



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
19.07.2017 Bulletin 2017/29

(51) Int Cl.:
D06F 7/04 (2006.01)

(21) Application number: **14901656.0**

(86) International application number:
PCT/CN2014/095725

(22) Date of filing: **30.12.2014**

(87) International publication number:
WO 2016/037446 (17.03.2016 Gazette 2016/11)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(72) Inventors:
• **FUJIWARA, Masahiro**
Osaka
Osaka 532-0003 (JP)
• **YAMAMOTO, Masakazu**
Osaka
Osaka 532-0003 (JP)
• **NORO, Masaru**
Osaka
Osaka 532-0003 (JP)

(30) Priority: **09.09.2014 JP 2014183681**

(71) Applicants:
• **Haier Asia International Co., Ltd.**
Osaka-shi, Osaka 532-0003 (JP)
• **Qingdao Haier Washing Machine Co. Ltd.**
Qingdao, Shandong 266101 (CN)

(74) Representative: **Pfenning, Meinig & Partner mbB**
Patent- und Rechtsanwälte
Theresienhöhe 11a
80339 München (DE)

(54) **STAIN REMOVING DEVICE AND STAIN REMOVING UNIT**

(57) A stain removing device is provided. The device will not make hands tired, and can remove stains with a constant knocking force and speed throughout and steadily supply liquid needed to remove stains. The stain removing device (100) includes a head part (1) forming a knocking surface (111), a vibration unit (2) causing the head part (1) to vibrate in a direction substantially orthogonal to the knocking surface (111) by supplying power,

a liquid containing part (3) for containing liquid, and a water supply path (4) of its one end (41a) is connected to the liquid containing part (3) and the other end (1121h) being opened around the head part (1). The water supply path (4) is configured to supply the liquid to the periphery of the head part (1) via the other end (1121h), along with the vibration of head part (1) caused by the vibration unit (2).

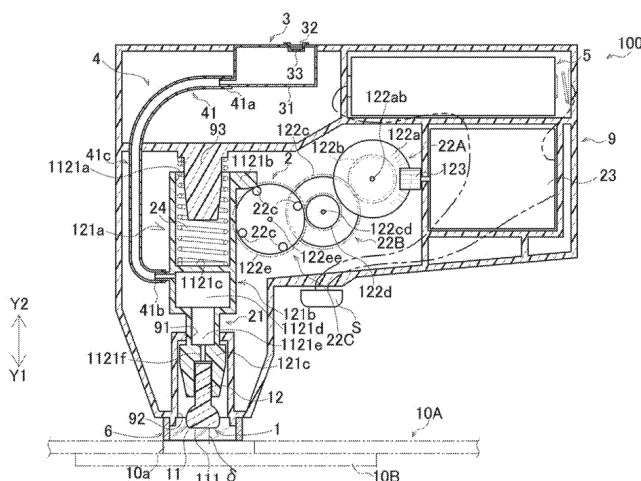


FIG. 1

Description**TECHNICAL FIELD**

5 **[0001]** The present disclosure relates to a stain removing device and a stain removing unit, which can remove stains, such as cosmetics or foodstuffs attached to a fabric during consumption by means of knocking and cleaning, and make actions of knocking the stain portion of the fabric and supplying water to the stain portion to be automatically performed.

BACKGROUND

10 **[0002]** In the case where a part of a fabric is adhered to stains, it is preferable to perform a cleaning treatment only on the stain portion of the fabric rather than the entire fabric in view of decontamination effect or efficiency. A device capable of partially washing a fabric is exemplified by a stain removing device disclosed in Patent Document 1. This stain removing device includes a solvent ejection unit for ejecting a solvent for removing the stain and an absorption unit capable of absorbing the solvent. The solvent is ejected from solvent ejection unit toward the stain portion of clothes or the like, and the absorption unit absorbs the stain and the solvent from the stain portion. However, although such stain removing device can remove the stain that is dissolved immediately by the solvent, for the solid stain in block shape that is attached to the fabric and is hard to be dissolved by the solvent, its removing ability is low and the stain removing effect is not good.

20 **[0003]** Meanwhile, as a member for removing stains, there is also known a stain removing system including a bottle containing the detergent and an absorption sheet (Non-Patent Document 1). The stain removing system can knock the stain portion whose bottom abuts against the absorption sheet at a front end of the bottle, and supply the detergent to the stain portion via fine holes formed at the front end of the bottle by means of the knocking action. The detergent penetrates into the clothing under the knocking action, and is absorbed by the absorption sheet together with the dirt constituting the stain portion.

25 **[0004]** In the stain removing system disclosed in Non-Patent Document 1, the solid stain in block shape adhering to the fabric can be physically decomposed to be dissolved easily in the detergent, since the detergent is supplied by such knocking action, thereby improving a removing ability against solid stain.

30 The prior art literature

Patent Document

35 **[0005]** Patent Document 1: Japanese Patent Application No. 2003-996

Non-Patent Document

40 **[0006]** Non-Patent Document 1: Internet <URL: http://product.rakuten.co.jp/product/-/93dbf4a642737b4f28312cd6847ec47c/?sc2id=gmc_100647_93dbf4a642737b4f28312cd6847ec47c&scid=s_kwa_pla>

SUMMARY

45 **[0007]** Problems to be solved by the present disclosure:

However, in the stain removing system of Non-Patent Document 1, when the solid stain detached from the clothing by means of stain removing action is not immediately dissolved in the detergent, there exists a problem that the detergent supply is reduced and the stain removing efficiency is reduced, since the solid stain is jammed in the fine holes of the front end of the bottle. In addition, since the action of removing the stain is performed by quickly moving the hand holding the bottle up and down, there is a problem that the knocking force and knocking speed are not constant, thereby causing problems of variations in the degree of stain removing and hands fatigue.

55 **[0008]** It is an object of the present disclosure to effectively solve the problems, and to provide a stain removing device and a stain removing system, which can always perform a stain removing operation with a constant knocking force and knocking speed without hands fatigue and stably supply a liquid for removing stain.

[0009] Solutions for solving the problems:

In view of the above problem, the present disclosure adopts the following technical solution.

[0010] The stain removing device of the present disclosure includes a head part forming a knocking surface; a vibration unit causing the head part to vibrate in a direction substantially orthogonal to the knocking surface by supplying power; a liquid containing part for containing liquid; and a water supply path of its one end being connected to the liquid containing part and the other end being opened around the head part. The liquid is supplied to a periphery of the head part via the other end of the water supply path, along with the vibration of head part caused by the vibration of the vibration unit.

[0011] In addition, in another embodiment, the stain removing device of the present disclosure includes a head part forming a knocking surface; a vibration unit causing the head part to vibrate in a direction substantially orthogonal to the knocking surface by supplying power; a liquid containing part for containing liquid; and a water supply path extending from the liquid containing part through the head part to the knocking surface and having an expending opening end facing the knocking surface. The liquid is supplied to the knocking surface from the liquid containing part via the water supply path, along with the vibration of head part caused by the vibration of the vibration unit.

[0012] Further, the present disclosure further includes a non-flexible waterproof cover part surrounding a side surface of the head part. The vibration unit has an elastic member capable of extending and contracting in a direction substantially orthogonal to the knocking surface, and the head part is protruded by an elastic force of the elastic member. An action end of the head part is arranged at a position that is slightly more protruding than a protruding end of the waterproof cover part.

[0013] The waterproof cover part of the present disclosure has a heater capable of generating heat when being supplied power.

[0014] Further, the present disclosure includes a liquid amount adjustment part, which can cause the liquid to drop from the other end of the water supply path by utilizing the vibration caused by the vibration unit and adjust a dropping amount of the liquid.

[0015] Further, the present disclosure includes a detergent containing part for containing a liquid detergent, and a detergent supply unit for supplying the detergent in the detergent containing part to the periphery of the head part.

[0016] Further, the present disclosure includes a vapor ejection unit capable of injecting vapor toward the head part.

[0017] Further, the present disclosure includes the stain removing device and a heating apparatus. The heating apparatus at least includes a heater that can generate heat when being supplied power and a heating plate formed with a knocked surface, on which a force is exerted by the head part constituting the stain removing device and conveying a heat generated by the heater.

Effect of the disclosure

[0018] According to the present disclosure described above, the vibration unit causes the head part to vibrate at the time of being supplied power and makes the action of the head part to knock a stain removing object automatic, therefore, the knocking force becomes uniform and the hands does not need to move quickly, the hands are not tired even if performing the stain removing operation for a long time. In addition, one end of the water supply path is connected to the liquid containing part, the other end of the water supply path has an opening rather than the knocking surface of the head part around the head part, the liquid is supplied to the periphery of the head part, so the water supply path will not be blocked even if the solid stain constituting the stain portion of the stain removing object is attached to the knocking surface, and the stain removing effect can be stably maintained. Particularly, for example, by appropriately designing the cross section of the flow path of the water supply path, an appropriate amount of liquid is continuously supplied toward the stain removing object along with the vibration, so the stain removing effect can be enhanced. Here, the liquid includes water, a mixture of water and detergent, detergent exclusive for stain removing, and the like.

[0019] According to another embodiment of the present disclosure, the vibration unit causes the head part to vibrate at the time of being supplied power and makes the action of the head part to knock a stain removing object automatic, therefore, the knocking force becomes uniform and the hands does not need to move quickly, the hands are not tired even if performing the stain removing operation for a long time. In addition, the solid stain of the stain portion decomposed by an impact from the vibration of the head part cannot be immediately dissolved in the liquid supplied by the liquid containing part, even if the knocking surface is immersed into the water supply path, it is difficult for the water supply path to be blocked by the solid stain, since the opening end of the water supply path is expansive. In addition, it is easy to be cleaned even if the water supply path is blocked by the solid stain, thus the stain removing effect can be stably maintained. In particularly, for example, by appropriately designing the cross section of the flow path except the opening end of the water supply path, an appropriate amount of liquid is continuously supplied toward the stain removing object along with the vibration, so the stain removing effect can be enhanced.

[0020] Particularly, according to the present disclosure further including the waterproof cover part, the stain removing operation is performed by means of pressing against the stain removing object by a protruding end of the waterproof cover part, so that the waterproof cover part can inhibit a scatter of the liquid caused by the vibration of the head part, thereby further preventing the liquid from spreading over a wide range, and thus the wetting area of the stain removing object is reduced, and the stain removing object can be used immediately after the stain removing operation. In addition,

during the stain removing operation, a distance between the body of the device and the stain removing object can be always kept constant, and the force (knocking force) of the stain removing object applied by the head part can be made appropriate and uniform. Further, an action end of the head part is arranged at a position that is slightly more protruding than the protruding end of the waterproof cover part, and an operation simulating an action of knocking (pressing) the stain portion with hands can be automatically realized, since the head part can clamp the stain removing object when protruding due to an elasticity of a coil spring.

[0021] Further, as long as the present disclosure includes the waterproof cover part and a heater that can generate heat at the time of being supplied power, the waterproof cover part can be heated by the heat generated by the heater, the stain portion and the its vicinity of the stain removing object can be always warmed via the waterproof cover part during the stain removing operation, thereby further improving the stain removing effect.

[0022] Particularly, according to the present disclosure including a liquid amount adjustment part that can cause the liquid to drop by means of vibration and can adjust the dropping amount of the liquid, since it is a structure in which the liquid drops due to vibration, the structure is simpler than an apparatus structure in which for example, the liquid is sent by a liquid pump. In such a structure, when a detergent mixed solution composed of mixture of water and detergent is liquid, a viscosity of the liquid is higher than water, thus the liquid may be difficult to drop, however, the liquid does not drop toward the stain removing object excessively or insufficiently by using the liquid amount adjustment part. Therefore, the stain removing effect is prevented from being reduced due to insufficient supply of the liquid, and the occurrence of permeation caused by a large amount of liquid being supplied to the stain portion of the stain removing object at a time can be prevented.

[0023] Further, according to the present disclosure including a detergent containing part and a detergent supply unit, when only water is accommodated in the liquid containing part, the water in the liquid containing part and the detergent in the detergent containing part can be supplied to the stain removing object at different times, respectively. Therefore, it is possible to remove the stain by using the detergent supplied by the detergent supply unit, and to rinse the stain removing object by only using the water supplied by the water supply path.

[0024] Particularly, according to the present disclosure including a vapor ejection unit, since a vapor can be used to warm the stain portion of the stain removing object and perform the stain removing operation simultaneously, the stain is easily dissolved in the detergent and the stain removing effect can be improved.

[0025] On the other hand, according to the present disclosure having the stain removing device and the heating apparatus as described above, it is possible to perform the stain removing operation while heating the stain portion of the stain removing object with the heat from the heater, so the stain is more easily dissolved in the detergent, and the stain removing effect can be further improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

Fig. 1 is longitudinal sectional view showing a stain removing device according to a first embodiment of the present disclosure.

Fig. 2 is a longitudinal sectional view showing the stain removing device in Fig. 1 in a state in which the head is protruded.

Figs. 3(A) and 3(B) are a longitudinal sectional views showing the stain removing device in Fig. 1 when being not in use.

Figs. 4(A) and 4(B) are a perspective views showing a part of a cylinder and a head part constituting the stain removing device according to a second embodiment of the present disclosure.

Figs. 5(A), 5(B) and 5(C) are a schematic diagram showing the head part and a supply hole in Fig. 4(B).

Fig. 6 is a longitudinal sectional view showing a stain removing device according to a third embodiment of the present disclosure.

Fig. 7 is a longitudinal sectional view showing a stain removing device according to a fourth embodiment of the present disclosure.

Fig. 8 is a longitudinal sectional view showing the stain removing device in Fig. 7 in a state in which the head is protruded.

Fig. 9 is a longitudinal sectional view showing a stain removing device according to a fifth embodiment of the present disclosure.

Fig. 10 is a longitudinal sectional view showing a stain removing unit according to a sixth embodiment of the present disclosure.

Fig. 11 is an exploded view showing a heating apparatus of the stain removing unit in Fig. 10.

Figs. 12(A) and 12(B) are various views showing a stain removing device according to a seventh embodiment of the present disclosure.

Figs. 13(A), 13(B) and 13(C) are various schematic circuit diagrams showing a circuit for supplying power to a motor

and a heater of the stain removing device in Fig 12.

Fig. 14 is a partial sectional view showing a stain removing device according to an eighth embodiment of the present disclosure.

Figs. 15(A), 15(B) and 15(C) are various views showing a variant of the head part in Fig. 1.

DETAILED DESCRIPTION

<First Embodiment>

[0027] Hereinafter, the first embodiment of the present disclosure will be described with reference to accompanying drawings.

[0028] Figs. 1 and 2 are longitudinal sectional views showing a stain removing device 100 according to the first embodiment of the present disclosure. The stain removing device 100 of the present disclosure shown in Fig. 1 and Fig. 2 is a handheld apparatus capable of partially cleaning clothing 10A that is served as a stain removing object, including a head part 1, a vibration unit 2, a liquid containing part 3, a water supply path 4, a battery 5, a waterproof cover part 6 and a housing body 9 in which a half of structures of these elements are arranged.

[0029] The head part (the head part of a cylinder) 1 includes a knocking part 11 forming a knocking surface 111 and a cylinder insertion portion 12 extending from the knocking part 11. A longitudinal section of the knocking part 11 is substantially semicircular shape and is more particularly slightly closer to the circle shape than the semicircular shape. The head part 1 is made of a resin such as nylon, and vibrates in a direction substantially orthogonal with the knocking surface 111 in a state in which the head part 1 protrudes into a head accommodation part 92 recessed in the housing body 9 from the housing body 9 via an opening 91, and exerts a knocking force to the clothing 10A that is served as the stain removing object disposed opposed to the knocking surface 111. Hereinafter, the direction substantially orthogonal with the knocking surface 111 is referred to as a vibration direction. In addition, in the vibration direction, a direction in which the head part 1 faces the clothing 10A is referred to as a protruding direction Y1, and the opposite direction is referred to as a returning direction Y2. In addition, the material of the head part 1 is not limited to resin, and may also be metal (for example, Stainless Used steel, sus) and the like.

