, is not limited to the above metal material and it is not limited to the column shape or the like. The gripper may be made of any material as long as the material is excellent in vibration resistance and lightweight properties and at the same time it has heat resistance. A material easy to hold with a hand, excellent in operability, and having a shape facilitating the disposition of the above structural member such as the aforementioned vibration means is a preferred embodiment for forming the gripper of the hair iron. As described above, a lightweight gripper is preferable, because an excessively heavy gripper may interrupt the hair styling work.

[1-8] Method of using hair style treatment device:

**[0112]** The hair style treatment device of this embodiment shown in Fig. 1 is used with the hair held by the arms via the vibrator and the fixing member as shown in Fig. 23. More specifically, the hair style treatment device is used as described below. One arm 2A and the other arm 2B are opened. Then, the hair after softening treatment is placed between the opened arms 2A and 2B and sandwiched so as to be held between them and is abutted against the vibrator. The hair style treatment device 1 is turned on to apply vibration to the hair. If another hair is abutted against the vibrator 9 of the arm 2B, one arm 1A and the other arm 2B are opened again to adjust the position of the hair abutted against one or the other arm and the above process is repeated. If the hair is wrapped around the arm 2B, uneven wrapping thickness may lead to failure in obtaining a sufficient advantageous effect. Therefore, it is preferable to wrap the hair so as to abut against the vibrator without unevenness. Further, in the hair style treatment device of this embodiment shown in Fig. 19, the second gripper 4B is spaced apart from the first gripper 4A to open one arm 2A and the other arm 2B. Then, the hair after softening treatment is wrapped around the arm 2B and abutted against the portion in which the vibrator of the arm 2B is disposed. The gripper 4B is brought close to the gripper which is the device body 4A by a hand, so that the arm 2A and the arm 2B rotate (open or close) to cause the arm body to hold the hair. The hair style treatment device 1 is turned on to apply vibration to the hair. If another hair is abutted against the vibrator 9 of the arm 2B, the gripper 4B and the gripper which is the device body 4A are spaced apart from each other (released) by the hand again to rotate (open) the arm 2A and the arm 2B so that the hair is released from the arms in order to adjust the position of the hair abutted against one or the other arm, and then the above process is repeated. If the hair is wrapped around the arm 2B, uneven wrapping thickness may lead to failure in obtaining a sufficient advantageous effect. Therefore, it is preferable to wrap the hair so as to abut against the vibrator without unevenness.

Industrial Applicability

**[0113]** As described above, according to the present invention, it is possible to exert the cutting of cystine linkage, salt linkage, hydrogen linkage, and the like in keratin of the hair into the details thereof by utilizing the stretchability inherent in the hair by restrictedly and repeatedly applying a force in the stretching direction to the hair in an almost natural state without applying stress to hair roots. Moreover, the hair styling treatment is able to be smoothly performed, thereby reducing treatment time and facilitating the re-bonding of the cystine linkage and the hydrogen linkage thereafter. Further, a strong styling effect is exerted on the hair, thereby providing an excellent advantageous effect of the hair style treatment de-

vice capable of keeping the hair style for a long term after the treatment. Particularly, the present invention enables the treatment at relatively low temperatures and thus prevents hair damage.

## Claims

1. A hair style treatment device for giving a desired style to hair softened by applying or spraying a softening agent or to hair treated by applying a hair-treating agent, the device comprising:

   an arm body (2) having two arms (2A,2B) rotatably connected to each other via a connecting mechanism (5);
   at least one vibration means (3) disposed in one of said arms (2A,2B) or in a device body (4A, 4B) connected to said arm body (2) and generating vibration of a predetermined frequency; and
   at least one vibrator (9) disposed in one or the other arm,
   wherein the arm body (2) is adapted to be able to hold or release the hair via the vibrator (9) by the rotation of the connecting mechanism (5), and
   wherein the vibrator is slidable and able to transmit vibration from the vibration means to the hair thus held,
   **characterised in that** the vibrator (9) is slidable in the width direction of the arm body (2) and is vibrated in the width direction by the vibration means (3).

2. The hair style treatment device according to claim 1, wherein there are at least two said vibrators (9) and at least two of the vibrators are disposed in parallel in the width direction in one or both of the arms (2A,2B).

3. The hair style treatment device according to claim 1 or 2, wherein the vibration generated by the vibration means (3) is able to be selectively applied to arbitrary one or more of the vibrators (9).

4. The hair style treatment device according to one of claims 1 to 3, wherein a temperature heater (49) is disposed in one or the other arm (2A,2B) or in the device body (4A,4B) and heat is able to be applied to the hair when the hair is held.

5. The hair style treatment device according to one of claims 1 to 4, wherein the amplitude of vibration of the vibrator (9) is in the range of 0.0001 mm to 10 mm.

6. The hair style treatment device according to one of claims 1 to 5, wherein the frequency of the vibration means (3) is switchable.

7. The hair style treatment device according to one of claims 1 to 6, wherein the part in contact with the hair of the hair style treatment device is made of an elastic material.

8. The hair style treatment device according to one of claims 1 to 7, wherein a first vibrator (9) which vibrates in the width direction is disposed in the one arm and a second vibrator (53) which vibrates in the longitudinal or thickness direction is disposed in the other arm.

9. The hair style treatment device according to claim 8, wherein the vibration from the first vibrator and the second vibrator to the hair is able to be applied by only one of the vibrators, by the vibrators alternately, or by both of the vibrators at a time.

## Patentansprüche

1. Haarstylingvorrichtung, um Haar, das durch das Auftragen oder Aufsprühen eines Weichmachers weich gemacht wurde, oder Haar, das durch das Auftragen eines Haarbehandlungsmittels behandelt wurde, ein gewünschtes Styling zu verleihen, wobei das Gerät Folgendes umfasst:

   einen Schenkelkörper (2) mit zwei Schenkeln (2A, 2B), die schwenkbar über einen Verbindungsmechanismus (5) miteinander verbunden sind;
   zumindest ein Schwingungsmittel (3), das in einem der Schenkel (2A, 2B) oder einem Vorrichtungskörper (4A, 4B), der mit dem Schenkelkörper (2) verbunden ist, angeordnet ist und Schwingungen mit einer vorbestimmten Frequenz erzeugt; und
   zumindest einen Schwingungserzeuger (9), der in einem oder dem anderen Schenkel angeordnet ist,
   wobei der Schenkelkörper (2) geeignet ist, um das Haar durch den Schwingungserzeuger (9) durch das Schwenken des Verbindungsmechanismus (5) zu halten oder freizugeben, und
   wobei der Schwingungserzeuger verschiebbar und in der Lage ist, Schwingungen von dem Schwingungsmittel auf das so gehaltene Haar zu übertragen,
   **dadurch gekennzeichnet, dass** der Schwingungserzeuger (9) in Richtung der Breite des Schenkelkörpers (2) verschiebbar ist und durch das Schwingungsmittel (3) in Richtung der Breite in Schwingung versetzt wird.

2. Haarstylingvorrichtung nach Anspruch 1, worin zu-

mindest zwei Schwingungserzeuger (9) vorliegen und zumindest zwei der Schwingungserzeuger parallel in Breiterichtung in einem oder beiden Schenkeln (2A, 2B) angeordnet sind.

3. Haarstylingvorrichtung nach Anspruch 1 oder 2, worin die durch das Schwingungsmittel (3) erzeugte Schwingung selektiv an einen beliebigen oder mehrere beliebige Schwingungserzeuger (9) angelegt werden kann.

4. Haarstylingvorrichtung nach einem der Ansprüche 1 bis 3, worin eine Heizvorrichtung (49) in einem oder dem anderen Schenkel (2A, 2B) oder in dem Vorrichtungskörper (4A, 4B) angeordnet ist und Wärme auf das Haar angewandt werden kann, wenn dieses gehalten wird.

5. Haarstylingvorrichtung nach einem der Ansprüche 1 bis 4, worin die Schwingungsamplitude des Schwingungserzeugers (9) im Bereich von 0,0001 bis 10 mm liegt.

