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(54) Automatic hair washing machine

(57) An automatic hair washing machine including a sink in which a head portion of a user is laid, the sink having an enclosed space that is formed when the head portion is laid in the sink, a nozzle link unit for jetting liquid containing at least one of washing water and cleaning agent liquid, and a mist spraying unit for spraying mist into the enclosed space.

FIG.4A

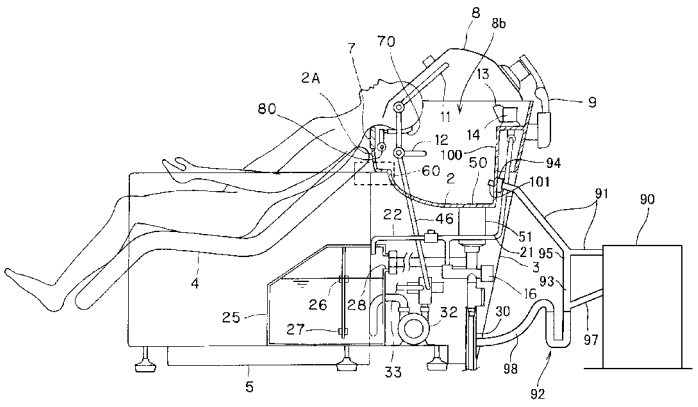

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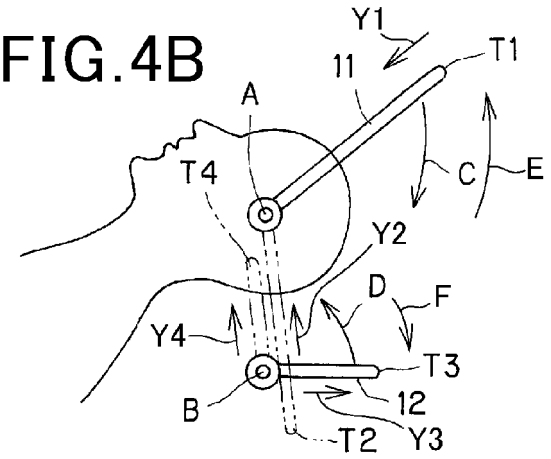
FIG.4B



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an automatic hair washing machine for automatically washing a head portion laid (or put) in a sink.

2. Description of Related Art

[0002] An automatic hair washing machine for automatically washing a head portion of a user (customer or hair-washing target) is known (for example, see JP-A-7-236511) . According to this automatic hair washing machine, a nozzle link for jetting washing (cleaning) water to the head portion of the user is mounted at the inside of a sink in which the head portion of the user is put, and the washing water is jetted from the nozzle link to the head portion (containing hair) of the user to automatically wash (clean) the hair of the user.

[0003] Recently, it has been adopted to spray mist to the head portion of a user so that a treatment effect or a relaxation effect is achieved. In view of the foregoing situation, the automatic hair washing machine for automatically washing the head portion of a user (hair-washing target) as described above has been required to effectively spray mist by taking advantage of the characteristic that the head portion can be automatically washed.

SUMMARY OF THE INVENTION

[0004] The present invention has been implemented in view of the foregoing situation, and has an object to provide a automatic hair washing machine that can effectively spray mist by taking advantage of the characteristic that the head portion of a user (hair-washing target) can be automatically washed (cleaned).

[0005] In order to attain the above obj ect, there is provided an automatic hair washing machine comprising: a sink in which a head portion of a user is laid, the sink having an enclosed space that is formed when the head portion is laid in the sink; a nozzle link unit for jetting liquid containing at least one of washing water and cleaning agent liquid; and a mist spraying unit for spraying mist into the enclosed space.

[0006] In the above automatic hair washing machine, the mist spraying unit has a mist generator for generating mist, a mist feeding pipe for introducing the mist generated in the mist generator into the sink, a mist discharge port that is provided in the sink to spray out the mist fed through the mist feeding pipe into the sink, and a water discharging trap provided to the mist feeding pipe.

[0007] In the above automatic hair washing machine, the mist discharge port is configured so that a spray direction of the mist is changeable.