[0030] The vibration unit 2 includes a motor 23 rotating by using power supplied from a battery 5 that is served as a power supply part; first to third gears 22A to 22C for transmitting the rotation force of the motor 23; a cylinder 21 for supporting the head part 1 by making the knocking surface 111 at a front end and moving in the vibration direction; and a coil spring 24 served as an elastic member accommodated inside the cylinder 21.

[0031] The first gear 22A has a large-diameter portion 122a engaged with a drive gear 123 of the motor 23 and being rotatable around a shaft 122ab and a small-diameter portion 122b integrally formed and coaxially arranged with the large-diameter portion 122a. The second gear 22B is disposed between the first gear 22A and the third gear 22C, and has a large-diameter portion 122c engaged with the small-diameter portion 122b of the first gear 22A and being rotatable around a shaft 122cd, and a small-diameter portion 122d integrally formed and coaxially arranged with the large-diameter portion 122c and engaged with the third gear 22C. The third gear 22C is configured to rotate in a clockwise direction around a shaft 122ee (see Fig. 1), and have four protrusions 22c spaced equally in the circumferential direction and parallel to the shaft 122ee at its edge. In addition, the number of the protrusions 22c is not limited to four, and may be one to three, or five or more.

[0032] The cylinder 21 includes a coil spring accommodation portion 121a having a tubular shape with a bottom and receiving therein the coil spring 24 which is in a extending/contracting state in the vibration direction, an inserted portion 121c inserted into the cylinder insertion portion 12 of the head part 1; and a liquid storage portion 121b disposed between the inserted portion 121c and the coil spring accommodation portion 121a and capable of storing liquid therein.

[0033] A fixing portion 93 of the coil spring accommodation portion 121a extending in a boss shape from the housing body 9 toward the protruding direction Y1 is inserted through an opening 1121a, and accommodates the other side of the coil spring 24 supported at a base end of the fixing portion 93. In addition, the coil spring accommodation portion 121a includes an engaging claw 1121b which can engage with the protrusion 22c of the third gear 22C at its side surface. When the protrusion 22c is not engaged with the engaging claw 1121b (see Fig. 2), the cylinder 21 exerts an elastic force via the coil spring 24 toward the protruding direction Y1 on a bottom surface 1121c of the coil spring accommodation portion 121 a that abuts the other side of the coil spring 24, thus the head part 1 is pushed out.

[0034] On the other hand, when the protrusion 22c is engaged with the engaging claw 1121b (see Fig. 1), the cylinder 21 exerts a compressive force via the bottom surface 1121c to the coil spring 24 along with the rotation of the third gear 22C, so that the head part 1 moves toward the returning direction Y2. Thereafter, when the protrusion 22c is disengaged from the engaging claw 1121b, the head part 1 moves toward the protruding direction Y1 due to the elasticity of the compressed coil spring 24. By repeating such operations, the head part 1 vibrates (amplitude movement). In the present embodiment, as described above, the third gear 22C has four protrusions 22c, and the head part 1 reciprocates four times by means of making one rotation of the third gear 22C.

[0035] The liquid storage portion 121b is composed of a wide portion 1121d whose width is wider than the width of opening 91 of the housing body 9 and a narrow portion 1121c e whose width is narrower than the width of the opening 91 of the housing body 9 and which is projecting from the opening 91. The wide portion 1121d is fixed at the edge of the opening 91 so as to restrict the moving range of the cylinder 21 in the protruding direction Y1. The wide portion 1121d of the liquid storage portion 121b is connected with a liquid supply pipe 41 that will be described below, thus the liquid storage portion 121b stores the liquid supplied from the accommodation part through the liquid supply pipe 41, and supplies the liquid to the inserted portion 121c via the narrow portion 1121 e.

[0036] The inserted portion 121c has a water supply hole 1121f extending from the narrow portion 1121c and an inserted segment 1121g (see Fig. 2) which is inserted into the hole of the cylinder insertion portion 12 of the head part 1 by slightly pressing. A water supply groove (slit groove) 12a extending in an axial direction is formed intermittently on the outer periphery of the cylinder insertion portion 12. The liquid in the narrow portion 1121e is supplied to the inserted segment 1121 g via the water supply hole 1121f, in a state where the head part 1 vibrates due to the vibration of the vibration unit 2, as shown in Fig. 2, the liquid is discharged little by little (1 to 1.5 cc/min) from a discharge port 1121h of the water supply groove 12a at a predetermined depth (about 0.1 to 0.3 mm in this embodiment) located in the gap between the cylinder insertion portion 12 and the inserted segment 1121g.

[0037] On the other hand, when the head part 1 does not vibrate, the liquid cannot be discharged from the discharge port 1121h due to surface tension but remains between the cylinder insertion portion 12 and the inserted portion 121c. In this manner, the size of the water supply groove 12a is adjusted to such a degree that a small amount of liquid is discharged by virtue of vibration of the head part 1, and the amount of the used liquid is smaller than that of other cleaning methods such as spray cleaning and brush cleaning, therefore, the liquid is difficult to scatter to any position other than the stain portion 10a of the clothing 10A.

[0038] In addition, the cylinder inserting portion 12 is not limited to being inserted into the inserted portion 121c by pressing, and may be inserted by screw fixing. Further, the head part 1 can be removed from the inserted portion 121c, and another head part can be mounted to the inserted portion 121c. Therefore, in the stain removing device 100, for example, when dirt is adhered to the knocking surface 111 which directly abuts the stain portion of the clothing 10A, the head part 1 may be removed and cleaned, or be replaced with a new one. Further, the water supply groove 12a may be formed in the inserted segment 1121 g instead of the cylinder insertion portion 12. Furthermore, the present disclosure is not limited to the configuration in which the surface tension acts on the liquid at the discharge port 1121h, the present disclosure may adopt another configuration, in which the liquid is prevented from dropping due to the surface tension at the opening end of the water supply hole 1121f when the head part 1 does not vibrate, by means of adjusting the water supply hole 1121f of the cylinder 21 to a predetermined diameter (for example, 0.3 mm).

[0039] The liquid containing part 3 includes an accommodation part body 31 for containing the liquid discharged from the inserted portion 121c and supplied to the periphery of the head part 1 and a cover member 33 clogging the liquid supply hole 32 formed in the accommodation part body 31. An air hole (not shown) is formed in the cover member 33. Therefore, even if the liquid supply hole 32 is clogged by the cover member 33, the inside of the liquid containing part 3 does not become negative pressure, the liquid can drop from the discharge port 1121h immediately after the start of vibration since the liquid can successfully flow into the water supply path 4.

[0040] Herein, the liquid only can be water, a detergent mixed solution in which water and a detergent are mixed at a constant ratio, or a detergent exclusive for stain removing and the like. In the present embodiment, the detergent mixed liquid is used. When the detergent mixture is used as the liquid, the detergent is continuously supplied to the clothing 10A, so that the detergent does not disappear from the stain portion 10a due to vaporization, scattering or the like during the stain removing operation, thereby maintaining a high stain removing effect. In addition, there is no need to additionally provide a unit for supplying the detergent, so the structure of the apparatus is simpler.

[0041] The water supply path 4 supplies the liquid in the liquid containing part 3 to the periphery of the head part 1. The water supply path includes a flexible liquid supply tube 41, the liquid storage portion 121b, the water supply hole 1121f and the inserted segment 1121g of the inserted portion 121c, and the water supply groove 12a of the head part 1, in which one end 41a of the flexible liquid supply tube 41 is connected to the liquid containing part 3, the other end 41b is connected to the wide portion 1121d of the liquid storage portion 121b. Herein, one end of the water supply path 4 is constituted by one end 41a of the liquid supply tube 41, and the other end is constituted by the discharge port 1121h located at the opening end of the water supply groove 12a between the inserted segment 1121g and the cylinder insertion portion 12.

[0042] In such a stain removing device 100, an absorption pad 10B abuts the bottom of the stain portion 10a of the clothing 10A, and the absorption pad 10B is used when the housing body 9 is grasped in such a manner that the knocking face 111 of the head part 1 is configured to opposite to the stain portion 10a.

[0043] When a power switch S provided on the outside of the housing body 9 is operated, the motor 23 is rotated when the power is supplied from the battery 5, and the rotation is decelerated and transmitted simultaneously to the third gear 22C by the first gear 22A and the second gear 22B. When the protrusion 22c is engaged with the engaging claw 1121b, the cylinder 21 and the head part 1 are lifted up by a predetermined dimension δ (about 5 mm in the present

embodiment) (see Fig. 1). When the protrusion 22c is disengaged from the engaging claw 1121b, the cylinder 21 is pushed out due to the elasticity of the coil spring 24, so that the head part 1 knocks the stain portion 10a (see Fig. 2). At this time, the liquid supply tube 41 absorbs the vibration of the cylinder 21 by the flexible deformation of a central portion 41c, the liquid drops gradually from the discharge port 1121h along with the vibration and is transmitted to the side surface of the knocking part 11 and then is supplied to the stain portion 10a.

[0044] By making the housing body 9 move along the clothing 10A and repeating such operation simultaneously, the liquid supplied to the stain portion 10a dissolves the stain constituting the stain portion 10a, and is knocked out from the clothing 10A and absorbed by the absorption pad 10B. That is, the stain removing device 100 of the present embodiment removes the stain by transferring the stain of the clothing 10A and the liquid together to the absorption pad 10B. There are no particular restrictions on the absorption pad 10B, various components which has a high liquid absorption rate may be used as the absorption pad 10B. For example, a kitchen paper can be used as the absorption pad 10B after being folded. In addition, when the contact position of the head part 1 with respect to the absorption pad 10B is periodically changed in the stain removing operation, the dropped liquid is stably absorbed by the absorption pad 10B, so the high stain removing efficiency can be maintained. In the present embodiment, since the detergent mixed solution in the liquid state is used, the detergent can be easily and continually supplied to the stain portion 10a, even if the contact position of the head part 1 is changed.

[0045] In the above structure, the vibration unit 2 causes the head part 1 to vibrate when the power is supplied, since the operation of knocking the clothing 10A by the head part 1 can be automated, the knocking force becomes uniform and the hands are not needed to move quickly, thus the hand cannot fatigue even if the stain removing operation is performed for a long time. Further, when one end 41a of the water supply path 4 is connected to the liquid containing part 3, the discharge port 1121h of its other end is opened at the periphery of the head part 1 rather than the knocking surface 111 of the head part 1, and the liquid is supplied to the periphery of the head part 1, so the water supply path 4 will not be clogged even if the solid stain constituting the stain portion 10a is attached to the knocking surface 111, thereby stably maintaining the stain removing effect. In particular, for example, by appropriately designing the cross section of the flow path of the water supply path 4, an appropriate amount of liquid is continuously supplied toward the stain removing object along with the vibration, so the stain removing effect can be enhanced. Furthermore, since the structure that the liquid drops by means of vibration is used, the structure is simpler than, for example, other structures that the liquid is sent by a pump.

[0046] Therefore, the stain removing device 100 according to the present embodiment as described above is compact and has good portability, and when the spill of eating or cosmetics etc. adheres to the fabric, it can be washed immediately so that the stain is inconspicuous. In addition, curtains, mats, etc. which are not easy to be washed integrally, can be partially washed suitably.

[0047] As shown in Fig. 2, the waterproof cover part 6 is detachably attached to the housing body 9 via a rib 9a at a position of the side surface of the knocking part 11, encircling the head part 1. In the present embodiment, the waterproof cover part 6 is made of an acrylic, and is a non-flexible and cylindrical transparent member. As described above, the vibration unit 2 causes the head part 1 to protrude by the elastic force of the coil spring 24. By adjusting the stroke of the head part 1, the action end of the head part 1 is arranged to a position which slightly protrudes beyond the protruding end 61 of the waterproof cover part 6. Specifically, a distance t in the vibration direction from the knocking surface 111 of the head part 1 at the protruding position to the protruding end 61 of the waterproof cover part 6 is set to a predetermined distance (about 1 to 2 mm in this embodiment).

[0048] The stain removing operation is performed in such a state that the protruding end 61 of the waterproof cover part 6 presses against the clothing 10A, since the waterproof cover part 6 prevents the liquid scattering due to the vibration of the head part 1 and thus prevents the liquid from spreading over a wide range, the wetting area of the clothing 10A is reduced and the clothing 10A can be put on immediately after the stain removing operation. In addition, during the stain removing operation, a distance between the body of the device and the clothing 10A can be always kept constant, and the force (knocking force) exerted by the head part 1 to the clothing 10A can be made appropriate and uniform. In addition, the action end of the head part 1 is arranged to the position that slightly protrudes beyond the protruding end 61 of the waterproof cover part 6, and an operation simulating an action of knocking (pressing) the stain portion 10a with hands can be automatically realized, since the head part 1 can clamp the clothing 10A when protruding due to the elasticity of the coil spring 24. In addition, since the waterproof cover part 6 is transparent, the removing state of the stain portion can be confirmed during the stain removing operation through the waterproof cover part 6.

[0049] The shape of the waterproof cover part 6 is not limited to a cylindrical shape, other shapes may also be used, for example, a substantially conical shape (a shape in which the protruding end 61 expands toward the clothing 10A), as long as it can cover the entire side surface of the knocking part 11. Further, the waterproof cover part 6 may be fixed to the housing body 9 other than being detachable.

[0050] Fig. 3 is longitudinal sectional view showing the stain removing device 100 when not in use. Fig. 3(A) is a longitudinal sectional view showing a head part 1X for preventing the liquid from dropping. Fig. 3(B) is a longitudinal sectional view showing a cap body (6X) for preventing the liquid from leaking. According to the stain removing device

100 of the present embodiment, the head part 1X for preventing the liquid from dropping as shown in Fig. 3(A) may be mounted at the inserted portion 121c from which the head part 1 is pulled out. The head part 1X for preventing the liquid from dropping has an insertion part 12X designed to have a shape and size that allows to be inserted without forming a gap such as the water supply groove 12a (see Fig. 2) between the head part 1X and the inserted segment 1121g of the inserted portion 121c. When the insertion portion 12X is inserted into the inserted segment 1121g, the liquid supplied through the water supply hole 1121f is blocked by the insertion portion 12X, and liquid dropping to the outside of the device body is prevented. By using the head part 1X for preventing the liquid from dropping at the time of carrying the stain removing device 100, it can prevent the liquid from leaking from the main body of the device due to shaking or vibration, and the head part 1X can be carried comfortably.

[0051] Further, in the stain removing device 100 of the present embodiment, the cap body 6X for preventing liquid from leaking shown in Fig. 3 (B) can be mounted to the housing body 9 from which the waterproof cover part 6 is detached. The cap body 6X for preventing the liquid from leaking is composed of a tubular portion 6Xa with one end 6Xa1 engaged with the rib 9a of the housing body 9 and a bottom portion 6Xb located at two side of the other end 6Xa2 of the tubular portion 6Xa. The liquid dropped from the discharge port 1121h is stored in a space Sp enclosed by the tubular portion 6Xa and the bottom portion 6Xb. As a result, even if the head portion 1 is inserted into the inserted portion 121c, the liquid leakage will not be occurred, thus the stain removing device 100 can be carried. In addition, the housing body 9 can be a structure in which the cap body 6X for preventing liquid leakage is mounted while keeping the waterproof cover part 6 in mounting state.

<Second Embodiment>

[0052] FIG. 4 is a perspective view showing a part of the cylinder 155 and the head part 151 constituting the stain removing device according to the second embodiment of the present disclosure. Fig. 4(A) shows a state before the head part 151 is inserted into the cylinder 155. Fig. 4(B) shows a state in which the head part 151 is inserted in the cylinder 155. The stain removing device according to the present embodiment is different from the first embodiment in that a liquid amount adjustment part 159, which is capable of adjusting the liquid dropping amount. Hereinafter, the configuration is substantially the same as that of the first embodiment, other than the configuration to be described below, so the description will be omitted.