6. Haarstylingvorrichtung nach einem der Ansprüche 1 bis 5, worin die Frequenz des Schwingungsmittels (3) einstellbar ist.

7. Haarstylingvorrichtung nach einem der Ansprüche 1 bis 6, worin der Teil der Haarstylingvorrichtung, der das Haar berührt, aus einem elastischen Material besteht.

8. Haarstylingvorrichtung nach einem der Ansprüche 1 bis 7, worin ein erster Schwingungserzeuger (9), der in Richtung der Breite schwingt, in dem einen Schenkel angeordnet ist und ein zweiter Schwingungserzeuger (53), der in Längs- oder Dickerichtung schwingt, in dem anderen Schenkel angeordnet ist.

9. Haarstylingvorrichtung nach Anspruch 8, worin die Schwingung, die durch den ersten Schwingungserzeuger und den zweiten Schwingungserzeuger auf das Haar übertragen wird, nur durch einen der Schwingungserzeuger, durch beide Schwingungserzeuger abwechselnd oder durch beide Schwingungserzeuger gleichzeitig auf das Haar übertragen werden kann.

**Revendications**

1. Dispositif de lissage de cheveux pour donner un lissage souhaité aux cheveux ramollis en appliquant ou en pulvérisant un agent de ramollissement ou aux cheveux traités en appliquant un agent de lissage, le dispositif comprenant :
un corps de bras (2) ayant deux bras (2A, 2B) raccordés en rotation entre eux via un mécanisme de raccordement (5) ;
au moins un moyen de vibration (3) disposé dans l'un desdits bras (2A, 2B) ou dans un corps de dispositif (4A, 4B) raccordé audit corps de bras (2) et générant la vibration d'une fréquence prédéterminée ; et
au moins un vibrateur (9) disposé dans l'un ou l'autre bras,
dans lequel le corps de bras (2) est adapté pour pouvoir tenir ou libérer les cheveux via le vibrateur (9) par la rotation du mécanisme de raccordement (5), et
dans lequel le vibrateur peut coulisser et est capable de transmettre la vibration du moyen de vibration aux cheveux ainsi maintenus,
**caractérisé en ce que** le vibrateur (9) peut coulisser dans le sens de la largeur du corps de bras (2), et est vibré dans le sens de la largeur par le moyen de vibration (3).

2. Dispositif de lissage de cheveux selon la revendication 1, dans lequel il y a au moins deux desdits vibrateurs (9) et au moins deux desdits vibrateurs sont disposés en parallèle dans le sens de la largeur dans l'un ou les deux des bras (2A, 2B).

3. Dispositif de lissage de cheveux selon la revendication 1 ou 2, dans lequel la vibration générée par le moyen de vibration (3) peut être sélectivement appliquée sur un ou plusieurs des vibrateurs (9) de manière arbitraire.

4. Dispositif de lissage de cheveux selon l'une des revendications 1 à 3, dans lequel un dispositif de chauffage (49) est disposé dans l'un ou l'autre bras (2A, 2B) ou dans le corps de dispositif (4A, 4B) et la chaleur peut être appliquée sur les cheveux lorsque les cheveux sont maintenus.

5. Dispositif de lissage de cheveux selon l'une des revendications 1 à 4, dans lequel l'amplitude de vibration du vibrateur (9) est de l'ordre de 0,0001 mm à 10 mm.

6. Dispositif de lissage de cheveux selon l'une des revendications 1 à 5, dans lequel la fréquence du moyen de vibration (3) est commutable.

7. Dispositif de lissage de cheveux selon l'une des revendications 1 à 6, dans lequel la partie en contact avec les cheveux du dispositif de lissage de cheveux est réalisée avec une matière élastique.

8. Dispositif de lissage de cheveux selon l'une des revendications 1 à 7, dans lequel le premier vibrateur (9) qui vibre dans le sens de la largeur est disposé

dans le premier bras et un second vibrateur (53) qui vibre dans le sens longitudinal ou de l'épaisseur est disposé dans l'autre bras.

**9.** Dispositif de lissage de cheveux selon la revendication 8, dans lequel la vibration provenant du premier vibrateur et du second vibrateur sur les cheveux peut être appliquée par un seul des vibrateurs, par les vibrateurs de manière alternée ou par les deux vibrateurs à la fois.