[0008] In the above automatic hair washing machine, drain water occurring in connection with the generation of the mist in the mist generator is trapped in the water discharging trap.

[0009] The above automatic hair washing machine further comprises a jetting unit for jetting the liquid from the nozzle link unit to the headportion laid in the enclosed space, and a controller for controlling the mist spraying unit and the jetting unit, wherein the controller controls the jetting unit and the mist spraying unit so that the jetting of the liquid by the jetting unit and the spray of the mist by the mist spraying unit are executed interlockingly with each other.

[0010] The automatic hair washing machine further comprises a cleaning operation course indicating unit for indicating one of cleaning operation courses each comprising a plurality of steps that contain at least a washing step based on jetting of liquid executed by the jetting unit and a mist step based on spray of mist executed by the mist spraying unit, and are arranged in a predetermined step order, wherein when any one of the cleaning operation courses is indicated through the indicating unit, the controller controls the jetting unit and the mist jetting unit so that the jetting of the liquid by the jetting unit and the spray of the mist by the mist spraying unit are executed at a predetermined timing corresponding to the order of each step of the cleaning operation course.

[0011] In the above automatic hair washing machine, the jetting unit has a mixing unit for mixing washing water with any one of shampoo liquid and rinsing liquid to generate the liquid to be jetted from the nozzle link unit, and the cleaning operation courses contain a first cleaning course whose step order is set so that the mist step is executed before a shampoo step for jetting the liquid containing the shampoo liquid, a second cleaning course whose step order is set so that the mist step is executed after a conditioning step for jetting the liquid containing the conditioner liquid, and a third cleaning course whose step order is set so that the conditioning step and the mist step are executed in parallel to each other.

[0012] In the above automatic hair washing machine, the mist spraying unit has a mist generator for generating mist, and the controller is connected to a mist generator controller for controlling the mist generator so that communications can be performed between the controller and the mist generator controller, and controls the jetting unit and the mist spraying unit in cooperation with the mist generator controller so that the liquid jetting of the jetting unit and the mist spray of the mist spraying unit are executed interlockingly with each other.

[0013] In the above automatic hair washing machine, the nozzle link unit is configured to jet the liquid while moving along the head portion laid in the sink, and when the nozzle link unit is located at a position where the nozzle link unit jets the liquid to a high position of the head portion laid in the sink, the controller controls the nozzle link unit to concentrically jet the liquid.

[0014] In the above automatic hair washing machine, the controller controls movement of the nozzle link unit

and jetting of the liquid from the nozzle link unit so that the liquid is jetted to a place corresponding to a position of the liquid trickling along the head portion in conformity with the trickling of the liquid attached to the head portion.

[0015] In the above automatic hair washing machine, after the liquid is jetted to the high place of the head portion laid in the sink, the controller controls the movement of the nozzle link unit and the jetting of the liquid from the nozzle link unit so that the liquid is jetted to a place corresponding to a position of the liquid trickling along the head portion while controlling the nozzle link unit so that the liquid is jetted within a predetermined range in a reciprocating style in conformity with the trickling of the liquid attached to the head portion.

[0016] In the above automatic hair washing machine, after the liquid is jetted to the high place of the head portion laid in the sink, the controller controls the jetting pressure of the liquid jetted from the nozzle link unit in conformity with the trickling of the liquid attached to the head portion along the head portion.

[0017] In the above automatic hair washing machine, the nozzle link unit is reciprocable between a head top position corresponding to a head top portion of the head portion laid in the sink and a rear head position corresponding to a rear head portion, and the controller concentrically jets the liquid when the nozzle link unit is located at the head top position.

[0018] In the above automatic hair washing machine, the nozzle link unit comprises a plurality of nozzle links that jet liquid to different sites of the head portion respectively, and are connected to a single motor through a power transmission mechanism so that the plurality of nozzle links are movable in synchronization with one another.