[0053] The liquid amount adjustment part 159 shown in Fig. 4 is composed of the cylinder 155 and the head part 151. The cylinder 155 adjoins the inserted segment 1121g of the inserted part 158 and a liquid storage portion 156 through a partition portion 157, and has first to third supply regions 157a to 157c formed at equal intervals on the edge portion of the partition portion 157. The supply holes 157x, penetrating the partition portion 157, of these supply regions 157a to 157c are formed in different quantity. In the present embodiment, one supply hole 157x is formed at the first supply region 157a, three supply holes 157x are formed at the second supply region 157b, and five supply hole 157x are formed at the third supply region 157c. Further, the number of the supply holes 157x is not limited to this. Furthermore, the head part 151 is provided with a notch 1152 at an end of an insertion portion 152, and has a plurality of water supply grooves 1153 extending from the notch 1152 to the knocking portion 11 on the side portion of the insertion portion 152.

[0054] Fig. 5 is a diagram schematically showing the head part 151 shown in Fig. 4(B) together with the supply hole 157x. In the Fig. 5, the notch 1152 is indicated by hatching. As shown in Fig. 5, the notch 1152 is formed in the insertion portion 152 over a range corresponding to one supply region 157a (157b, 157c). The liquid in the liquid storage portion 156 shown in Fig. 4 flows into the notch 1152 from the supply holes 157x formed in any one of the supply regions 157a (157b, 157c) opposing to the notch 1152, and drops to the periphery of the knocking part 11 through the water supply grooves 1153. As a result, the dropping amount of the liquid varies according to the supply region 157a (157b, 157c) opposed to the notch 1152. The dropping amount of the liquid is increased in the order of the state shown below: a state shown in Fig. 5(A) in which the notch 1152 is opposed to the first supply region 157a, a state shown in Fig. 5(B) in which the notch 1152 is opposed to the second supply region 157b, and a state shown in Fig. 5(C) in which the notch 1152 is opposed to the third supply region 157c.

[0055] In this way, the stain removing device according to the present embodiment causes the liquid to drop from the gap between the water supply groove 1153 served as the other end of the water supply path 158 and the insertion portion 152 of the head part 151 through using the vibration caused by the vibration unit 2, and has the liquid amount adjustment part 159 shown in Fig. 4 which can adjust the dropping amount of the liquid.

[0056] When only the depth of the water supply groove 12a is set, the liquid drops too much, the result is that circle blurring may be caused. However, the liquid does not drop to the clothing 10A in excess or insufficiency by means of utilizing the liquid amount adjustment part 159. Therefore, it can prevent the stain removing effect from being decreased due to insufficiency supply of the liquid, and prevent circle blurring caused by a large amount of liquid being supplied to the stain portion 10a at once.

[0057] Further, the liquid amount adjustment part 159 is not limited to the configuration described above as long as the liquid dropping amount can be adjusted. Furthermore, the configuration of the liquid amount adjustment part 159

may be applied to the stain removing devices of the third to fifth and the seventh embodiments described later. Furthermore, in the present embodiment, the water supply groove 1153 is formed on the insertion portion 152, but it may also be formed on the inserted portion 158.

<Third Embodiment>

[0058] Fig. 6 is a longitudinal sectional view showing a stain removing device 300 according to a third embodiment of the present disclosure. The shape of the housing body 309 of the stain removing device 300 of the present embodiment is substantially rectangular. A part of the arrangement positions and configuration of the elements in the housing body 309 is different from that of the first embodiment. Additionally, comparing to the first embodiment in which the housing body 9 is used while keeping it in a substantially horizontal position, the housing body 9 of the present embodiment is used while keeping it in a substantially standing attitude. Hereinafter, the configuration is substantially the same as that of the first embodiment, other than the configuration to be described below, so the same reference numerals are given and the description thereof will be omitted.

[0059] As shown in Fig. 6, in the stain removing device 300 of the present embodiment, a cylinder 321, a third gear 322C, a second gear 322B, a first gear 322A and a motor 23 forming a vibration unit 302 are disposed in the housing body 309 in this order along the vibration direction. Further, the cylinder 321 is composed of a coil spring accommodation portion 321a, an inserted portion 321c, and a hollow connecting portion 321b that connects the coil spring accommodation portion 321a and the inserted portion 321c. The structure of the coil spring accommodation portion 321a is same as that of the coil spring accommodation portion 121a (see Figs. 1 and 2) of the first embodiment except that an opening 1321ab communicated with the connecting portion 321b is formed at a bottom surface 1321a of the coil spring accommodation portion 321a. In addition, the structure of the inserted portion 321c is the same as that of the inserted portion 121c (see Figs. 1 and 2) of the first embodiment except that the inserted portion 321c has a hollow connection end 1321b extending from the water supply hole 1121f to the inside of the connecting portion 321b. Further, a through hole 393a throughout the vibration direction is formed on a fixing portion 393 of the housing body 309 inserted into the coil spring housing portion 321a.

[0060] The water supply path 304 is composed of a liquid supply hose 341, the connection end 1321b of the inserted portion 321c, the water supply hole 1121f, the inserted segment 1121g and the water supply groove 12a provided at the cylinder insertion portion 12 of the head part 1. One end 341a of the liquid supply hose 341 is connected to the liquid containing part 3 and pass through the through hole 393a of the fixing portion 393, an axial center portion of the coil spring 24 and the coil spring accommodation portion 321a, and the other end 341b is connected to the connection end 1321b inside the connection portion 321b via the opening 1321ab. The liquid supply hose 341 has a deformation portion 341c which is connected between the liquid containing part 3 and the connection end 1321b with a enough length and is flexibly deformed (absorbs vibration) along with the vibration of the vibration unit 302. In addition, the liquid supply hose 341 may be connected between the liquid containing part 3 and the connection end 1321b without a enough length. In this case, in order to absorb vibration, a part of the liquid supply hose 341 is preferably snake belly shape.

[0061] In the stain removing device 300, since the motor 23 is rotated by power supply from the battery 5 by means of operating the power switch S outside the housing body 309, the cylinder 321 and the head part 1 can vibrate and the liquid can drop from the discharge port 1121h by utilizing the rotation of the third gear 22C and the elasticity of the coil spring 24, the stain removing device 300 has same effect as the stain removing device 100 of the first embodiment.

<Fourth Embodiment>

[0062] Figs. 7 and 8 are longitudinal sectional views showing a stain removing device 400 according to a fourth embodiment of the present disclosure. The stain removing device 400 of this embodiment is different from the first embodiment in that it includes a detergent containing part 7 and a detergent supply unit 8. Hereinafter, other than the configuration to be described later, other configurations are the same as that in the first embodiment, so the same reference numerals are given, and the explanation is omitted.

[0063] The detergent containing part 7 includes an accommodation body 71 for containing a liquid detergent supplied to the periphery of the head part 1, and a cover member 73 provided with an air hole (not shown) and closing a liquid supply hole 72 formed on the accommodation body 71.

[0064] The detergent supply unit 8 supplies the detergent in the detergent containing part 7 to the periphery of the head part 1, and is composed of a detergent dropping button 81, a detergent supply hose 82, and a detergent supply portion 409a formed on the housing body 409 and opening to the periphery of the head part 1. One end 82a of the detergent supply hose 82 is connected to the detergent containing part 7 at a position where the pressure force is applied by the detergent dropping button 81, and the other end 82b is connected to the detergent supply portion 409a. The detergent supply portion 409a has a shape that the liquid is supplied from the knocking part 11 facing the head part 1 to a direction inclined slightly downward with respect to the horizontal, and the opening end is in a nozzle shape. The

detergent dropping button 81 is elastically in contact with a coil spring 81a for exerting an elastic force from the pressed position to the pushing up position.

[0065] In this embodiment as described above, only the water is accommodated in the liquid containing part 3, when the detergent dropping button 81 is pressed at an appropriate timing, the detergent drops to the periphery of the head part 1. As shown in Fig. 7, an operation of protruding the uplifted head part 1 as shown in Fig. 8 is continuously performed, so that the liquid drops. Therefore, the stain removing device 400 can adjust the detergent amount according to the degree of stain of the stain portion 10a. In addition, since the water in the liquid containing part 3 and the detergent in the detergent containing part 7 are supplied to the clothing 10A at different timings, respectively, the stain can be removed by using detergent supplied by the detergent supply unit 8, and the clothing 10A can be rinsed by only using the water supplied from the water supply path 4.

[0066] In addition, the structure for supplying detergent by using the detergent dropping button 81 is not limited to the above, and it may also be a structure that will be supplied by vibration is similar to the liquid in the liquid containing part 3, for example.

[0067] In addition, in the present embodiment, the device body is prevented from being enlarged by disposing the detergent containing part 7 and the detergent supply unit 8, therefore, the constitution of the third embodiment can be applied to the water supply path 304, the cylinder 321 and the fixing portion 393 of the housing body 409.

<Fifth Embodiment>

[0068] Fig. 9 is a longitudinal sectional view showing a stain removing device 500 according to a fifth embodiment of the present disclosure. The stain removing device 500 according to the present embodiment is different from the first embodiment in that it includes a vapor ejection unit 508 capable of ejecting vapor toward the knocking part 11 of the head part 1 and the motor 23 is driven by being supplied power via a power cable C with a mandrel C1. The stain removing device 500 is powered by the power cable C, as a result, there is no need to be imbedded a battery inside of the housing body 509, and thus the device body is further miniaturized. In addition, the power cable C is not limited to the one having the mandrel C1, and may also be a USB cable having a USB connector. In addition, the above first to fourth embodiments may be structures in which the power is supplied by the power cable C, but the present embodiment may also be a structure that the power is supplied by the battery. Hereinafter, other than the configuration to be described later, other configurations are the same as that in the first embodiment, so the same reference numerals are given, and the explanation is omitted.

[0069] As shown in Fig. 9, the vapor ejection unit 508 includes a liquid accommodation portion for vapor 507, a liquid dropping button for vapor 581, a vapor generation portion 583 for generating vapor, a liquid supply pipe for vapor 582 for supplying the water in the liquid accommodation portion for vapor 507 to the vapor generation portion 583, and a vapor ejection portion 584, in where one end 584a of the vapor ejection portion 584 is connected to the vapor generation portion 583 and the other end 584b is opened at the periphery of the head part 1. The liquid dropping button for vapor 581 is elastically in contact with a coil spring 581a for exerting an elastic force from the pressed position to the pushing up position.

[0070] The liquid accommodation portion for vapor 507 includes a liquid accommodation body for vapor 571 for containing water for vapor, and a cover member 573 for blocking a liquid supply hole for vapor 572 formed on the liquid accommodation body for vapor 571 and having an air hole (not shown) formed therein. The vapor generation portion 583 is composed of a heater switch 586 capable of switching to a power state of a heater 585, the heater 585 that generates heat while being powered via the power cable C, a vapor generation body 583 in which the heater 585 is disposed, and a thermostat 587 provided on the side wall of the vapor generation body 583 and adjusting the power state of the heater 585 according to the temperature of the heater 585. The thermostat 587 is configured to stop supplying power to the heater 585 so as to cool the heater 585 when an upper limit temperature is reached, and to supply power to the heater 585 again when a lower limit temperature is reached.

[0071] In the stain removing device 500 of the present embodiment, the heater is powered by means of the operation of the heater switch 586 to generate heat. When the liquid dropping button for vapor 581 is pushed at an appropriate timing and then the liquid drops from the liquid accommodation portion for vapor 507 to the heater 585, vapor is generated and ejected to the head part 1 from the other end of the vapor ejection portion 584. Since the stain removing device 500 includes the vapor ejection unit 508 for ejecting the vapor toward the head part 1, it can warm the clothing 10A by the vapor and perform the stain removing operation, thereby improving the stain removing effect. In addition, since the vapor has higher kinetic energy than water in the liquid state including hot water, and the vapor is easier soaked into the solid stain and the clothing 10A than the water in the liquid state, the solid stain and the dirt deep inside of clothing fibers can be dissolved and removed by the vapor, which also contributes to the improvement of the stain removing effect. Furthermore, discoloration of the clothing 10A can be prevented, since it is unnecessary to use a strong bleaching agent for stain removing.

[0072] Further, in the present embodiment, the structure of the fifth embodiment can be applied to the cylinder 321

and the fixing portion 393 of the housing body 509, since the maximization in the size of the device body is suppressed by providing the vapor ejection unit 508.

<Sixth Embodiment>

[0073] Fig. 10 is a longitudinal sectional view showing a stain removing unit 600 according to a sixth embodiment of the present disclosure. Fig. 11 is an exploded view showing a heating apparatus 601 constituting the stain removing unit 600 shown in Fig. 10. The stain removing unit 600 of the present embodiment shown in Fig. 10 is composed of the stain removing device 100 of the first embodiment and the heating apparatus 601.

[0074] As shown in Fig. 11, the heating apparatus 601 includes an absorption pad combined member (cover for absorption pad combined member) 681, a main cover 671, a decorative plate 661, a heating plate 651, a first heat insulation material 641, a heater 631, a second heat insulation material 621, and an apparatus body 611.

[0075] The absorption pad combined member 681 and the main cover 671 are circular in the plan view, and an opening 681a and an opening 671a are formed at the centers of the absorption pad combined member 681 and the main cover 671, respectively. The absorption pad combined member 681 rotates in a state in which a absorption pad 10B is sandwiched between one surface 681b of the absorption pad combined member 681 and one surface 671b of the main cover 671, and a thread portion 671c and a thread portion 681c are mounted on the main cover 671 by being mutually engaged with each other. The decorative plate 661 has a step between a central portion 661a and an end portion 661b. In a state where the decorative plate 661 is inserted within the heating apparatus 601, a raised surface 661ab of the central portion 661a is exposed through the opening 671a and is substantially parallel to one surface 671b of the main cover 671, and the end portion 661b is sandwiched between the other end 671d of the main cover 671 and the apparatus body 611. The decorative plate 661 is made of, for example, stainless steel. Through holes 661c and 671e passing through a safety switch 1614 to be described later are respectively formed in the end portion 661b of decorative plate 661 and the main cover 671.

[0076] The heating plate 651 is insertedly disposed in the central portion of the decorative plate 661. A knocked surface 651a, to which an external force is exerted from the head part 1 of the stain removing device 100, is opposite to the heating plate 651. The heating plate 651 is made of, for example, aluminum with high thermal conductivity. The thickness of the heating plate 651 is set to about 1 to 2 mm. Since the heating plate 651 has high strength and high thermal conductivity simultaneously, it can quickly and uniformly transmit the heat from the heater 631 to the absorption pad 10B, and the deformation of the absorption pad 10B is suppressed by the external force exerted by the head part 1 in the stain removing operation, thereby maintaining a high stain removing efficiency.

[0077] The first heat insulation material 641 is a heat insulation material disposed at a back side of the heating plate 651 and configured for the temperature adjustment, and is made of, for example, silicon rubber. The second heat insulation material 621 is disposed on the apparatus body 611 and blocks the heat of the heater 631, and is made of, for example, glass wool. For example, the heater 631 disposed between these heat insulation materials can use for example a ceramic heater. In addition, the heating plate 651 has a good appearance by performing coating, but it is also possible to adopt a configuration without using the decorative plate 661.

[0078] The apparatus body 611 includes a power cable 1613, a main switch 1611 capable of switching the power state to the heater 631, a thermostat 1612 capable of adjusting the power state of the heater 631 according to the temperature of the heater 631, and the safety switch 1614. When an upper limit temperature (for example, 70°C) of the thermostat 1612 is reached, the thermostat 1612 stops the power supply to the heater 631 to cool the heater 631. When the lower limit temperature (for example, 60°C) of the thermostat 1612 is reached, the thermostat 1612 starts the power supply to the heater 631 again. The safety switch 1614 is configured to protrude from the one surface 671b of the main cover 671 via the through holes 661c and 671e, and the power can be supplied to the heater 631 when the absorption pad 10B mounted at a predetermined position is pressed. On the other hand, the power supplied to the heater 631 can be stopped when the absorption pad 10B is not pressed. That is, the heating apparatus 601 can be configured to mount the absorption pad 10B to the predetermined position on the main cover 671 and make the absorption pad combined member 681 to be used in the case of closure.