FIG.1A

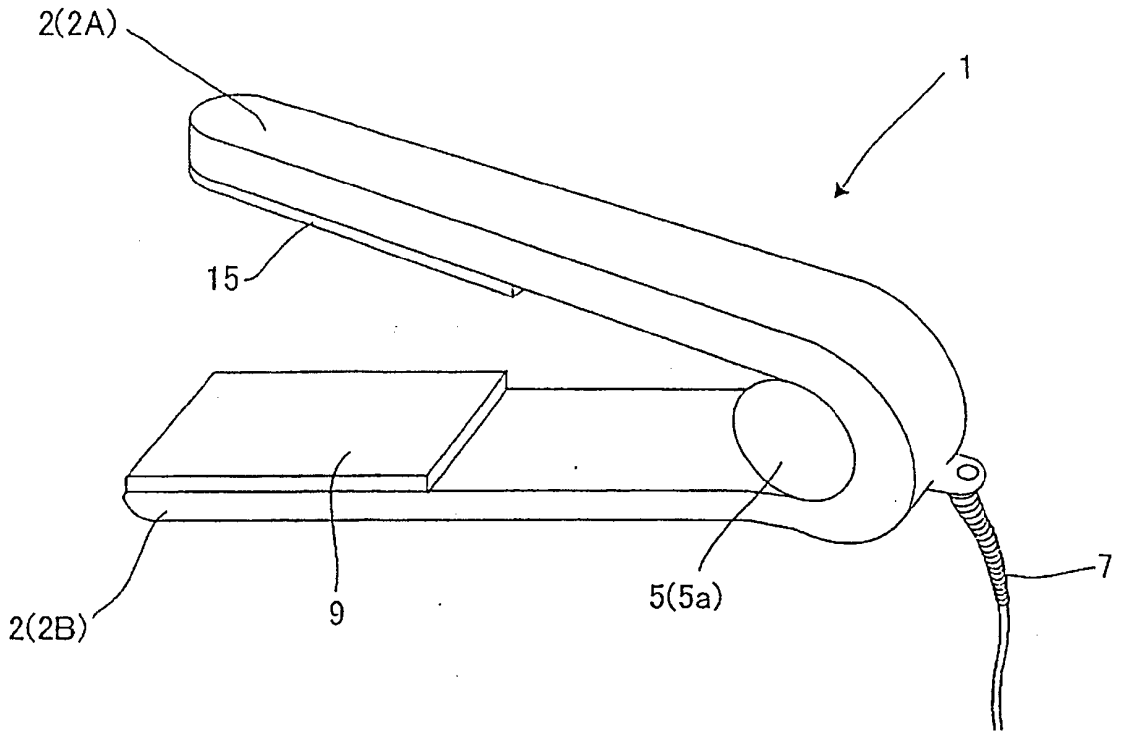



FIG.1B

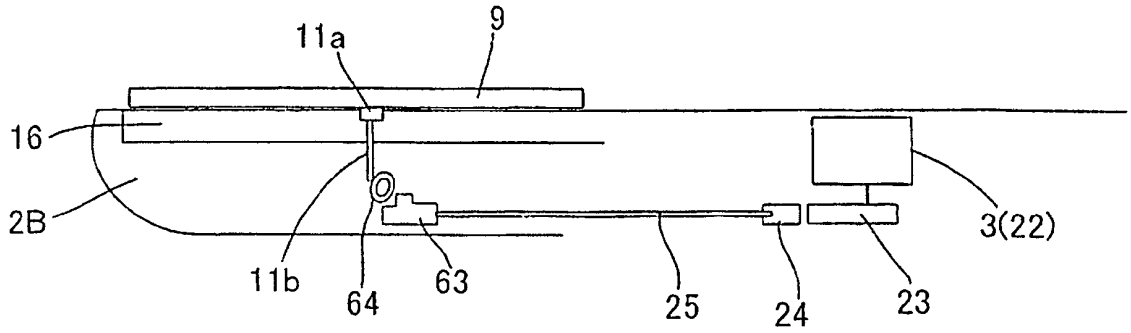


FIG.2

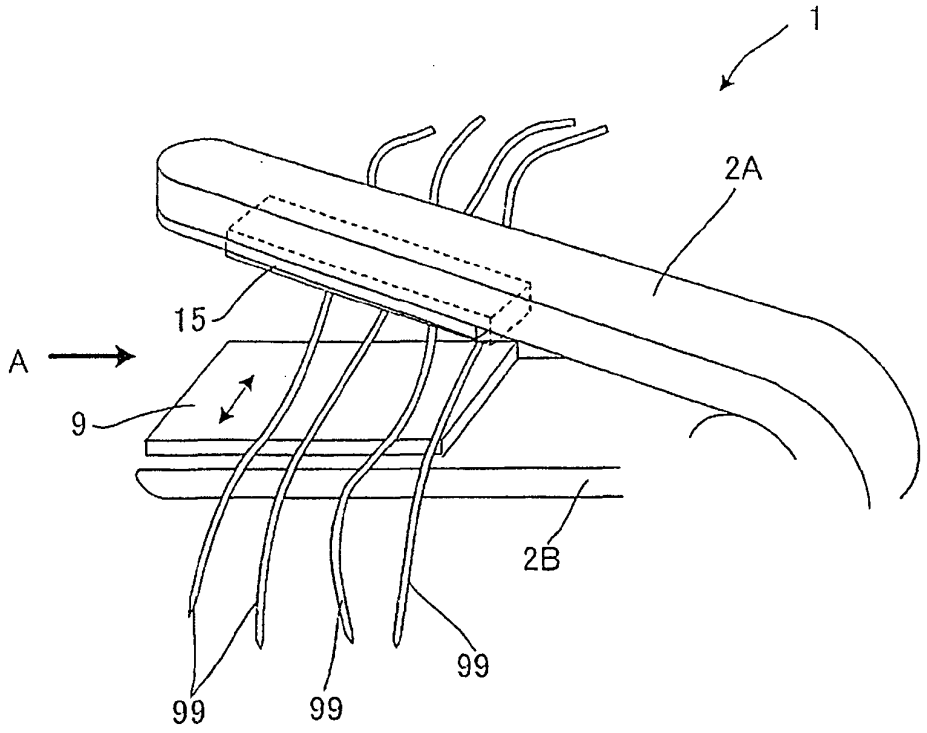



FIG.3A

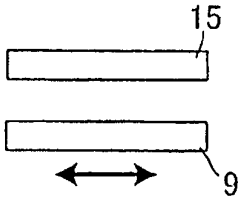



FIG.3B

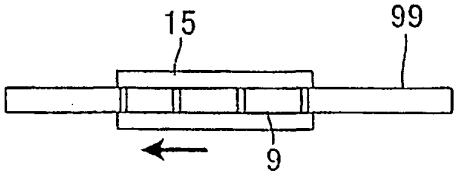



FIG.3C

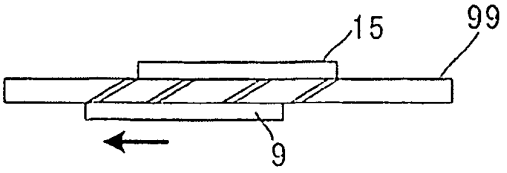


FIG.3D

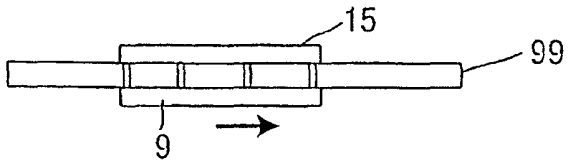



FIG.3E

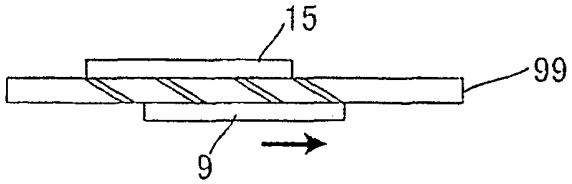



FIG.4

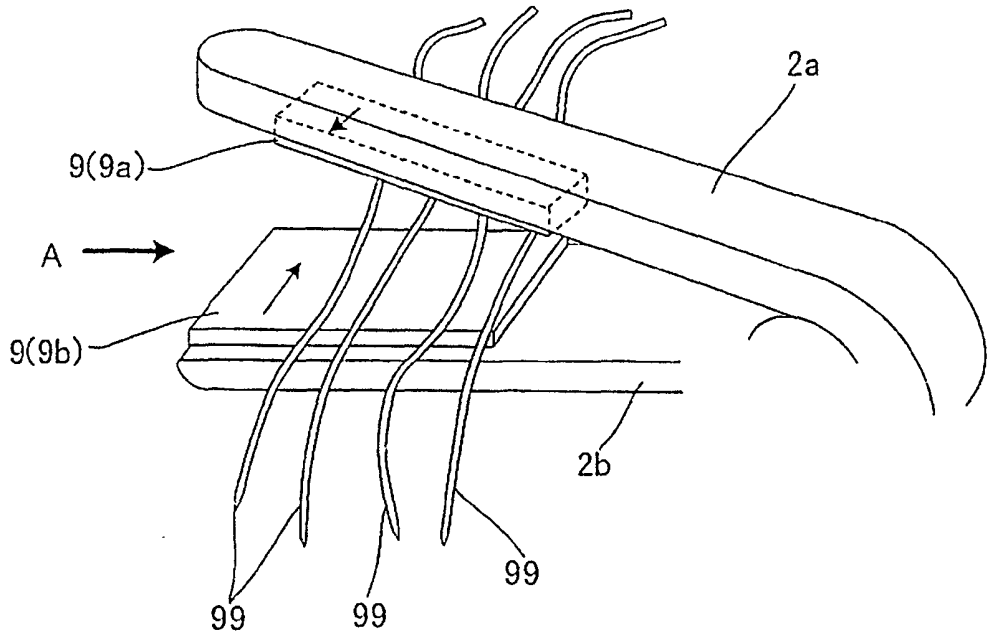



FIG.5A

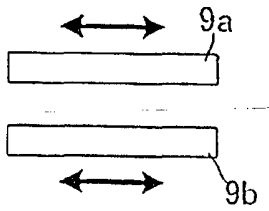


FIG.5B

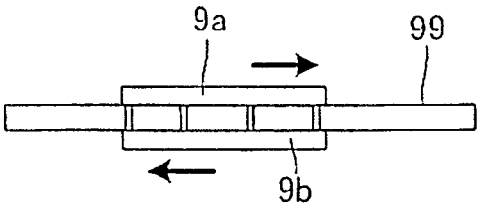