[0019] In the above automatic hair washing machine, the nozzle link unit comprises an upper nozzle link that is reciprocable between a head top position corresponding to a head top portion of the head portion laid in the sink and a rear head position corresponding to a rear head portion of the head portion, and a lower nozzle link that is reciprocable between a hair position corresponding to a hair hanging from the head portion laid in the sink and a neck position corresponding to a neck, wherein the lower nozzle link is moved in a direction from the hair position to the neck position in synchronization with movement of the upper nozzle link in a direction from the head top position to the rear head position, and the lower nozzle link is moved in a direction from the neckposition to the hair position in synchronization with movement of the upper nozzle link in a direction from the rear head position to the head top position.

[0020] In the above automatic hair washing machine, the power transmission mechanism has a gear rotating according to driving of the motor, wherein the plurality of nozzle links are moved synchronously with each other through the gear that is rotated by driving the motor.

[0021] In the above automatic hair washing machine, the power transmission mechanism is provided to one side surface of the sink.

[0022] According to the present invention, mist can be effectively sprayed by actively utilizing a characteristic of automatically washing the head portion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

Fig. 1 is a perspective view showing an automatic hair washing machine according to a first embodiment;

Fig. 2 is a top view of the automatic hair washing machine;

Fig. 3 is a side view of the automatic hair washing machine when an outer frame of a sink holding table is detached;

Fig. 4A is a cross-sectional view of the automatic hair washing machine, and Fig. 4B is an enlarged view of a main part of the automatic hair washing machine;

Fig. 5 is a diagram showing a water passage through which water for the automatic hair washing machine flows;

Fig. 6 is a perspective view showing a sink connecting portion;

Fig. 7 is an explodedperspective view showing the sink connecting portion;

Figs. 8A and 8B are perspective views showing each member equipped to the sink connecting portion;

Fig. 9 is a partially cross-sectional view of the sink connecting portion;

Fig. 10A is a left side view of the sink under a state that a driving mechanism is exposed, and Fig. 10B is a front view of the sink;

Fig. 11 is a block diagram showing the functional construction of the automatic hair washing machine and a mist generator;

Fig. 12 is a diagram showing an operation panel;

Fig. 13 is a flowchart showing the operation of the automatic hair washing machine and the mist generator, particularly the operation from the time when an operation course is selected till the selected operation course is executed;

Fig. 14 is a flowchart showing the operation of the automatic hair washing machine and the mist generator, particularly the operation thereof when a scalp care course is executed;

Fig. 15 is a flowchart showing the operation of the automatic hair washing machine and the mist generator, particularly the operation thereof when a mist process is executed;

Fig. 16 is a flowchart showing the operation of the automatic hair washing machine and the mist generator, particularly the operation thereof when a hair care course I and a hair care course II are executed;

Fig. 17 is a cross-sectional view of the automatic hair washing machine according to a second embodi-

ment;

Fig. 18A is an enlarged view of a sink portion of Fig. 17, and Fig. 18B is a diagram showing the movement of an upper nozzle link and a lower nozzle link;

Fig. 19 is a diagram showing a water passage through which water for the automatic hair washing machine flows;

Figs. 20A and 21B are front and plan views showing the relationship between a head support net and a nozzle link for a neck;

Figs. 21A and 21B are plan and end views showing the head support net;

Fig. 22 is a block diagram showing the functional construction of the automatic hair washing machine;

Fig. 23 is a flowchart showing a basic operation in an automatic hair washing process of the automatic hair washing machine;

Fig. 24A is a diagram showing a relaxation step, Fig. 24B is a diagram showing a first rinsing step, and Fig. 24C is a diagram showing a shampoo step;

Fig. 25A is a diagram showing a second rinsing step, Fig. 25B is a diagram showing a conditioning step, and Fig. 25C is a diagram showing a third rinsing step; and

Fig. 26A is a diagram showing a menthol agent jetting step, and Fig. 26B is a diagram showing a fourth rinsing step.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0024] Preferred embodiments according to the present invention will be described hereunder with reference to the accompanying drawings.

<First Embodiment>

[0025] A first embodiment according to the present invention will be described with reference to the accompanying drawings.