[0079] For such heating apparatus 601, when the main switch 1611 is operated, the heater 631 generates heat, and the heat is transferred to the heating plate 651 to raise the temperature of the absorption pad 10B. Therefore, when the clothing 10A is placed on the heating apparatus 601, in the state where the stain portion 10a is opposed to the heated absorption pad 10B, an operation of exerting knocking force to the knocked surface 651a through the head part 1 of the stain removing device 100 can be performed. Therefore, the stain removing unit 600 of the present embodiment continuously heats the stain portion 10a at about 50°C, since the dirt is more easily dissolved in the liquid at this time, the stain removing operation can be performed, as a result, the stain removing effect is further improved. In addition, since it is not necessary to use a strong bleaching agent in order to remove stain, the color fading of the clothing 10A is prevented.

[0080] Further, in the present embodiment, the heating apparatus 601 is used in combination with the stain removing device 100 of the first embodiment, but it is also possible to use in combination with the stain removing devices 200 to

500 of the second to fifth embodiments described above or in combination with the stain removing device 700 of the seventh embodiment described below.

[0081] Furthermore, in the present embodiment, the heating apparatus 601 has a circular plane, but may have a rectangular plane. In this case, one side of the absorption pad combined member is connected to another component of the heating apparatus (the main cover, the decorative plate, the heating plate, the first heat insulation material, the heater, the second heat insulation material, the apparatus body) via a hinge or the like. Preferably, a foldable structure is constructed in which the absorption pad combined member is sandwiched between other components of the heating device 60.

<Seventh Embodiment>

[0082] Fig. 12 is a view showing a stain removing device 700 according to a seventh embodiment of the present disclosure. Fig. 12(A) is a longitudinal sectional view showing the stain removing device 700 of this embodiment, Fig. 12(B) is a perspective view of a waterproof cover part of the stain removing device 700 of this embodiment. Fig. 12(C) is a longitudinal sectional view showing the waterproof cover part in an exploded manner.

[0083] In addition, Fig. 13 is a schematic circuit diagram showing a circuit for supplying power to the motor 23 and the heater 731 of the stain removing device 700, and shows three power states corresponding to sliding positions of an operation portion SS1 of a switch SS. Further, in the circuit of Fig. 13, a power up part is represented by solid lines and a non-power up part portion is represented by dot-chain lines.

[0084] As shown in Fig. 12, the stain removing device 700 of the present embodiment is different from the third embodiment shown in Fig. 6 mainly in that the structure of the waterproof cover part 706 and the motor 23 is driven while being powered by a USB connector CC1. The USB connector CC 1 is connected to an external power source BB (see Fig. 13) via a USB cable CC2 (see Fig. 13). Therefore, since the stain removing device 700 of the present embodiment is configured to be powered by the external power source BB, it is not necessary to insert the battery within the housing body 709, and thus the device body becomes more compact. Hereinafter, other than the configuration to be described later, other configurations are the same as that of the third embodiment, so the same reference numerals are given and the explanation will be omitted. In Fig. 12, wirings connected between the USB connector CC 1 and the motor 23 are not shown.

[0085] As shown in Figs. 12(A) to 12(C), the waterproof cover part 706 includes a guide frame 732, a heater 731, a pressing member 733, a heat insulation packing 734, and a power connector 735. Like the above-described embodiments, the waterproof cover part 706 of the present embodiment is also detachable with respect to the housing body 709 through a rib 709a at a position on a side surface of the knocking portion 11 which encircles the head part 1.

[0086] The guide frame 732 has a bottom surface region 732c with flat annular shape, an inner cylinder region 732a extending from an inner periphery of the bottom surface region 732c, and an outer cylinder region 732b which is coaxial with the inner cylinder region 732a and extends from an outer periphery of the bottom surface region 732c. An internal space Is is formed by these regions 732a-732c. Therefore, as shown in Fig. 12(C), an inner surface of the bottom surface region 732c is curved based on the shape of the heater 731. The length L1 of the inner cylinder region 732a in the extending direction is shorter than the length L2 of the outer cylinder region 732b in the extending direction. In the internal space Is, the heater 731, the pressing member 733 and the heat insulation packing 734 are disposed in this order from the bottom surface region 732c toward an opening 732d. During the stain removing operation, an outer surface 732e of the bottom surface region 732c is pressed by the clothing 10A. The guide frame 732 is made of, for example, aluminum having high thermal conductivity. Therefore, the heat from the heater 731 can be quickly transferred to the clothing 10A, and the temperature of the heater 731 can be rapidly decreases after use, so the stain removing device 700 can be stored and carried immediately after use.

[0087] The heater 731 is an annular member constituted by wound nickel-chromium heating wires, and generates heat while being powered through the USB connector CC 1 and the power connector 735. In addition, the power supplied to the heater 731 is, for example, about 5W. The temperature of the heater 731 is set to be about 80 °C -100 °C when generating heat. In addition, the heater 731 may be another heater such as a ceramic heater.

[0088] The pressing member 733 is an annular member having a pressing surface 733a which is curved based on the shape of the heater 731 having a circular cross section. Such pressing member 733 restricts the movement of the heater 731 by causing the pressing surface 733a and the heater 731 to abut against each other in the internal space Is, and inhibits the heat of the heater 731 from transmitting to the rib 709a.

[0089] The heat insulation packing 734 is an annular member made of silicon and mounted along the outer cylinder region 732b, and there is a gap between the heat insulation packing 734 and the inner cylinder region 732a of the guide frame 732 in the inner space Is. The heat insulation packing 734 is composed of a cylinder region 734a abutting against the outer cylinder region 732b and the pressing member 733, and a flange region 734b extending outward from an end portion of the cylinder region 734a.

[0090] The power connector 735 shown in Fig. 12(B) and Fig. 13 is a member which protrudes from the internal space

Is and is attached to the opening end surface of the guide frame 732, and is engaged with a housing body side connector (not shown) provided on a side of the housing body 709. The heater 731 is electrically connected to the external power source BB via the power connector 735.

[0091] The waterproof cover part 706 as described above is mounted to the housing body 709 by inserting the rib 709a into the internal space Is to be in contact with the inner peripheral surface 734c of the heat insulation packing 734. At this time, an end surface of the outer cylinder region 732b of the guide frame 732 is brought into contact with the housing body 709 via the flange region 734b of the heat insulation packing 734, as a result, the waterproof cover part 706 is positioned in the vibration direction, and the flange region 734b serves to separate the housing body 709 from the outer cylinder region 732b. In addition, as shown in Fig. 12(C), the length L3 of the rib 709a in the vibration direction is configured to be shorter than the length L4 of the heat insulation packing 734 in the vibration direction, and a front end of the rib 709a is a position separated from the pressing member 733. Then, the heat insulation packing 734 is located between the outer cylinder region 732b of the guide frame 732 and the rib 709a, and a heat insulation space Gp (see Fig. 12(A)) is formed between the inner cylinder region 732a of the guide frame 732 and the rib 709a. Further, as described above, since the length L1 of the inner cylinder region 732a of the guide frame 732 is shorter than the length L2 of the outer cylinder region 732b, the flange region 734b separates the housing body 709 from the outer cylinder region 732b of the guide frame 732, the front end of the inner cylinder region 732a is the position separated from the housing body 709. Therefore, when the waterproof cover part 706 is mounted to the housing body 709 by utilizing the internal space Is in which the heater 731 is disposed, the pressing member 733 and the guide frame 732, which become of high temperature due to the heat from the heater 731, are configured to not in direct contact with the housing body 709 including the rib 709a, so a damage to the body of the stain removing device 700 caused by the heat from the waterproof cover part 706 is suppressed.

[0092] In addition, the waterproof cover part 706 is provided with a temperature adjustment portion such as a thermostat capable of adjusting the power state to the heater 731 according to the temperature of the heater 731 in order to prevent overheating of the guide frame 732 and even the clothing 10A. Further, the waterproof cover part 706 may be provided with a temperature display portion such as a thermo tape for displaying the temperature of the guide frame 732. As a result, the user can hold the temperature of the waterproof cover part 706.

[0093] On the other hand, although the vibration unit 702, the liquid containing part 703, and the water supply path 704 are functionally the same as those of the stain removing device 300 of the third embodiment, but their shapes and arrangement positions in the housing body 709 are different from those of the stain removing device 300 of the third embodiment, as shown in Fig. 12(A).

[0094] Specifically, as shown in Fig. 12(A), a third gear 722C constituting the vibration unit 702 is provided with two protrusions 722c protruding in a radial direction and spaced equally in a circumferential direction, for substituting the protrusion 22c (see Fig. 6) extending parallel to the axis 122ee. The number of vibrations per unit time of the head part 1 can be adjusted by the number of the protrusions 722c. In the present embodiment, the knocking action of the head part 1 is set to be performed 15 to 20 times per second. In addition, the number of the protrusions 722c is not limited to two, and may be one or three or more.

[0095] In addition, the cylinder 721 constituting the vibration unit is formed by a part of a second member 721y integrally engaged on an outer periphery of the first member 721x having a bottomed cylindrical shape in the vibration direction. A coil spring accommodation portion 721a is formed inside the first member 721x. The liquid storage portion 721b, the inserted portion 721c and the inserted segment 1121g are constituted by a second member 721y having a bottomed cylindrical shape and formed from a repeating portion of the first member 721x to the head part 1. The second member 721y covers the first member 721x to an approximate center in the vibration direction, and an engaging claw 1721b engaged with the protrusions 722c of the third gear 722C is arranged on an end portion of a side of the second member 721y closing the first member 721x.

[0096] On the coil spring accommodation portion 721 a, the other end of the coil spring 24 and the housing body 709 are composed of other members, and its base end side accommodates the fixing portion 793 fixed to the housing body 709.

[0097] The liquid storage portion 721b is composed of a wide portion 1721d whose width is wider than the width of the opening 1721g of the housing body 709 and a narrow portion 1721e whose width is narrower than the width of the opening 1721 g of the housing body 709 and protruding from the opening 1721g. The wide portion 1721d is arranged on a restriction member 709b by an opening edge arranged along the housing body 709, so that the moving range of the cylinder 721 in the protruding direction Y1 is restricted. Further, by using an elastic material such as rubber or urethane resin and the like as the restriction member 709b for the cylinder, damages to the cylinder 721 and the housing body 709 are suppressed, and the noise when driving the stain removing device 700 is suppressed. In addition, for suppressing the noise when driving the stain removing device 700, the whole or substantially the entirety of the housing body 709 has a double structure, and it is effective to dispose components such as the vibration unit 702 in such a housing body 709. In addition, since the housing body has a double structure, a fixing member such as a screw fixed at an inner surface of the housing body are not visible from the outside of the housing body, and the appearance design of the stain removing device can be improved.

[0098] The inserted portion 721c has a tapered water supply hole 1721f extending from the narrow portion 1721e and an inserted segment 1121g having the substantially same width as the narrow portion 1721e. The cylinder insertion portion 12 of the head part 1 is inserted into the inserted segment 1121 g by slightly pressing.

[0099] A bottom surface 703a of the accommodation part body 703a of the liquid containing part 703 is inclined towards one end 741a of a liquid supply pipe 741. The shape of the liquid containing part 703 is different from that of the stain removing device 300 of the third embodiment. In addition, the other end 741b of the liquid supply pipe 741, the one end 741a of which is connected to the liquid containing part, is connected to the wide portion 1721d of the cylinder 721. In addition, a coil spring 741c is wound around the other end 741b of the liquid supply pipe 741 to prevent the flexibly deformed liquid supply pipe 741 from curving to make the liquid from not to flow.

[0100] In the present embodiment, the switch SS is a slide type member, and the operation portion SS 1 of the switch SS is set to three slide positions: an OFF position as shown in Fig. 12(A) and Fig. 13(A), a first slide position as shown in Fig. 13(B), and a second slide position as shown in Fig. 13(C). Specifically, when the operation section SS1 is at the OFF position, it is a power off state in which the power is not supplied to neither the motor 23 of the vibration unit 702 nor the heater 731; when the operation section SS1 is at the first slide position, it is a preheating state in which only the heater 731 is powered via the power connector 735, and when the operation section SS1 is at the second slide position, it is a heating and knocking state in which both of the motor 23 of the vibration unit 702 and the heater 731 are powered simultaneously.

[0101] Therefore, in the preheating state, the waterproof cover part 706 presses against the clothing 10A and the clothing 10A is heated. During the clothing 10A is heated to a certain extent, by switching the switch SS to the heating and knocking state, the stain removing operation can be performed after the clothing 10A has been heated.

[0102] In this way, since the stain removing device 700 of the present embodiment is of a structure in which the waterproof cover part 706 pressing the clothing 10A is heated by the heat from the heater 731 during the stain removing operation, the stain portion of the stain removing object and its periphery can always be heated via the waterproof cover part 706 during the stain removing operation even if the heating apparatus 601 shown in Fig. 10 is not separately used, thus the miniaturization is realized and the stain removing effect is further improved. Further, so long as the heater is disposed inside the head part rather than the waterproof cover part, the heat can be transmitted only to the clothing 10A intermittently, and the clothing 10A cannot be efficiently heated.

[0103] In addition, a LED, which is lit up when the heater 731 is in the powered state, may be provided on the stain removing device 700 of the present embodiment. By doing so, the user can also hold to heat the waterproof cover part 706.

[0104] In addition, the waterproof cover part 706 of the present embodiment is detachable from the housing body 709. The waterproof cover part 6, in which the heater of the stain removing device 100 of the first embodiment shown in Fig. 1 is not provided, may be mounted on the housing body 709 of the stain removing device 700 according to the dirty degree of the clothing 10A or available power and the like.

[0105] Furthermore, in the present embodiment, the switch SS is a slide type, but other types of switch such as a rotary type switch or a push button type switch may be used.

[0106] In addition, as described above, the stain removing device 700 of the present embodiment and the heating apparatus 601 shown in Fig. 10 may be used simultaneously. By doing so, the clothing 10A can be heated more effectively, and the stain removing effect can be further improved.

<Eighth Embodiment>

[0107] Fig. 14 is a partial cross-sectional view showing a stain removing device 800 according to an eighth embodiment of the present disclosure. In the figure, only a part of a cylinder 183 and a head part 181 are illustrated. The stain removing device 800 of the present embodiment is different from that of the first embodiment in that the liquid flows through the inside of the head part 181 rather than flow from the side surface of the head portion 1 (see Fig. 1 and the like). Hereinafter, the configuration other than the configuration to be described later is the same as that of the first embodiment, so the description of the same configuration as that of the first embodiment will be omitted.

[0108] The cylinder 183 shown in Fig. 14 has a coil spring accommodation portion (not shown), an inserted portion 183a, a liquid storage portion 183b, and a cylinder water supply hole 183a1. The coil spring accommodation portion accommodates the coil spring 24 (see Fig. 1 and the like), and the inserted portion 183a is a member in which a cylinder inserting portion 181 a of the head part 181 which will be described later is removably inserted. The liquid storage portion 183b is located between the inserted portion 183a and the coil spring accommodation portion, and stores the liquid supplied from the liquid accommodation portion 3 (see Fig. 1 and the like) therein. The cylinder water supply hole 183a1 is formed to pass through the inserted portion 183a from the liquid storage portion 183b and is opened to a cone shaped toward a base end 184a1 of the head part 181.