FIG.5C

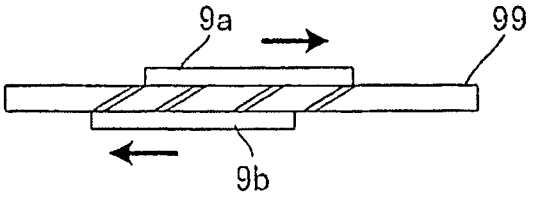



FIG.5D

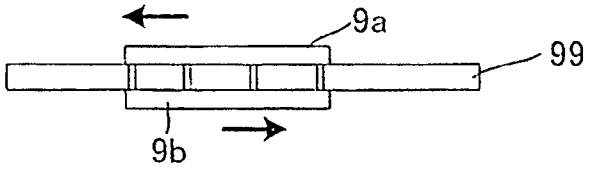



FIG.5E

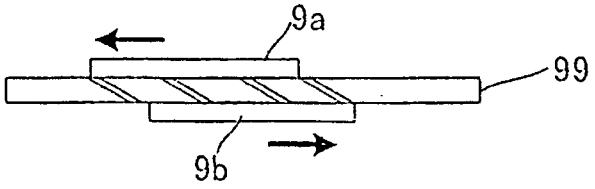


FIG.6

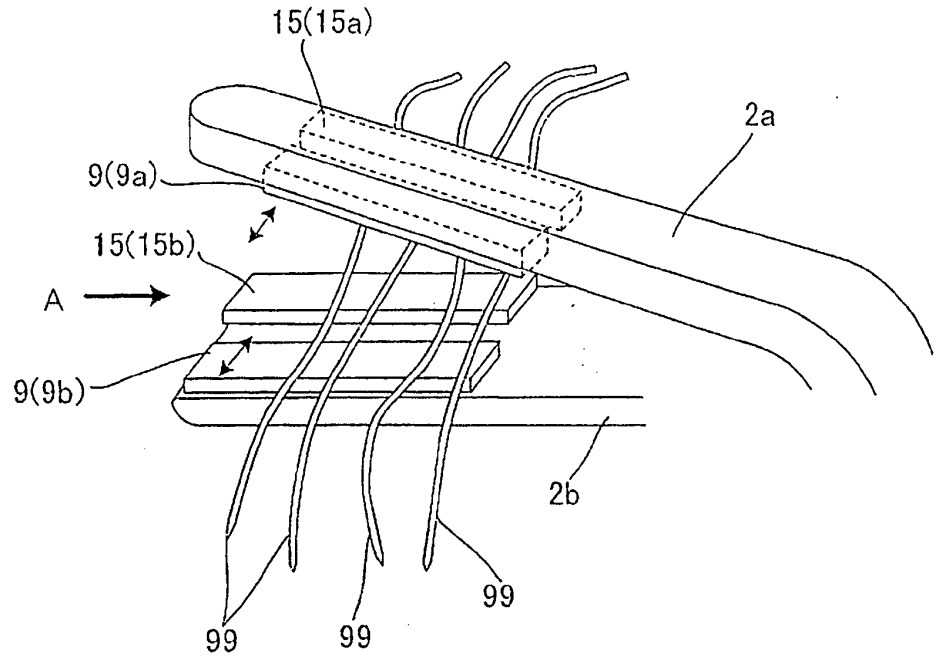



FIG.7A

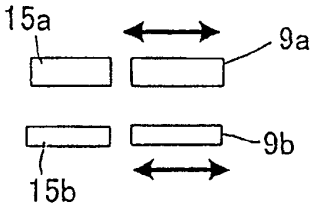



FIG.7B

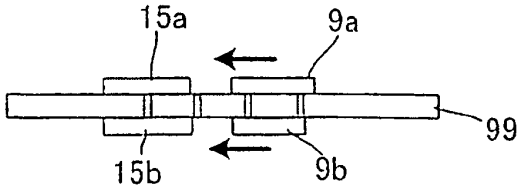



FIG.7C

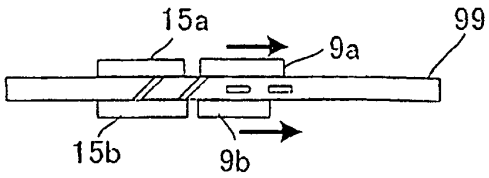


FIG.7D

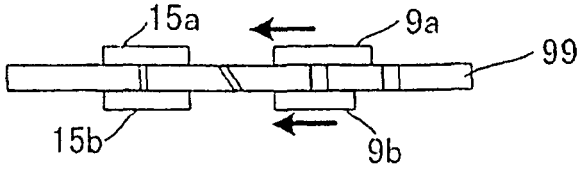



FIG.7E

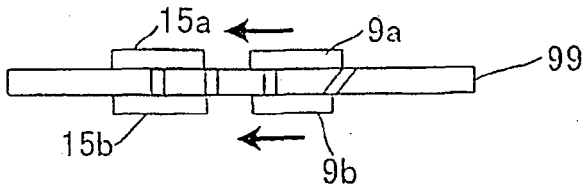



FIG.8A

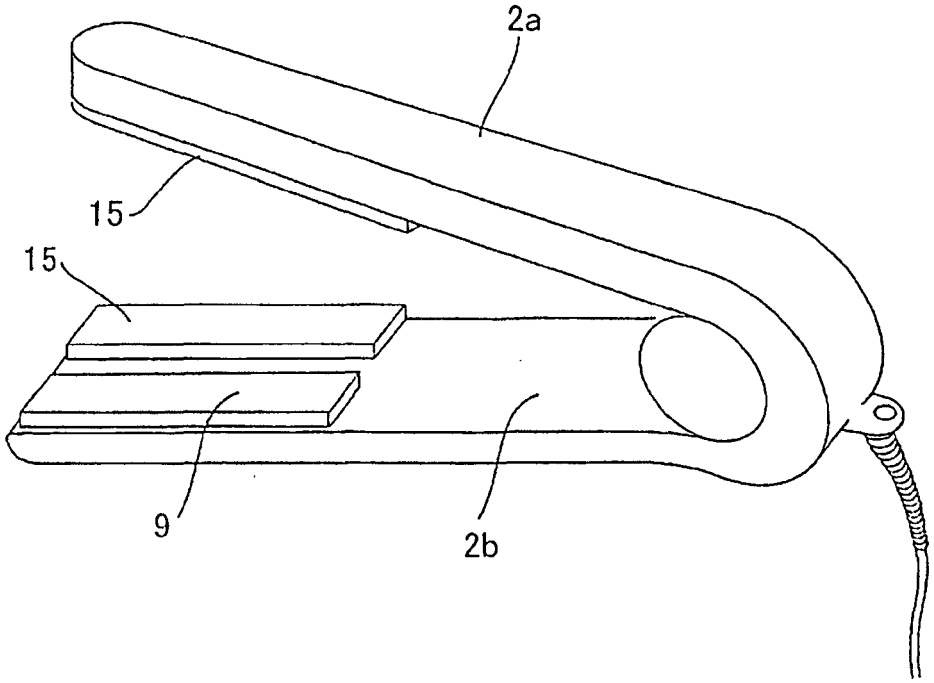


FIG.8B

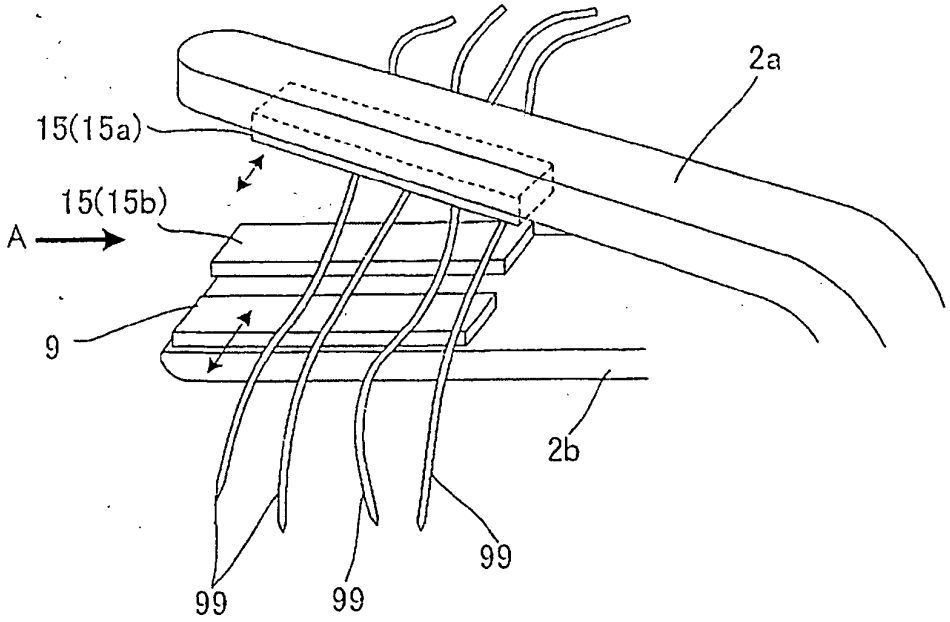