[0026] Fig. 1 is a perspective view showing an automatic hair washing machine 1, and Fig. 2 is a top view of the automatic hair washing machine. Fig. 3 is a side view of the automatic hair washing machine 1 when an outer frame of a sink holding table 3 is detached. Fig. 4A is a cross-sectional view of the automatic hair washing machine 1, and Fig. 4B is an enlarged view of a main part of the automatic hair washing machine 1. Fig. 5 is a diagram showing a water passage through which water for the automatic hair washing machine 1 flows.

[0027] As shown in Figs. 1 to 5, the automatic hair washing machine 1 has a sink 2 in which the head portion of a user (hair-washing target) is laid (put or mounted), a sink holding table 3 for holding the sink 2, a seat (Fig. 4) which is disposed in front of the sink holding table 3 and on which the user sits (see Fig. 4), and a seat holding table 5 (Fig. 4) for holding the seat 4.

[0028] As shown in Figs. 1 to 4, the sink 2 is a bowl-shaped member having an opening at the upper side thereof. A head support net 70 for supporting the rear head portion of a user so that the head portion faces the inside of the sink 2 under the state that the user turns up is disposed at the front portion of the sink 2. Furthermore, a neck table 7 is disposed on a front surface portion 2A of the sink 2, and the user can lay (or put) his/her neck on the neck table under the state that the user sits on the seat 4 and turns up so that the rear head portion is mounted on the head support net 70. The opening at the top of the sink 2 can be covered by a cover 8. The rear end of the cover 8 is linked to the rear end of the sink 2 through a link portion 9 (Fig. 4) so as to be rotatable about the link portion 9 within a vertical plane. When hair washing (cleaning) or the like is executed, the user who sits on the seat 4 lay (or puts) his/her neck on the neck table 7 while the cover 8 is opened, and then the cover 8 is closed, whereby the head portion of the user can be laid in the sink 2.

[0029] As shown in Figs. 1 and 2, a cut-out portion 8a for the head portion is formed in the cover 8 so that the head portion is placed (or fit) in the cut-out portion 8a.

[0030] As shown in Fig. 4, when the cover 8 is closed when the head portion of the user is laid (put) in the sink 2, the cut-out portion 8a is blocked by the headportion, and thus a substantially hermetically closed space (hereinafter referred to as enclosed space) 8b (Fig. 4) is formed in the space surrounded by the sink 2 and the cover 8 so that the head portion is laid so as to protrude into the enclosed space 8b. Here, the enclosed space does not mean the perfectly hermetically sealed space, and it means a space in which water-tightness is maintained to the extent that washing water jetted from each nozzle link provided in the enclosed space 8b does not leak from the enclosed space 8b to the outside.

[0031] According to this embodiment, as described later, any one of washing liquid (water) which does not any cleaning agent such as shampoo liquid, conditioner liquid or the like, and cleaning agent liquid which is blended with cleaning agent such as shampoo liquid, conditioner liquid or the like can be jetted from each nozzle link provided in the enclosed space 8b. In the first embodiment, when the washing water and the cleaning agent liquid are not particularly discriminated from each other, they are merely represented as "washing water".

[0032] When automatic hair washing is executed, washing water is jetted from each nozzle link (described later) provided in the enclosed space 8b to the head portion to wash the hair of the head portion. At this time, since the head portion is laid so as to protrude into the enclosed space 8b, the automatic hair washing can be smoothly performed with preventing leakage of the washing water jetted from each nozzle link to the outside of the enclosed space 8b. Furthermore, according to this embodiment, as described later in detail, mist can be arbitrarily sprayed to the head portion of the user by using the enclosed space 8b.

[0033] As not shown in the figures, the cut-out portion

8a of the cover 8 is provided with a face seal for sealing the gap between the cut-out portion 8a and the head portion, and the hermetic sealing (water-tightness) of the enclosed space 8b can be more enhanced by the face seal.

[0034] An upper nozzle link 11 and a lower nozzle link 12 for jetting washing water to the head portion and hair of a user are arranged in the sink 2.