[0109] The head part 181 includes the cylinder insertion portion 181 a into which the inserted portion 183a can be removably inserted, a knocking portion 181b formed with a knocking surface 182, a head water supply hole 184' extending to the knocking surface 182 through the head part 181. The head water supply hole 184' is composed of a water storage

portion 184A, which has a substantially rectangular longitudinal cross section, and is opposed to the cylinder water supply hole 183a1 and opened at the base end 184a1 of the head part 181, and passes through the cylinder inserting portion 181a; an expanding portion 184C having a trapezoidal longitudinal cross section and an opening end 184a2 expanding and opened toward the center of knocking surface 182, and a small-diameter portion 184B connecting the water storage portion 184A and the small-diameter portion 184B. The flow path cross section of the small-diameter portion 184B is smaller than that of the water storage portion 184A and that of the expanding portion 184C. The liquid in the small-diameter portion 184B is slightly discharged to the expanding portion 184C when the head part 181 is vibrated by vibration unit (not shown). On the other hand, the liquid is prevented from dropping by an action of surface tension when the head part 181 is not vibrated. The liquid storage portion 183b, the cylinder water supply hole 183a1, and the head water supply hole 184' together with the liquid supply pipe 41 (see Fig. 1) constitute a water supply path 184. The liquid in the liquid storage portion 183b drops to the head part 181 from the cylinder water supply hole 183a1, and then flows through the head water supply hole 184' to be supplied to the knocking surface 182.

[0110] In addition, a plurality of annular protruding portions 181 a' separated from each other in the vibration direction are formed on the side surface of the cylinder inserting portion 181a of the head part 181. When the cylinder inserting portion 181a is inserted into the cylinder 183, the protruding portions 181a' is stably fixed by pressing against an inner surface of the inserted portion 183a.

[0111] The above configuration is the same as the above embodiments, the vibration unit (not shown) vibrates the head part 181 when being powered, the action of knocking the clothing 10A (see Fig. 1) by the head portion 181 can be automated, as a result, the knocking force becomes uniform, and there is no need to quickly move the hand, the hand will not feel fatigue even if the stain removing operation is performed for a long time. In addition, the solid stain of the stain portion 10a (referring to Fig. 1) decomposed by the impact from the vibrating head part 181 is not immediately dissolved in the liquid supplied by the liquid containing part (not shown), since the opening end 184a2 is expanded, the water supply path 184 is not easily blocked by the solid stain even if the decomposed solid stain is soaked in the water supply path 184 from the knocking surface. Even if the water supply path 184 is blocked by the solid stain, it is easy to clean the water supply path 184, so the stain removing effect can be stably maintained.

[0112] Particularly, by appropriately designing a portion of the water supply path 184 other than the opening end 184a2, that is, the cross section of the flow path of the small-diameter portion 184B, since an appropriate amount of liquid is continually supplied to the clothing 10A along with the vibration of the head part 181, and the liquid is prevented from flowing down due to the surface tension when the head part 181 does not vibrate, a liquid leakage is prevented when the stain removing operation is not performed. Since such a dropping adjustment function also works in cylinder water supply hole 183a1, liquid exceeding the capacity of the water storage portion 184A will not be supplied at once from the cylinder water supply hole 183a1. Further, the water supply groove 12a formed on the side surface of the head part 1, as in the stain removing device 100 shown in Fig. 1, are not required. Since the protruding portions 181a can be formed on the side surface of the head part 181, the head part 181 can be stably mounted to the cylinder 183 even if it is extracted from the cylinder 183 repeatedly many times.

[0113] The configurations of the head part 181 and the cylinder 183 of the present embodiment may be applied to the other embodiments described above.

[0114] In the above, embodiments of the present disclosure have been described, but the specific structure of each part is not limited to the above-described embodiments.

[0115] For example, although in the stain removing devices 100 to 500 and 700 of the above-described embodiments, the knocking surface 111 of the head part 1 is used downward, it may also be a structure in which the knocking surface 111 is used transversely. In this case, a structure for example in which the liquid is pump is used.

[0116] In addition, in the above embodiments, the knocking surfaces 111, 182 of the head part 1 (see Fig. 1), the head part 151 (see Fig. 4) and the head part 181 (see Fig. 14) are flat (plane), but the shapes of the knocking surfaces 111 and 182 are not limited to this, and may be, for example, a concave-convex shape as shown in Fig. 15. FIG. 15 is a diagram showing a variant of the head part 1 shown in Fig. 1. Specifically, Fig. 15(A) is a perspective view showing the head part 171, Fig. 15(B) is a side view showing the head part 171, and Fig. 15(C) is a bottom view showing the head part 171. As shown in Figs. 15(A) and 15(B), a knocking surface 172 formed on the knocking portion 171a of the head part 171 is composed of a base 172a and a surface 172ba of a plurality of protrusions 172b protruding from the base 172a. As shown in Figs. 15(B) and 15(C), each of the protrusions 172b is hemispherical shape and regularly arranged in the base 172a. The stain removing devices 100 to 500 and 700 of the present disclosure are appropriately replaced with those having different shapes such as the head part 171 and the head part 1 according to the type of dirt constituting the stain portion 10 a, thereby removing stain more effectively.

[0117] In the above embodiments, the head parts 1, 181 can be detached from the cylinders 21, 183 and replaced, but may also be an undetachable structure. Furthermore, the head part 1 may be configured to be rotatable about an axis parallel to the vibration direction by using a stroke motion.

[0118] Still further, in the above-described embodiments, a mechanism for heating the liquid may be arranged in the stain removing devices 100 to 500 and 700, alternatively a structure in which the heated liquid drops toward the clothing

10A may also be arranged in the stain removing devices 100 to 500 and 700, therefore, the stain removing effect is further improved.

[0119] In addition, in the first embodiment shown in Fig. 1, the liquid containing part 3 is fixed in the housing body 9, but it may also be detachably mounted in the housing body 9. In this case, for example, the liquid containing part 3 is provided at a position where the liquid can be supplied to the head part 1 without passing through the liquid supply pipe 41 and the cylinder 21, that is, the liquid containing part 3 is arranged at a position directly connected to the head part 1 or the periphery of the head part 1, the liquid containing part 3 and the head part 1 may be an integral structure which can be detached from the housing body 9.

[0120] With such a configuration, a plurality of liquid containing parts 3 in which different types of liquid (for example, water, solvent, etc.) are stored are prepared, the stain removing operation is performed by mounting the liquid containing part 3 containing the liquid suitable for the state of the stain portion 10a to the housing body 9, thereby improving the stain removing effect. In addition, the blocking of the water supply path 4 caused by concentration of the water stain or calcium component at positions which are not easy to clean, such as inside of the liquid supply pipe 41 or the cylinder 21, can be prevented, thus it is not necessary to disassemble the body of the stain removing device 100 for cleaning. Further, since the liquid containing part 3 is transparent or semitransparent, a certain amount of the liquid can be drawn out from the housing body 9 during the stain removing operation.

[0121] Further, the liquid containing part 3 may be configured to include an accommodation body in which a liquid accommodation space is formed and a cover member for opening and closing the liquid accommodation space. With such structure, the cover member can be taken down from the accommodation body when the liquid containing part 3 is taken down from the housing body 9, and since the liquid accommodation space can be replenished with the liquid, and the liquid in the liquid containing part 3 can be easily replaced with another kind of liquid such as ethanol, the convenience is improved and continuous use of the stain removing device 100 becomes possible. At this moment, the replenishment and replacement and the like of the liquid can be performed when the liquid containing part 3 is detached from the housing body 9, so the housing body 9 will not be wetted when being replenished, and the housing body 9 is not required to be subjected to a waterproof treatment. In addition, the interior of the liquid containing part 3 can be cleaned by disassembling it into the accommodation body and the cover member, so the water stain and the calcium component can be easily removed. Furthermore, the head part 1 is configured to be removable from the liquid containing part 3. With such a configuration, the most appropriate head part 1 and the liquid may be selected and used according to the state of the stain portion 10a and the like, so the stain removing effect can be improved. The above configuration in which the liquid containing part 3 and the like can be detached from the housing body 9 may also be applied to the stain removing devices 300 to 500, 700, and 800 described above.

[0122] Further, the materials constituting the stain removing devices 100 to 500, 700, 800, and the heating apparatus 601 are not limited to those indicated by hatching in the respective drawings.

[0123] Further, in the above embodiment, in the case where only water as a liquid drops from the stain removing devices 100, 300, 500, 700, 800, it is effective to directly coat the detergent on the stain portion 10a of the clothing 10A in advance when the stain removing operation is performed. In this case, the stain removing devices 100, 300, 500, 700, and 800 perform the knocking action while supplying water so as to play the effect of removing stain, and also play the effect of rising by continuing the operation, since the dropped water transfers the stain and the detergent to the absorption pad 10B.

[0124] In the above embodiment, the waterproof cover part 6 is cylindrical, but its cross-sectional diameter may be increased toward the protruding end 61 thereof. By doing so, the stain removing devices 100 to 500, 800 can be stably pressed against the clothing 10A.

[0125] Other configurations can be variously modified without departing from the scope of the spirit of the present disclosure.

List of reference numbers

[0126]

1, 151, 171, 181	head part;
2, 302, 702	vibration unit;
3, 703	liquid containing part;
4, 158, 704, 184	water supply path;
41a	one end of the water supply path;
1121h	discharge port (the other end of the water supply path);
6, 706	waterproof cover part;
7	detergent containing part;
8	detergent supply unit;

24	elastic member (coil spring);
61	protruding end of the waterproof cover part;
100, 300, 400, 500, 700, 800	stain removing device;
111, 172, 182	knocking surface;
5 159	liquid amount adjustment part;
184a2	opening end;
508	vapor ejection unit;
601	heating apparatus;
631,731	heater;
10 651	heating plate;
651a	knocked surface;
600	stain removing unit.

15 Claims

1. A stain removing device, comprising:

20 a head part provided with a knocking surface;
a vibration unit causing the head part to vibrate in a direction substantially orthogonal with the knocking surface by supplying power;
a liquid containing part for containing liquid; and
a water supply path with one end being connected to the liquid containing part and the other end being open to a periphery of the head part,
25 wherein the liquid is supplied to the periphery of the head part from the other end of the water supply path, along with a vibration of head part caused by a vibration of the vibration unit.

2. A stain removing device, comprising:

30 a head part provided with a knocking surface;
a vibration unit causing the head part to vibrate in a direction substantially orthogonal with the knocking surface by supplying power;
a liquid containing part for containing liquid; and
a water supply path extending from the liquid containing part through the head part to the knocking surface and
35 having an expending opening end facing the knocking surface,
wherein the liquid is supplied to the knocking surface from the liquid containing part via the water supply path, along with the vibration of head part caused by the vibration of the vibration unit.

40 3. The stain removing device according to claim 1 or claim 2, further comprising a non-flexible waterproof cover part surrounding a side surface of the head part,
wherein the vibration unit has an elastic member capable of extending and contracting in a direction substantially orthogonal with the knocking surface, the head part is protruded by an elastic force of the elastic member,
and wherein an operation end of the head part is arranged at a position slightly protruding from a protruding end of the waterproof cover part.

45 4. The stain removing device according to claim 3, wherein the waterproof cover part has a heater capable of generating heat when being supplied power.

50 5. The stain removing device according to claim 1, further comprising
a liquid amount adjustment part for causing the liquid to drop from the other end of the water supply path by utilizing the vibration caused by the vibration unit and capable of adjusting a dropping amount of the liquid.

6. The stain removing device according to claim 1 or claim 2, further comprising:

55 a detergent containing part for containing a liquid detergent, and a detergent supply unit for supplying the detergent in the detergent containing part to the periphery of the head part.

7. The stain removing device according to claim 1 or claim 2, further comprising:

a vapor ejection unit capable of injecting vapor toward the head part.

8. A stain removing unit, comprising:

5 a stain removing device according to claim 1 or claim 2; and a heating apparatus at least comprising a heater being capable of generating heat when being supplied power, and a heating plate provided with a knocked surface, on which a force is exerted by the head part constituting the stain removing device and conveying the heat generated by the heater.