FIG.9A

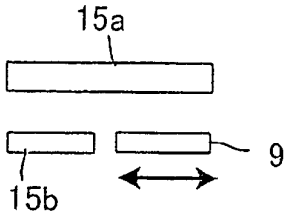



FIG.9B

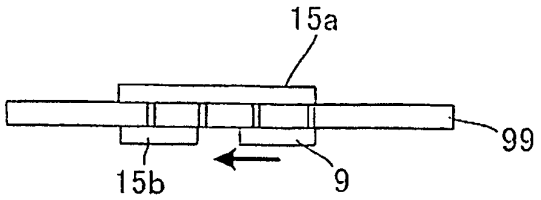



FIG.9C

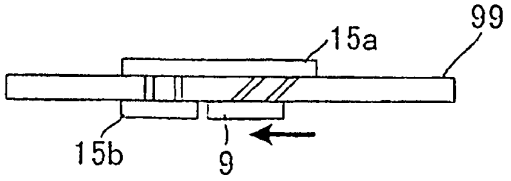


FIG.9D

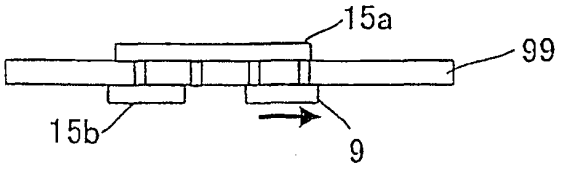



FIG.9E

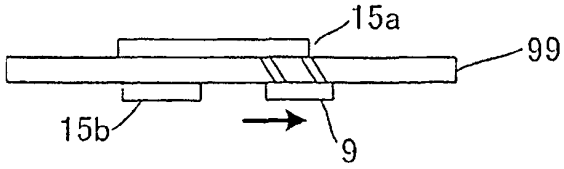



FIG.10

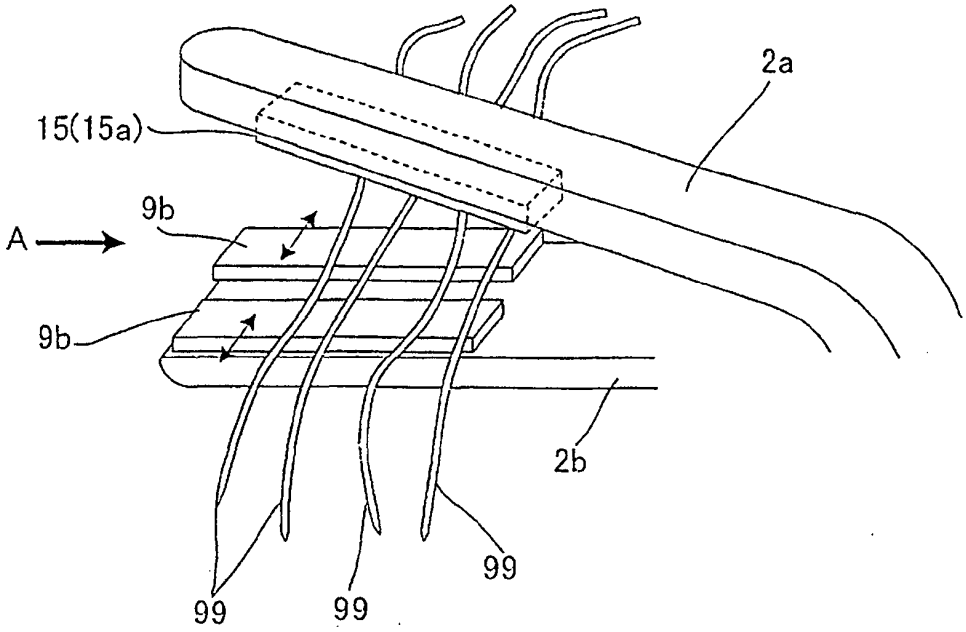



FIG.11A

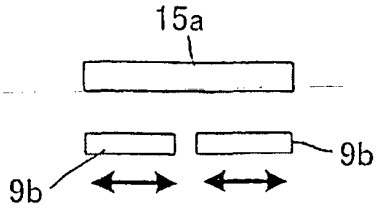


FIG.11B

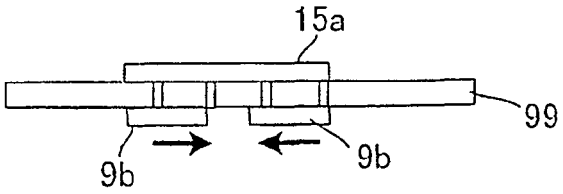



FIG.11C

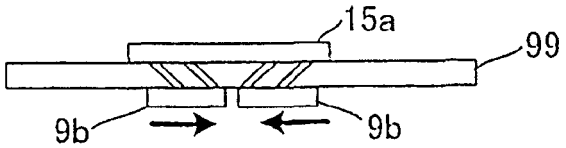



FIG.11D

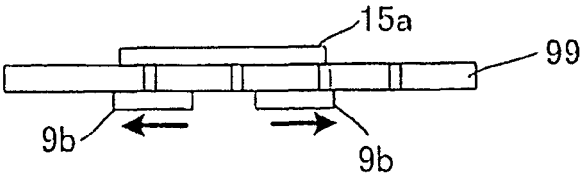



FIG.11E