10

15

20

25

30

35

40

45

50

55

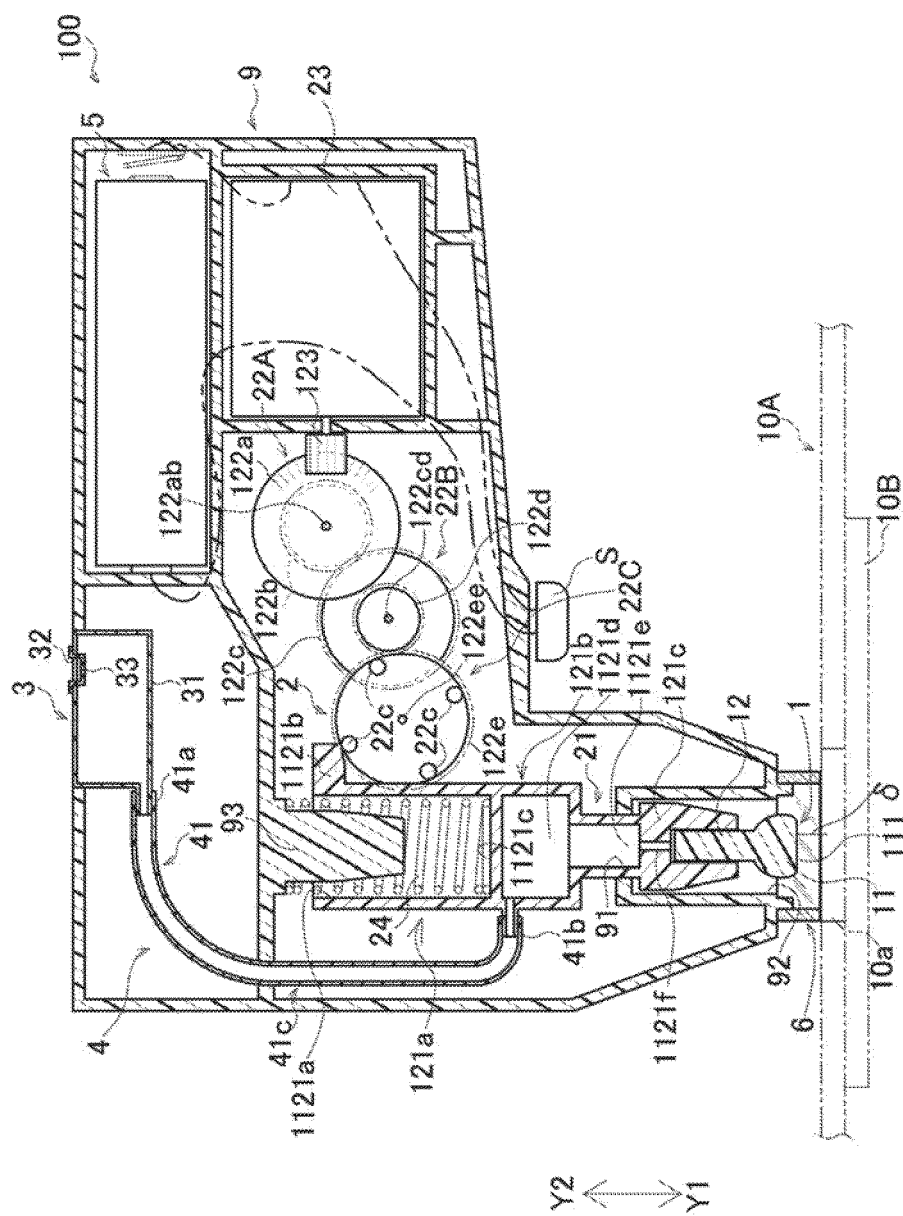


FIG. 1

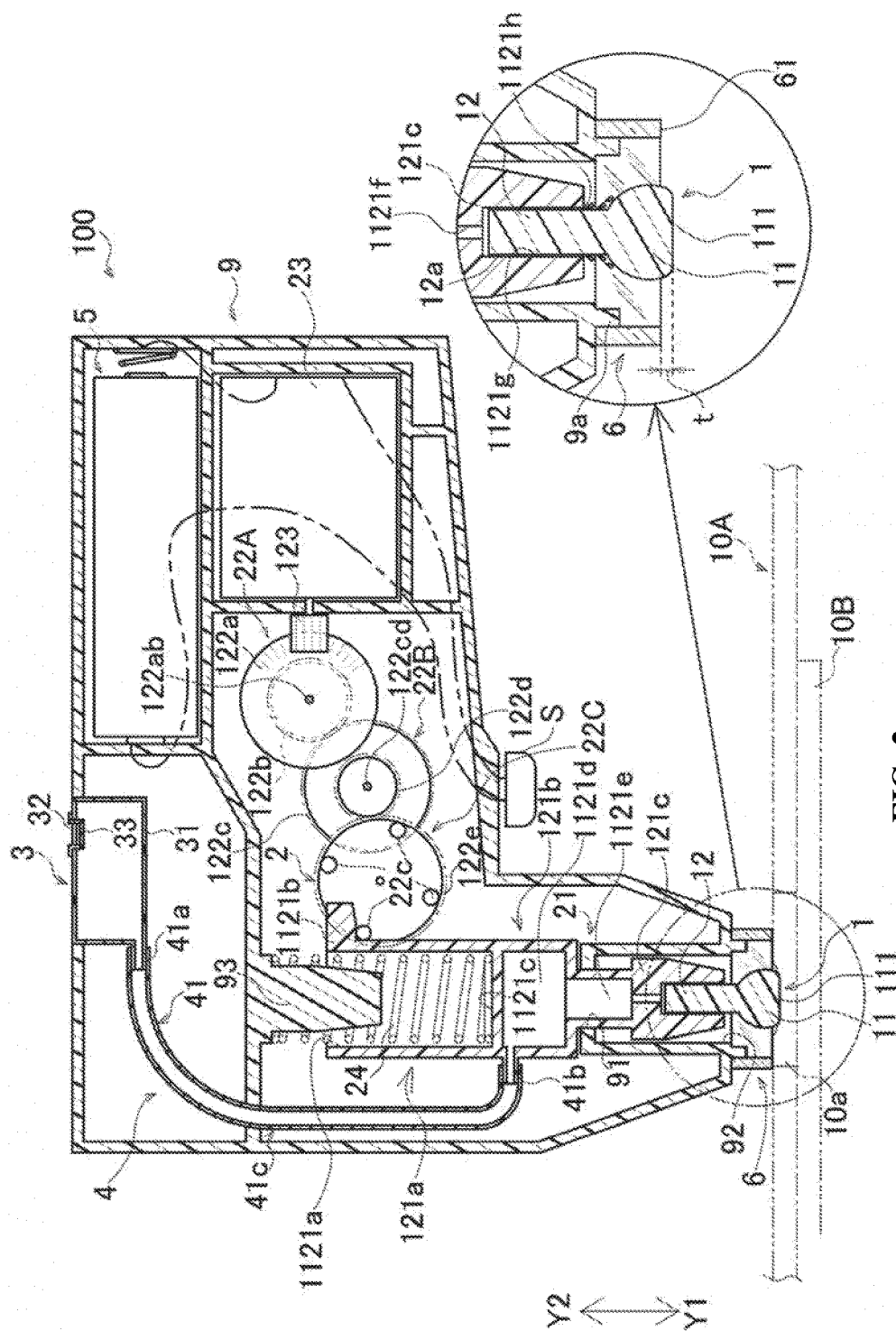


FIG. 2

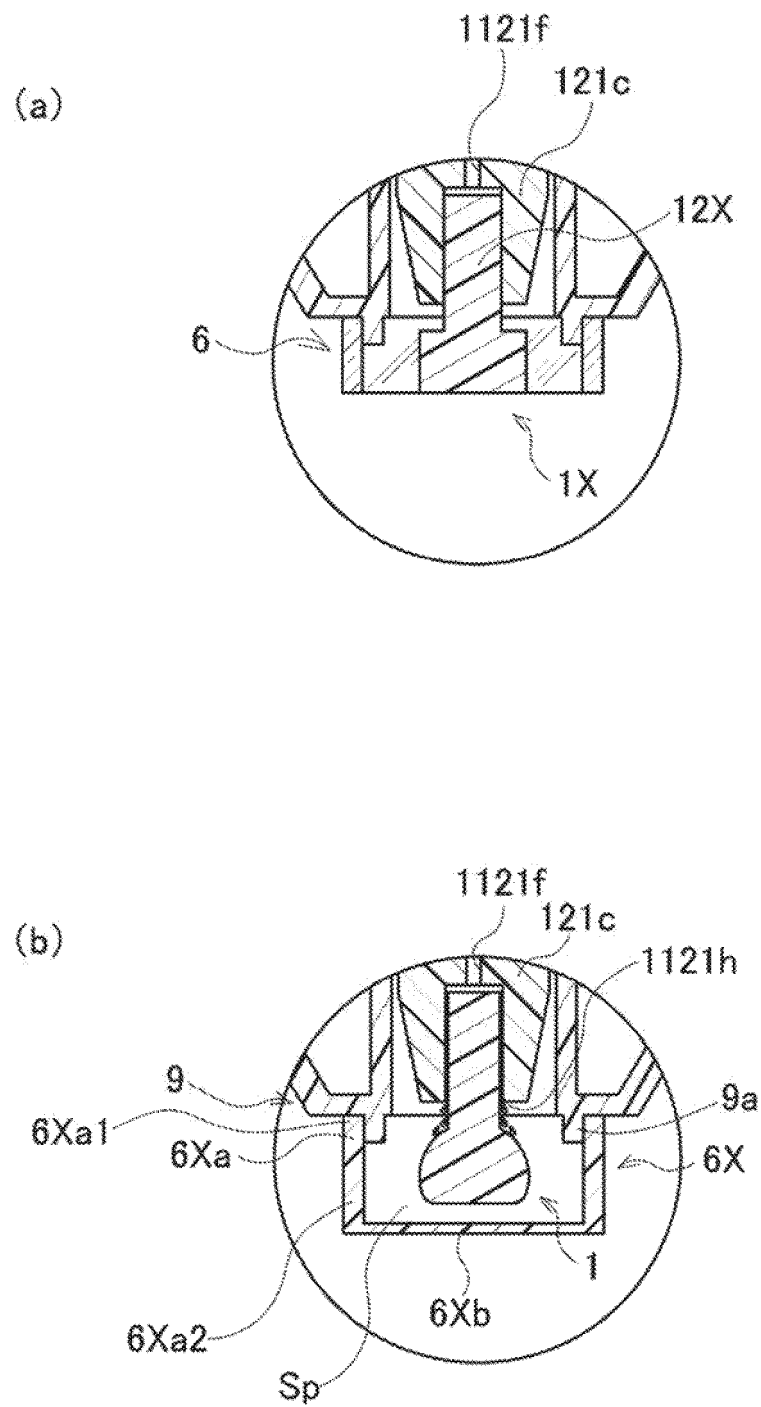


FIG. 3

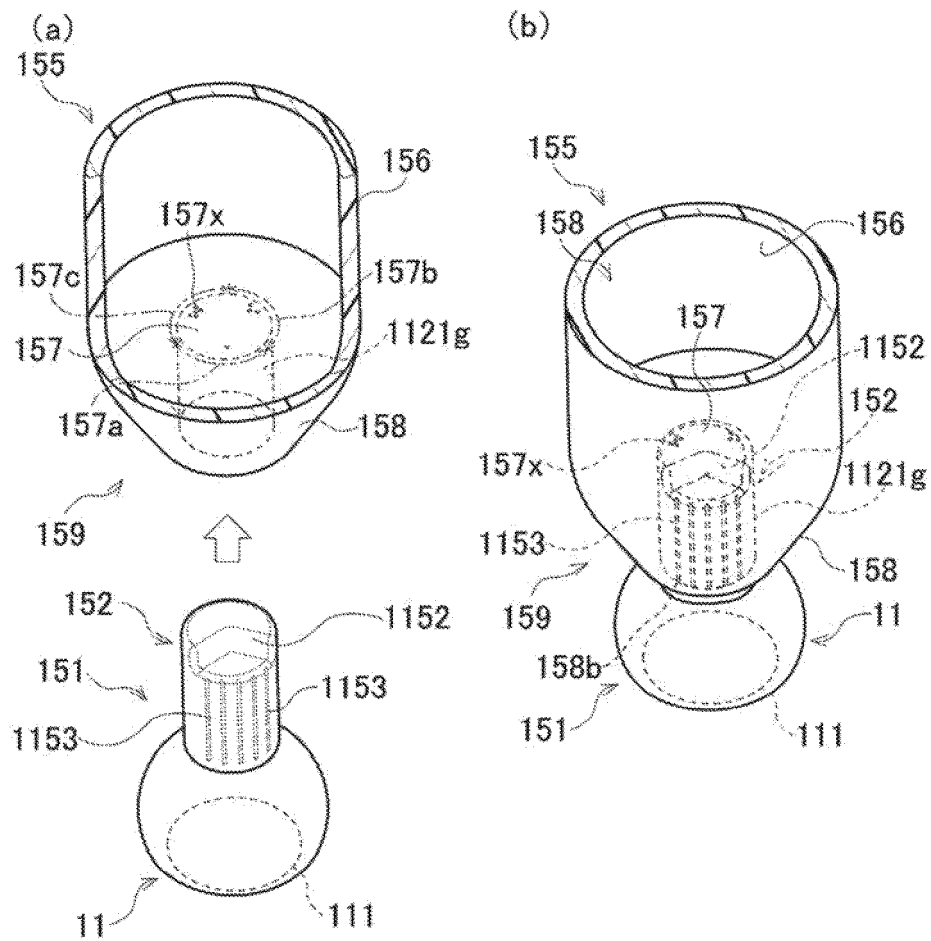
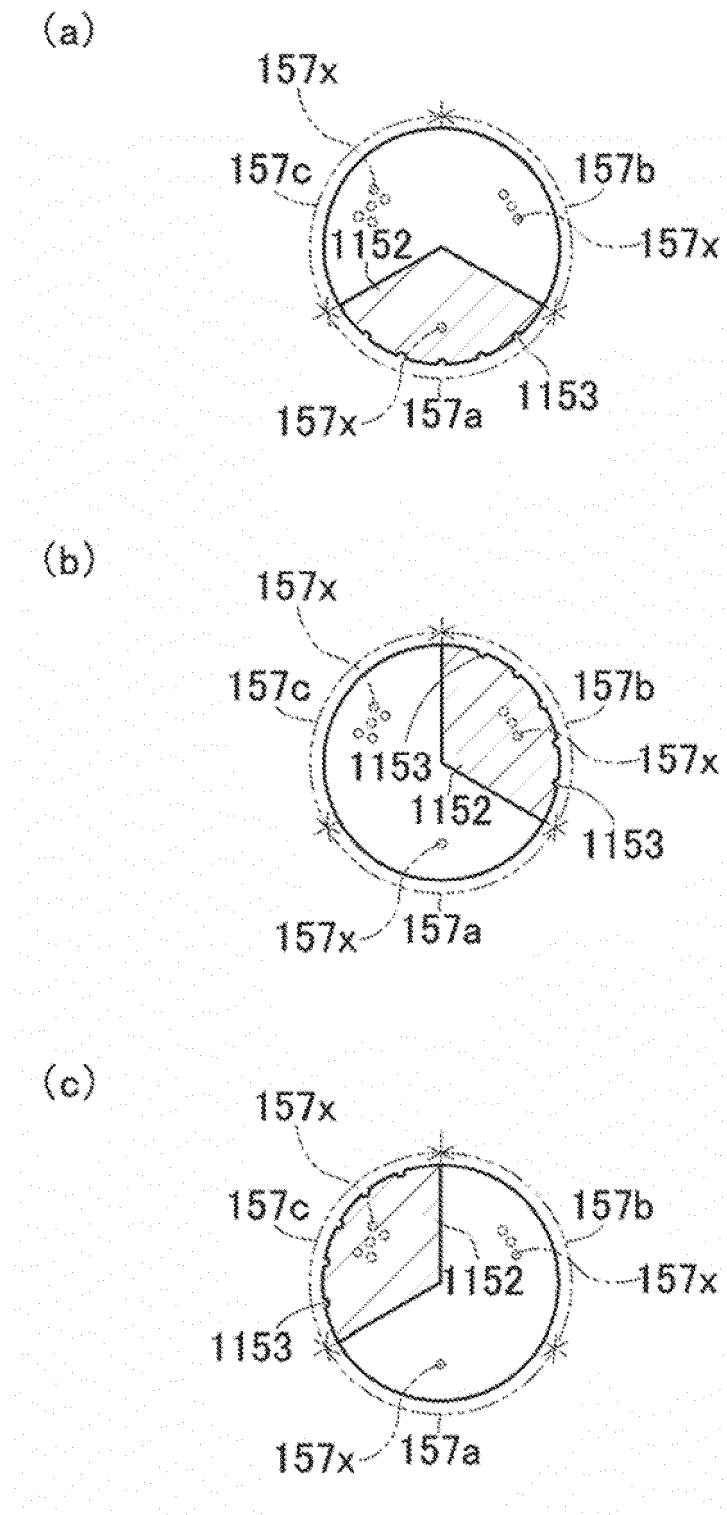


FIG. 4



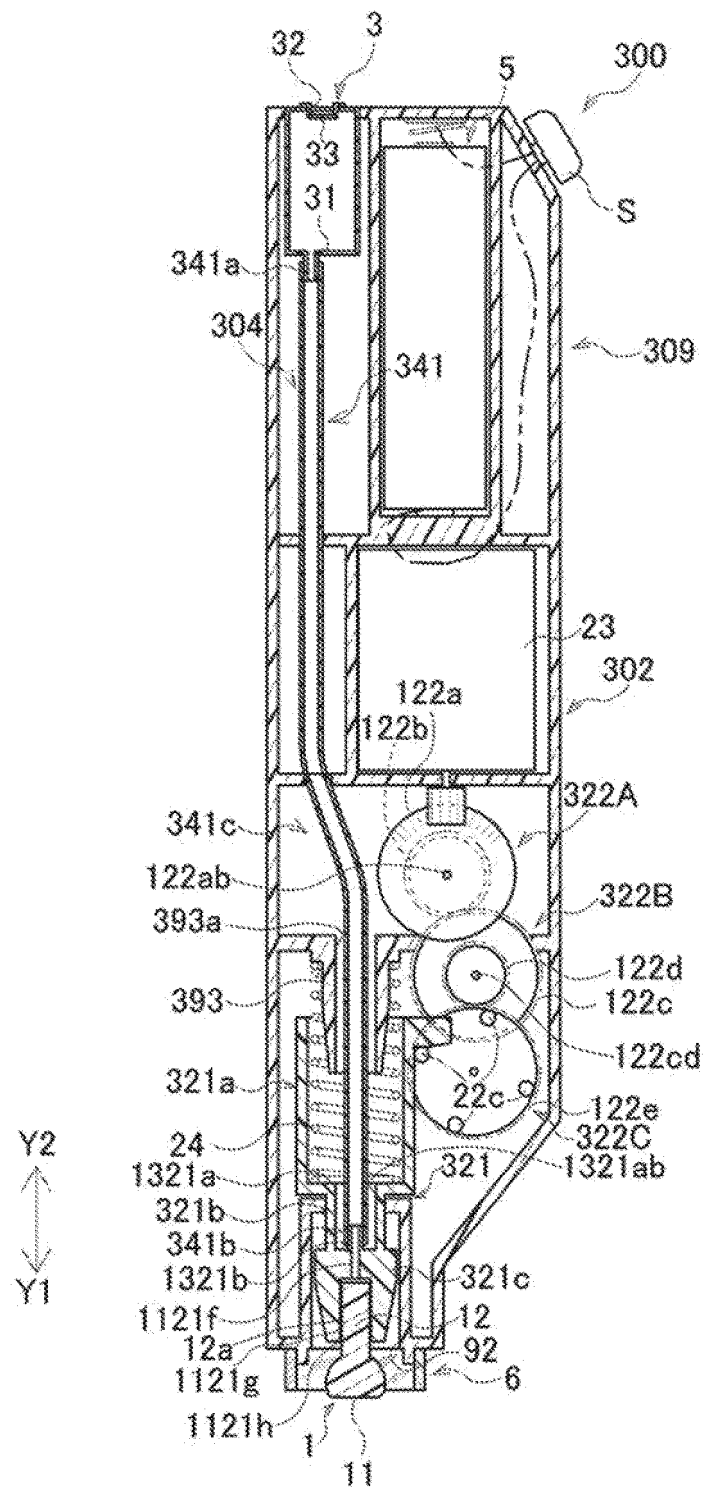


FIG. 6

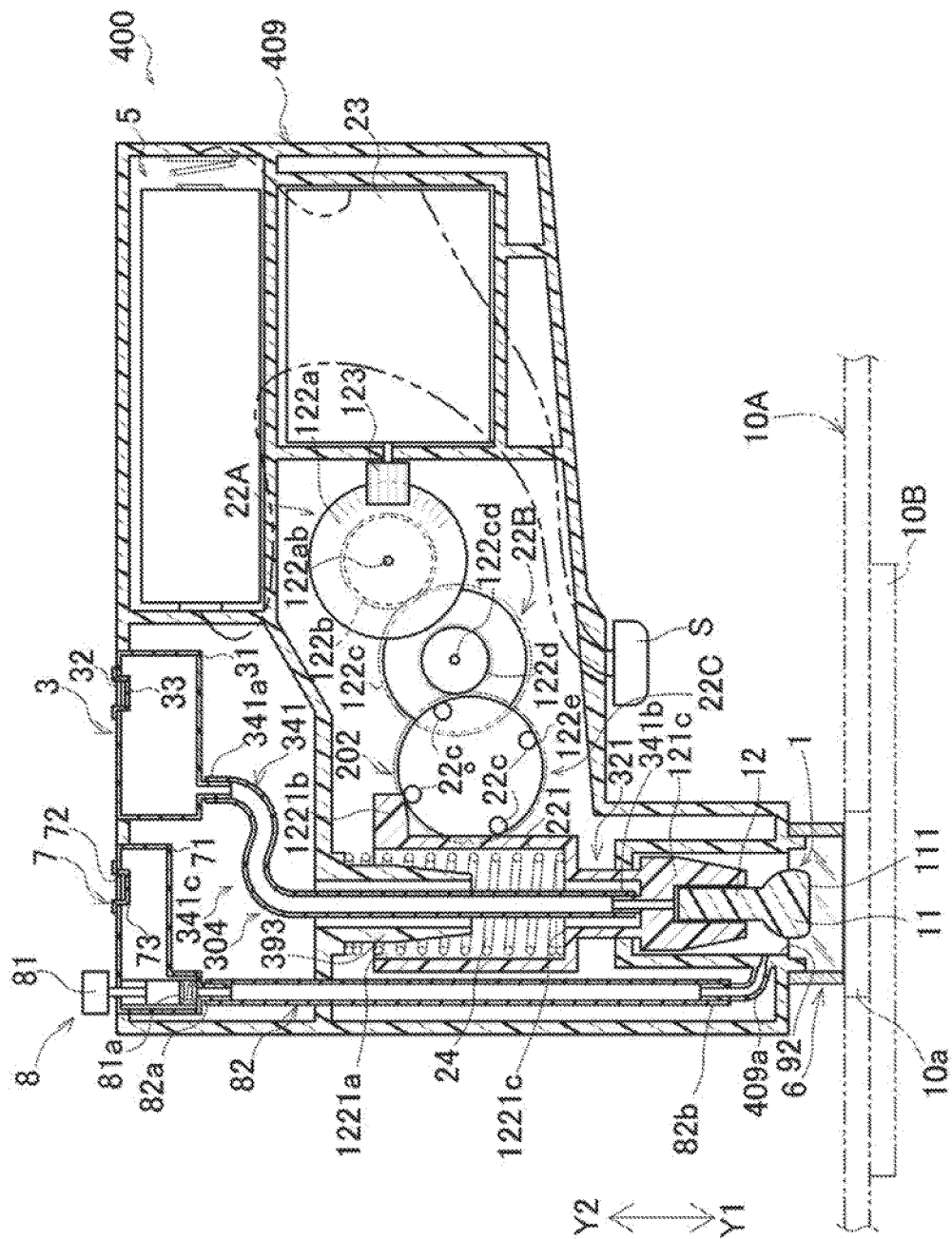
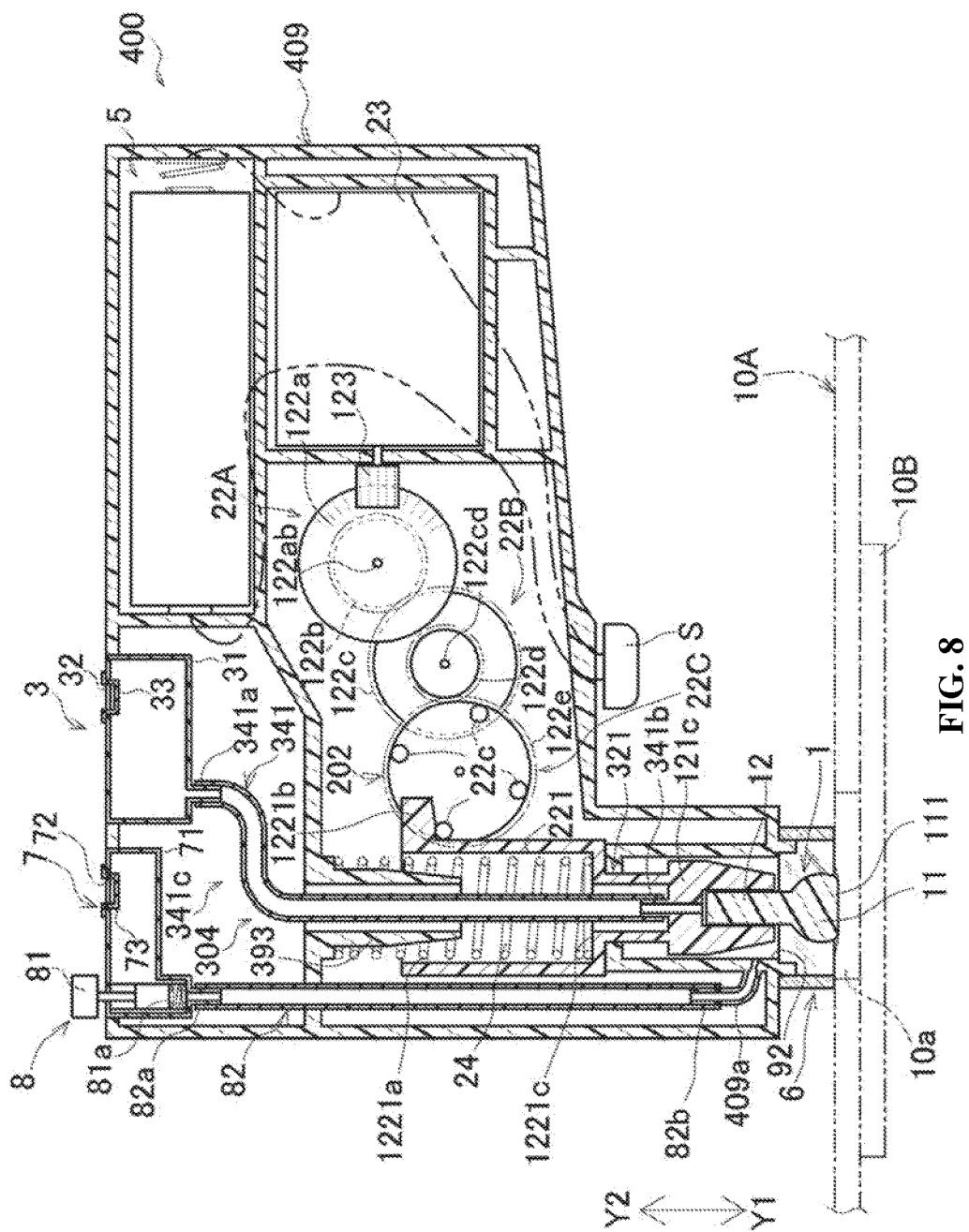