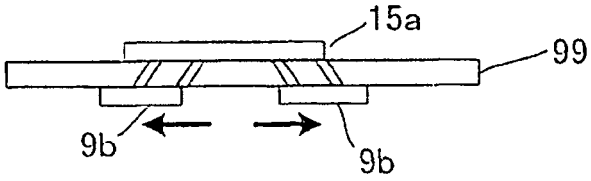


FIG.12

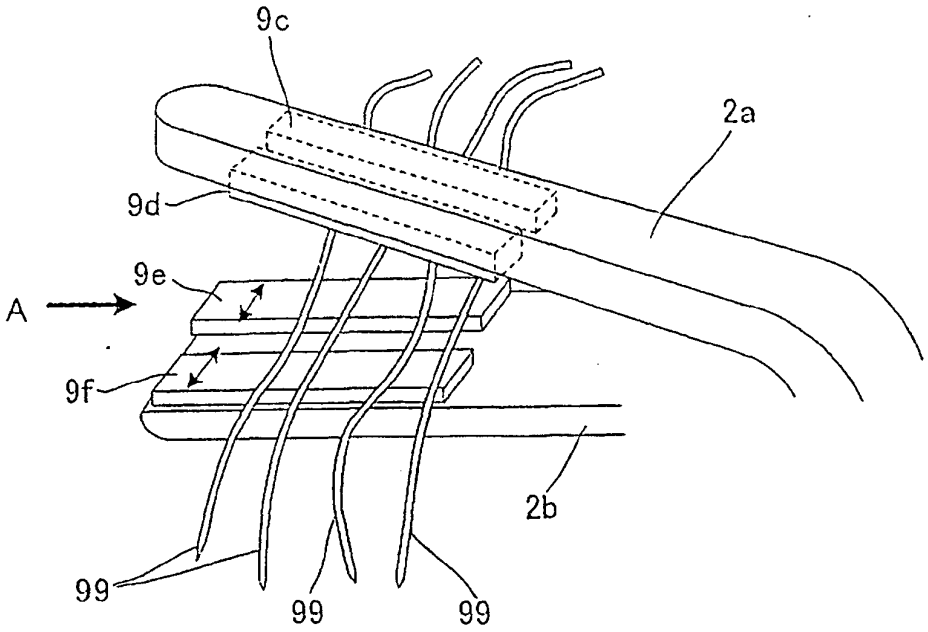



FIG.13A

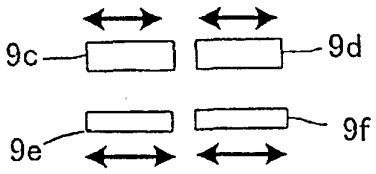



FIG.13B

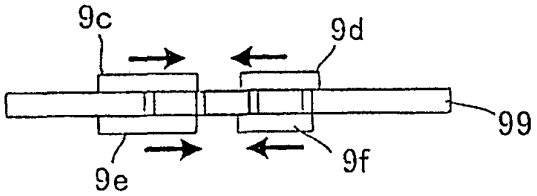



FIG.13C

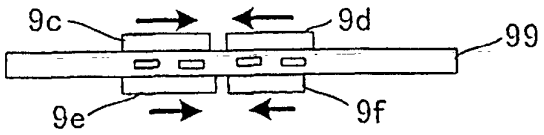


FIG.13D

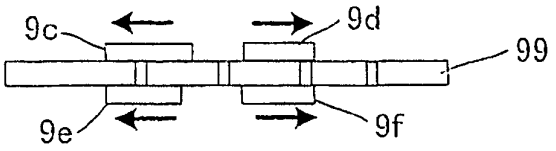



FIG.13E

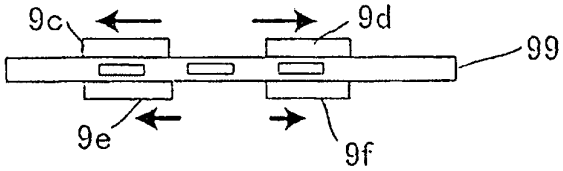



FIG.14

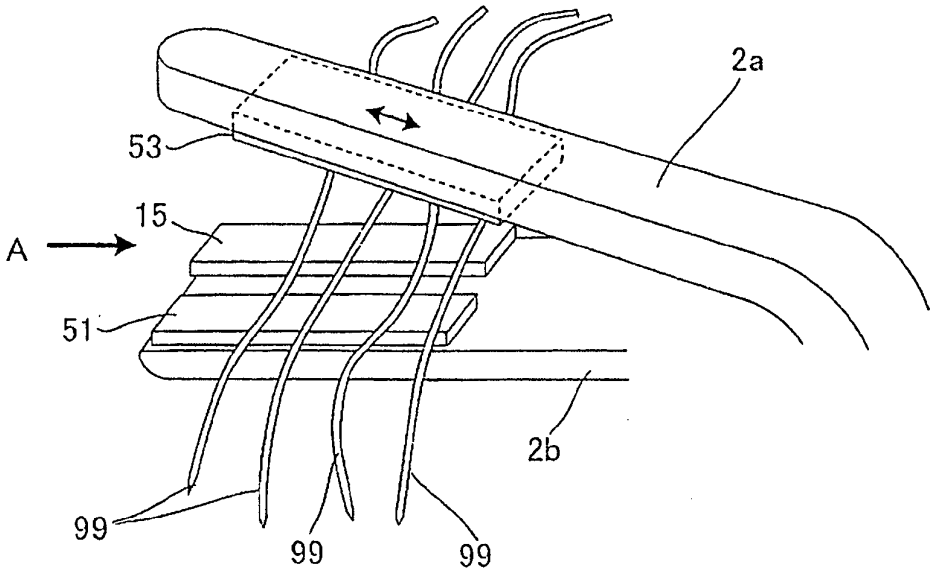



FIG.15A

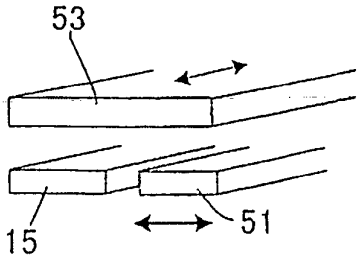


FIG.15B

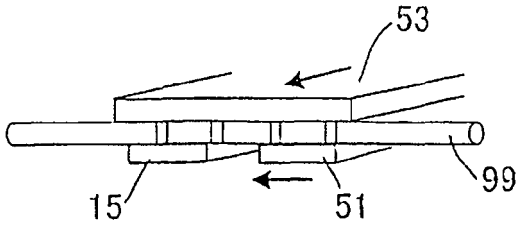



FIG.15C

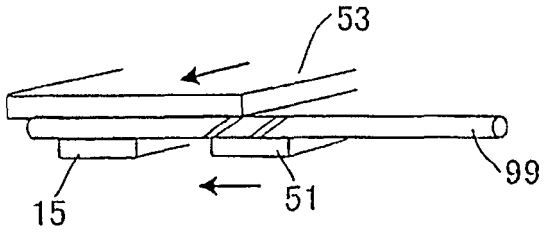



FIG.15D

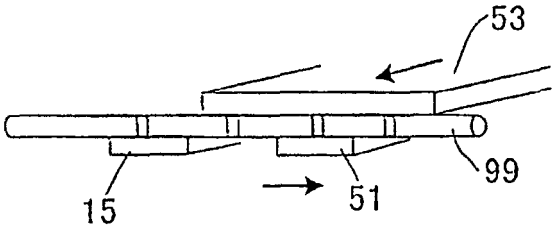



FIG.15E

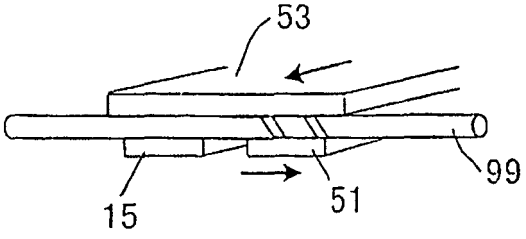


FIG.16

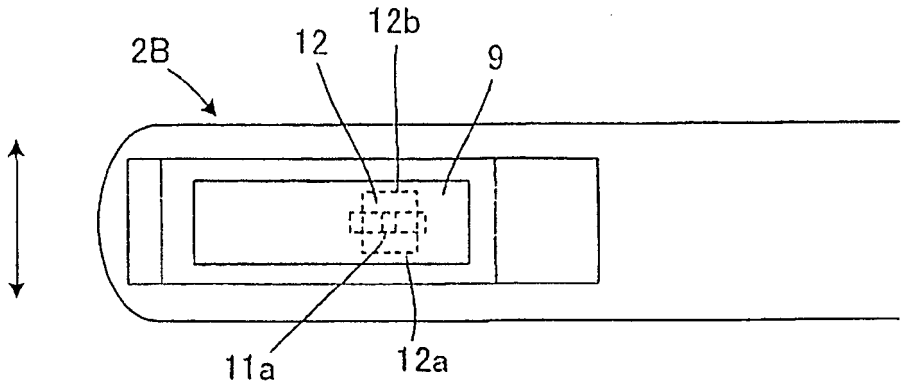



FIG.17

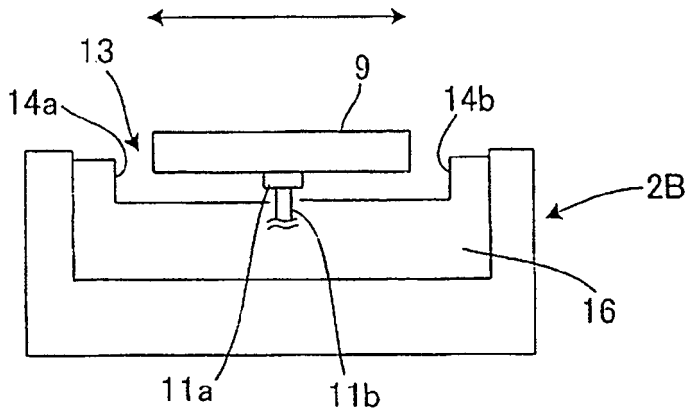


FIG.18A

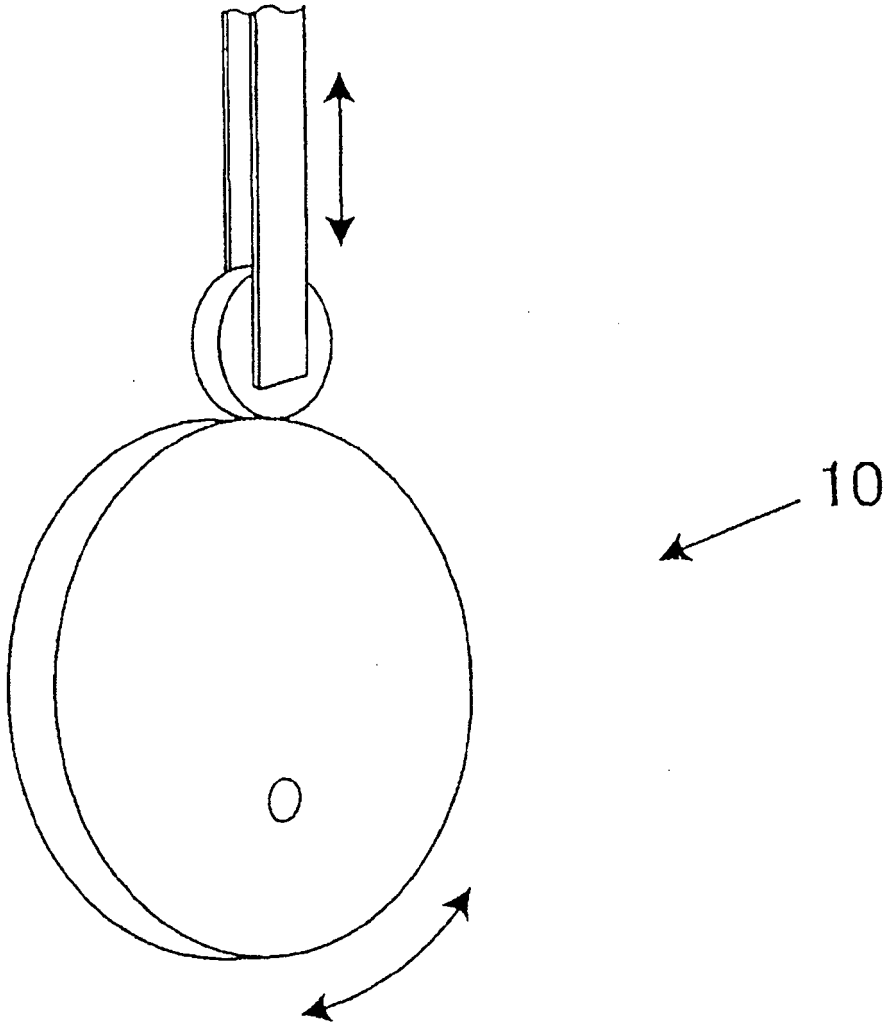


FIG.18B

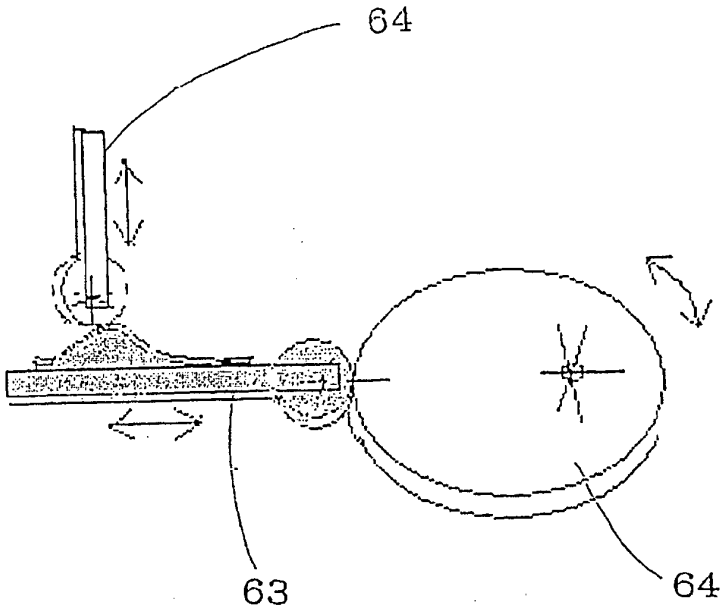



FIG.18C

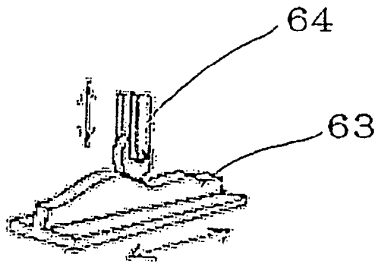



FIG.19

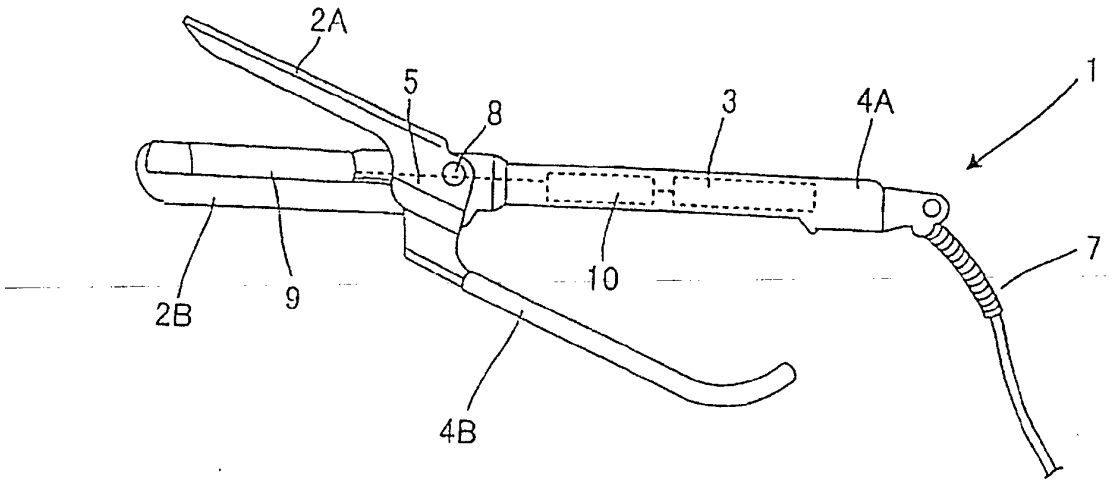


FIG.20A

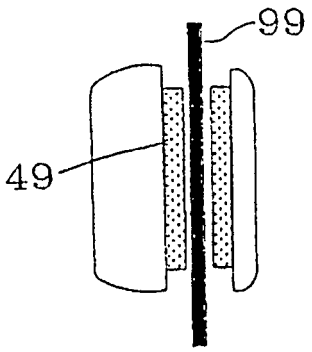



FIG.20B

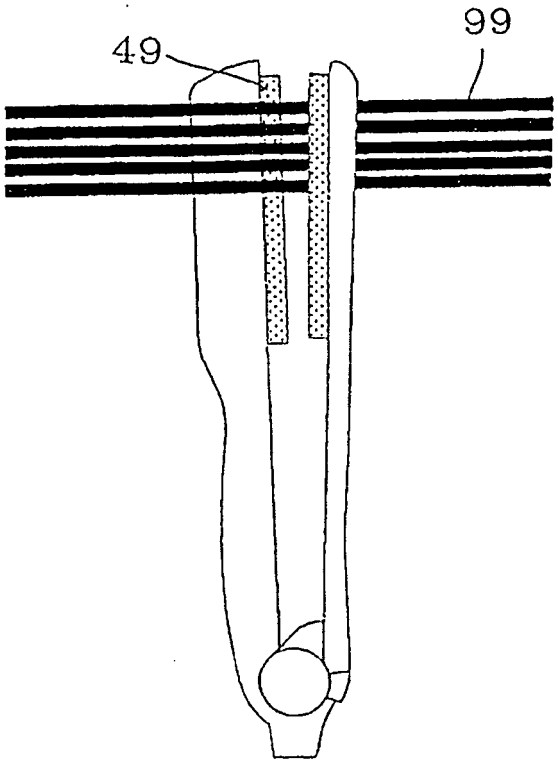
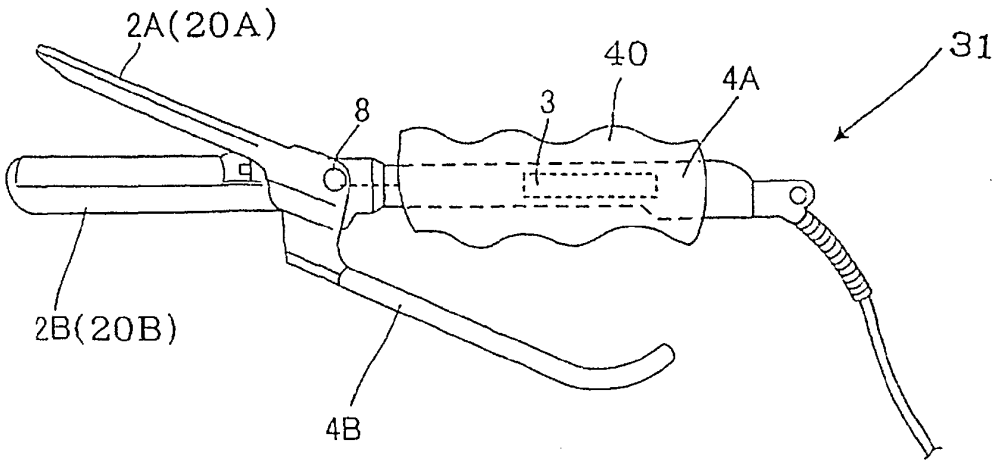