FIG. 7



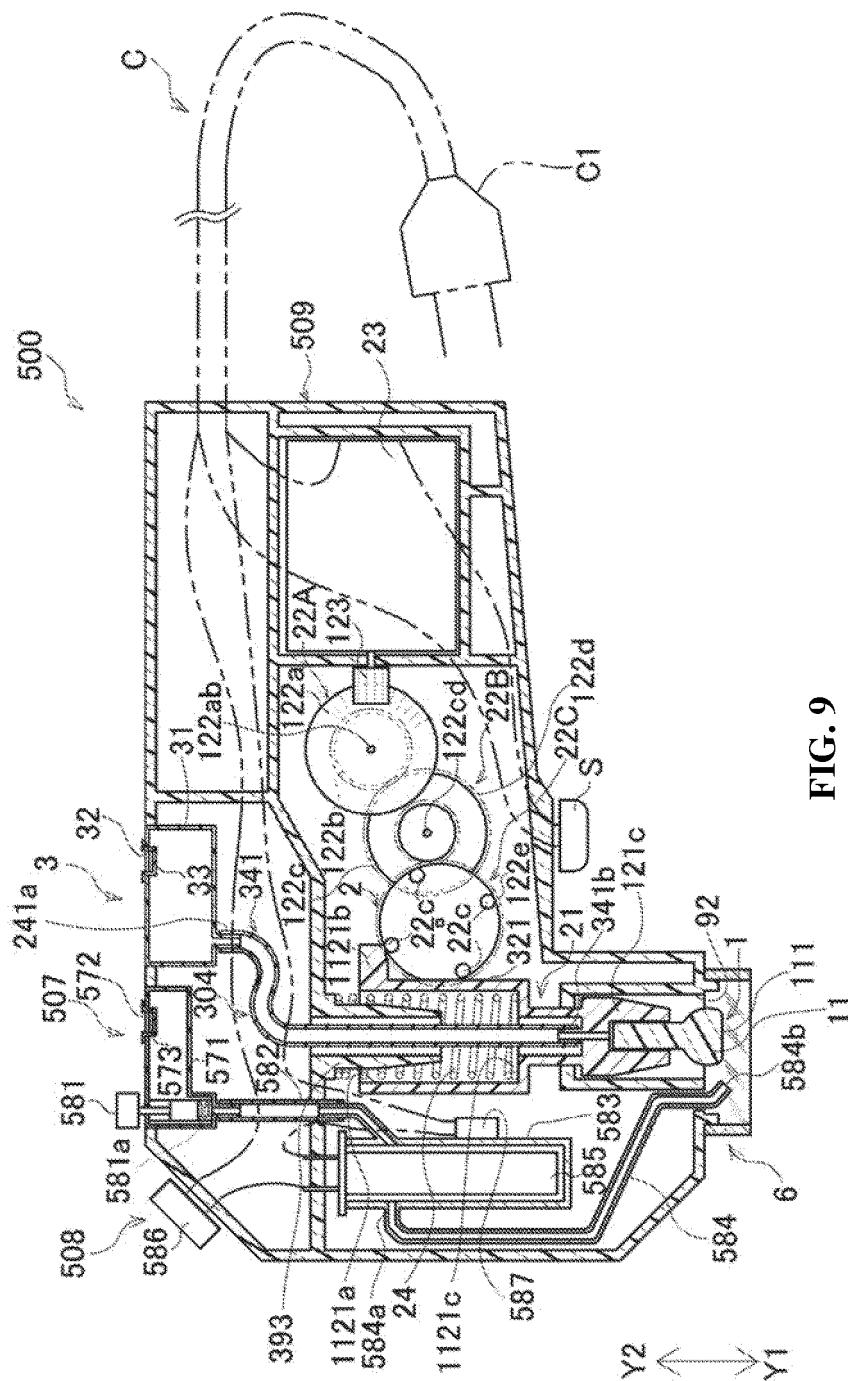


FIG. 9

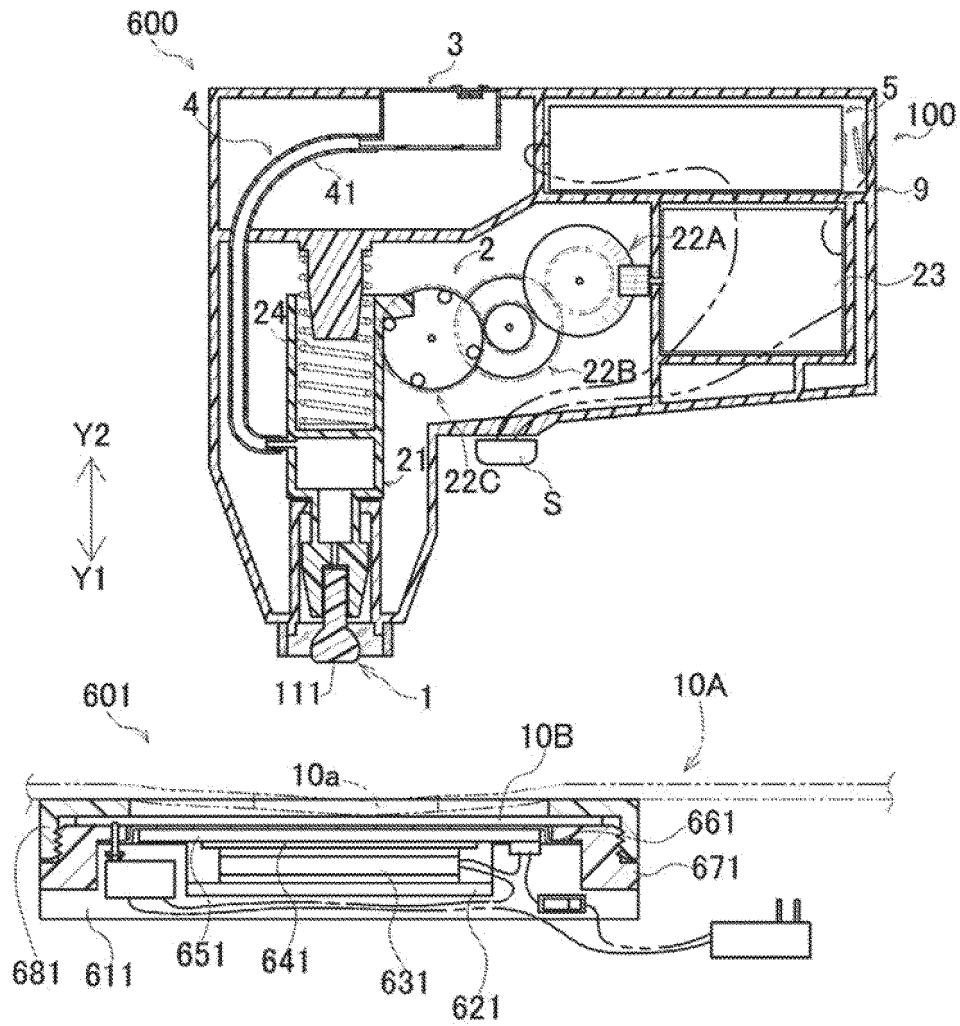


FIG. 10

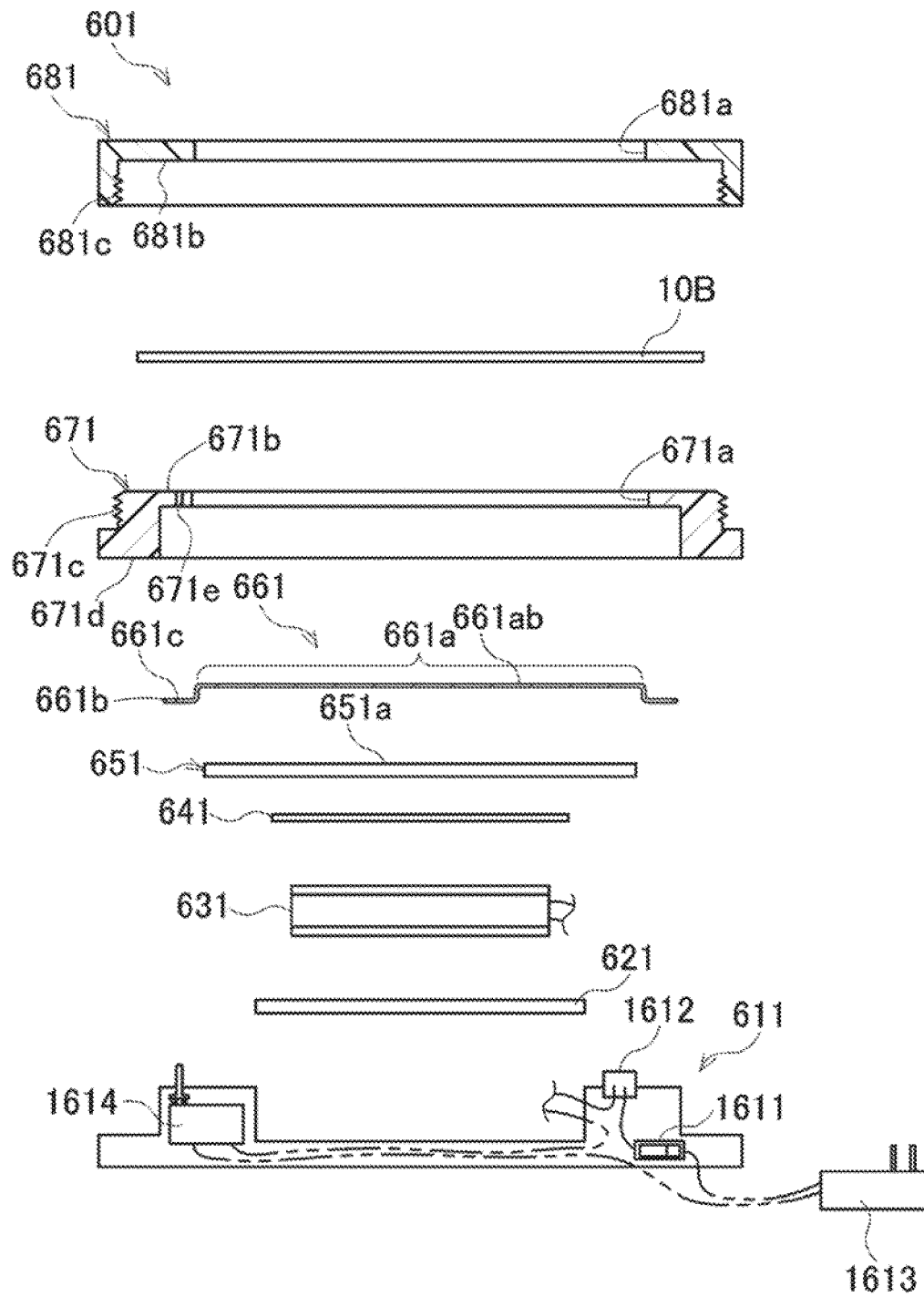


FIG. 11

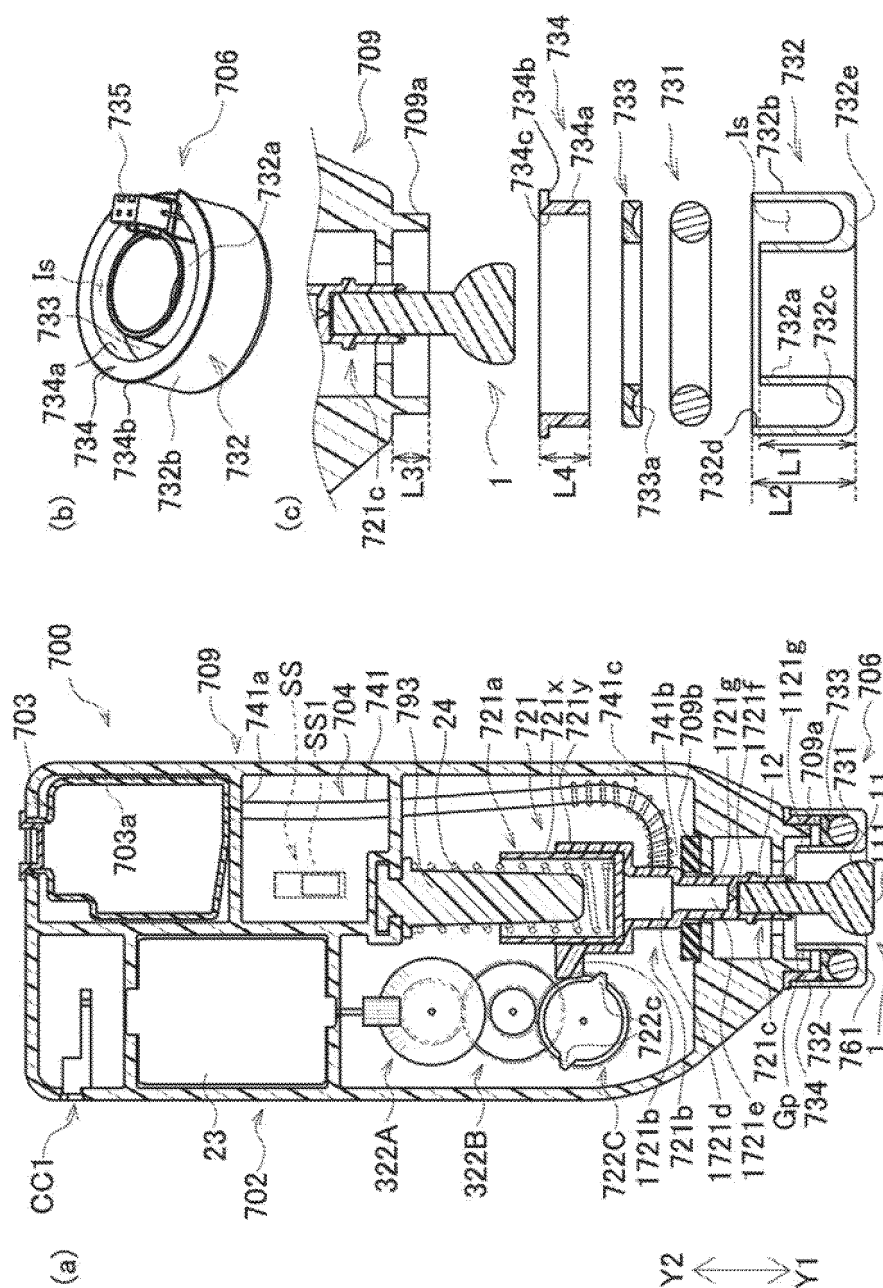


FIG. 12

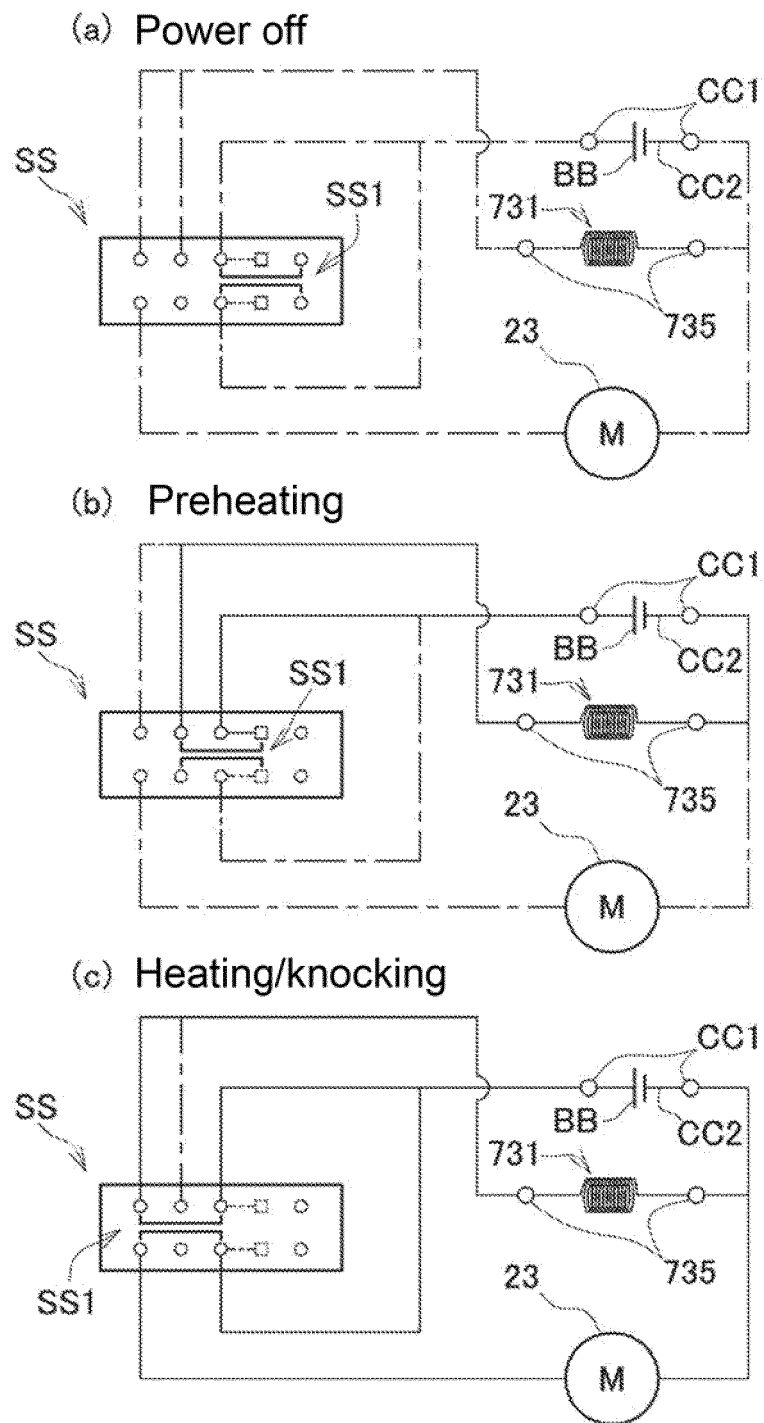


FIG. 13

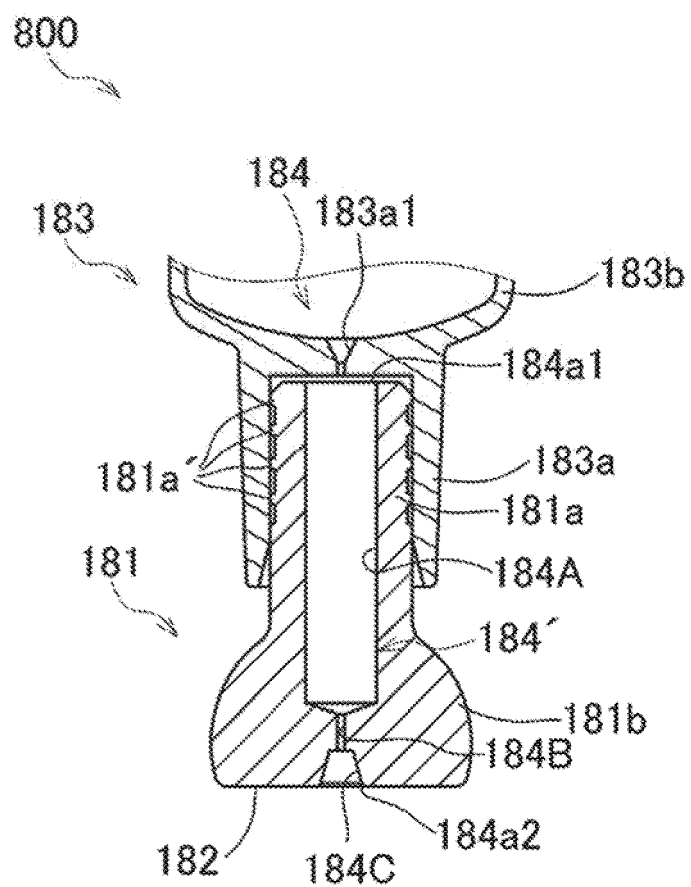


FIG. 14

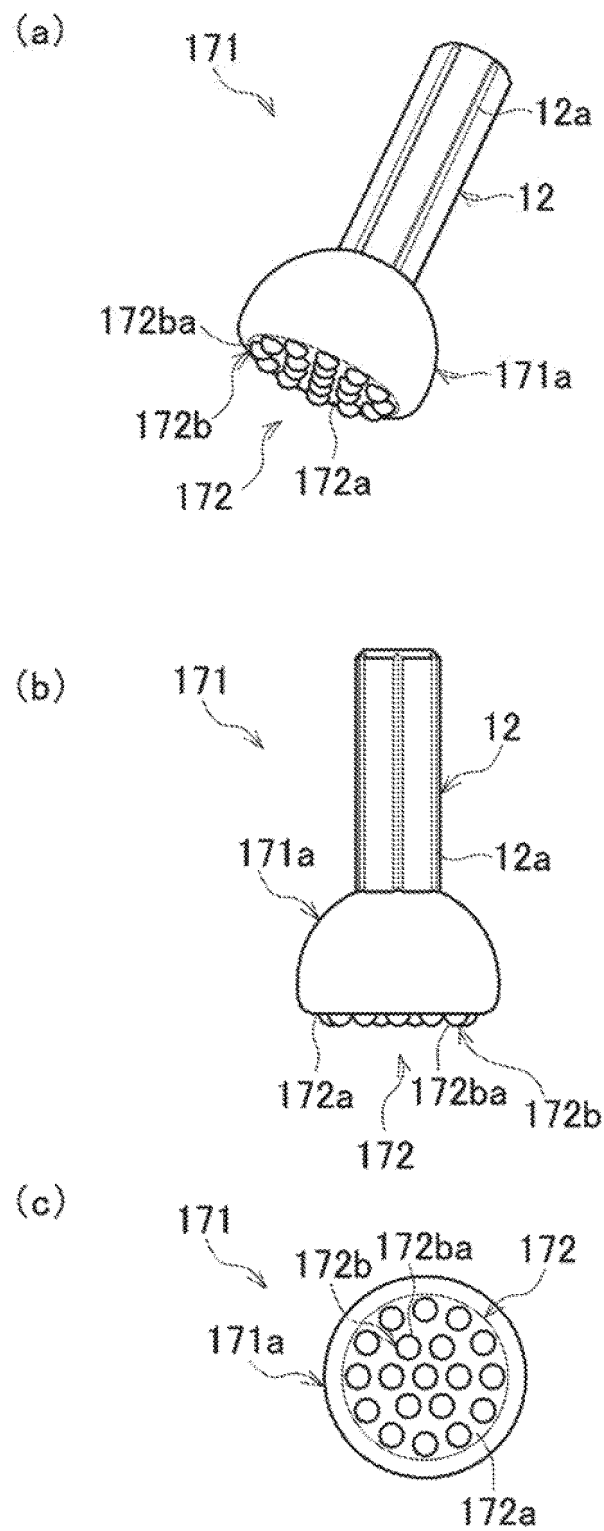


FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2014/095725

A. CLASSIFICATION OF SUBJECT MATTER

D06F 7/04 (2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D06F

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS; VEN; CNKI: STAIN, REMOV+, CLEAN, PART, KNOCK, VIBRATION, FABRIC, CLOTH+, LAUNDRY

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2001310165 A (KAO CORP.) 06 November 2001 (06.11.2001) , description, paragraph [0051], and figures 1 and 12	1-8
A	CN 103485116 A (WUXI LITTLE SWAN CO., LTD.) 01 January 2014 (01.01.2014) , the whole document	1-8
A	CN 201040803 Y (LU, Xinjin) 26 March 2008 (26.03.2008) the whole document	1-8
A	US 5402657 A (TECHNICAL ADVANTAGE) 04 April 1995 (04.04.1995) the whole document	1-8

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

* Special categories of cited documents:	“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
“A” document defining the general state of the art which is not considered to be of particular relevance	“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
“E” earlier application or patent but published on or after the international filing date	“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	“&” document member of the same patent family
“O” document referring to an oral disclosure, use, exhibition or other means	
“P” document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 05 June 2015	Date of mailing of the international search report 16 June 2015
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer FU, Guixin Telephone No. (86-10) 62084564

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2014/095725

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
JP 2001310165 A	06 November 2001	None	
CN 103485116 A	01 January 2014	WO 2014205868 A1	31 December 2014
CN 201040803 Y	26 March 2008	None	
US 5402657 A	04 April 1995	None	

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2003000996 A [0005]