FIG.21



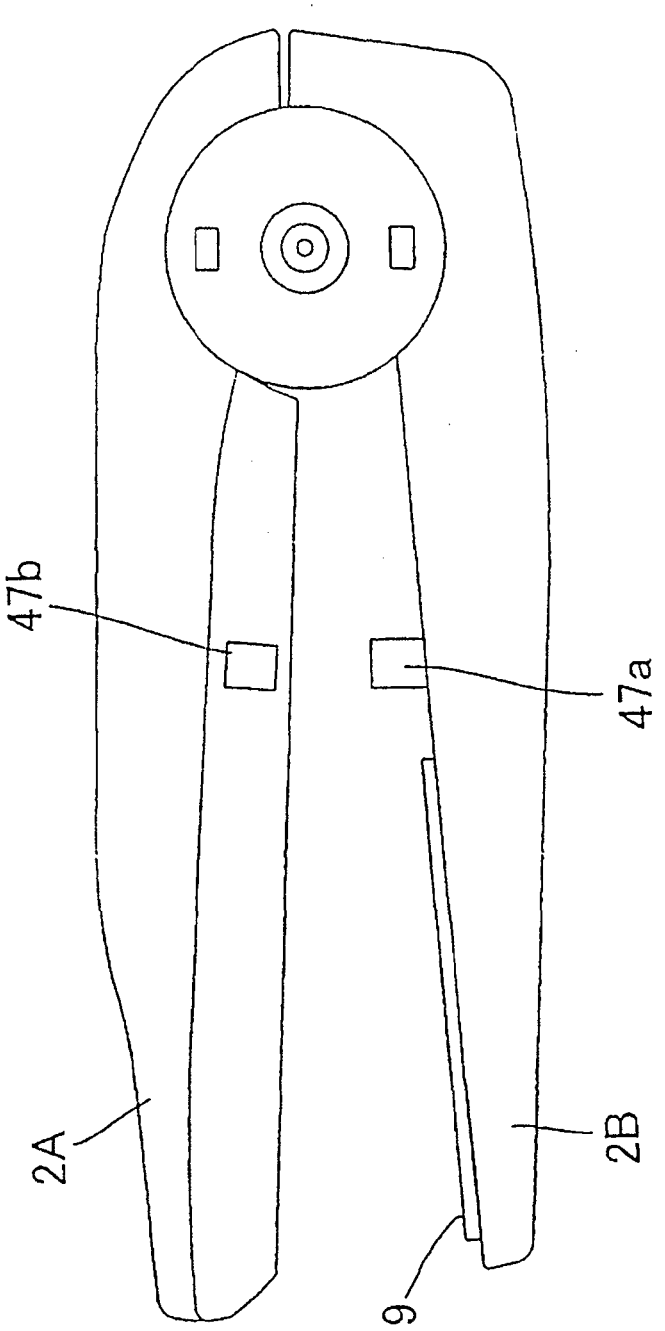
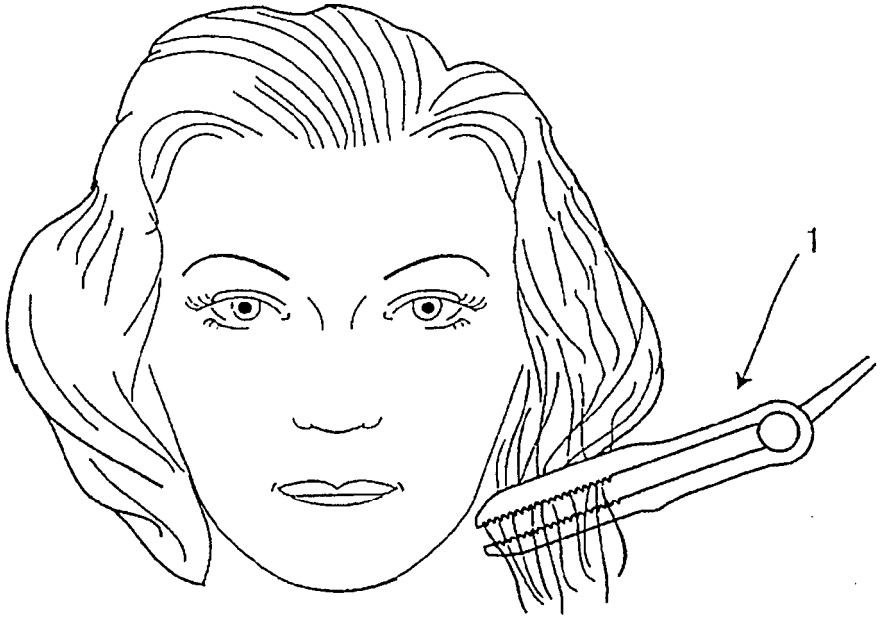



FIG.22

FIG.23



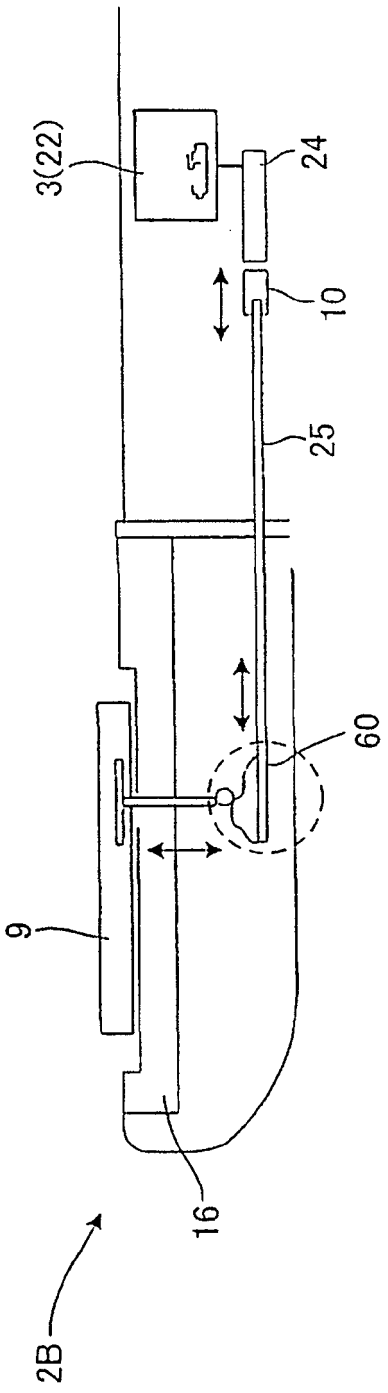



FIG.24

## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- JP 8299046 A **[0014]**
- JP 9262120 A **[0014]**
- JP 9262123 A **[0014]**
- JP 4069157 B **[0014]**