[0035] The upper nozzle link 11 comprises a pipe-shaped member which is curved so as to be convex to the obliquely upper right side in Fig. 4B and have a substantially arcuate shape along the head portion of the user and has plural nozzles arranged at predetermined intervals. The upper nozzle link 11 is supported at one end thereof (i.e., cantilevered) so as to be turnable (swingable) around the one end as indicated by arrows C and E in Fig. 4B so that the washing water can be jetted to the head portion of the user.

[0036] The lower nozzle link 12 comprises a pipe-shaped member which is wholly designed to be substantially M-shaped and curved so as to be convex (arcuate) toward the left side in Fig. 4B at the center portion of the M-shape and has plural nozzles arranged at predetermined intervals. The lower nozzle link 12 is supported at one end thereof (i.e., cantilevered) at the lower side of the upper nozzle link 12 so as to be turnable (swingable) around the one end thereof as indicated by arrows D and F in Fig. 4B. The lower nozzle link 12 jets washing water toward the rear side thereof to wash the user's hair which hangs down from the user's head at the rear side of the lower nozzle link 12.

[0037] Furthermore, a neck nozzle link 80 for jetting wash water to the neck of the user who turns up is disposed in the sink 2.

[0038] Each of the upper nozzle link 11, the lower nozzle link 12 and the neck nozzle link 80 is provided with plural nozzles, and washing water supplied to the upper nozzle link 11, the lower nozzle link 12 and the neck nozzle link 80 is jetted from each nozzle under a hair washing treatment.

[0039] The upper nozzle link 11 and the lower nozzle link 12 are turnable (swingable), and the neck nozzle 80 is fixed. The overall head portion and the overall hair of the user can be washed by jetting the washing water from each nozzle. A hand shower 13 is disposed at the upper rear portion in the sink 2. An operator (working staff of beauty salon or the like) turns on a cock 14 disposed at the right side of the hand shower 13 to adjust the amount of water to be discharged from the hand shower 13, whereby the user's hair can be manually washed.

[0040] A head top massage nozzle 150 is provided on a rear side surface 100 of the sink 2 as shown in Fig. 1. The head top massage nozzle 150 is a nozzle for jetting washing water to the top portion of the head supported on the head support net 70 to massage the head portion.

[0041] As shown in Fig. 1, a right-side head massage nozzle 151 is provided on a right side surface of the sink 2, and a left-side head massage nozzle 152 is provided on a left-side surface 100b of the sink 2. These side-head massage nozzles are nozzles for jetting washing water to the sides of the head supported on the head support net 70 to massage the head portion.

[0042] Washing water is jetted from the head top massage nozzle 150, the right-side head massage nozzle 151 and the left-side head massage nozzle 152 to massage the head portion of the user in a massage step described later and when a massage operation is executed.

[0043] As shown in Fig. 5, water used for the automatic hair washing machine 1 is supplied from tap water facilities and hot water facilities (not shown) at the outside of the machine through a mixing valve 15 and a water supply pipe 16 into the machine. Water is supplied from the tap water facilities through the water supply unit 17 to the mixing valve 15, and hot water is supplied from the hot water facilities through a hot water supply unit 18. The mixing valve 15 mixes the water supplied from the water supply unit 17 with the hot water supplied from the hot water supply unit 18, and feeds out warm water to the water supply pipe 16. A first thermistor 19 for detecting the temperature of warm water fed out from the mixing valve 15 is disposed at some midpoint of the water supply pipe 16. A motor 20 is driven on the basis of a detection result of the first thermistor 19, whereby the mixing valve 15 is opened or closed to adjust the mixing ratio between water and hot water, thereby generating warm water at a set temperature. The mixing valve 15 is an electrically-driven type valve whose valve opening is adjusted by the motor 20. The motor 20 is a DC motor or a DC electrical motor and has a brush or the like.

[0044] An operation panel 60 is provided at a side of the sink 2. For example, the set temperature, etc. for warm water stocked in a warm water stock tank 25 (described later) are determined by user' s operating the operation panel 60. The water supply pipe 16 is branched into a hand shower water supply pipe 21 and a warm water stocking water supply pipe 22 at some position thereof (at the downstream side of the first thermistor 19). The hand shower water supply pipe 21 intercommunicates with the hand shower 13 through a hand shower valve 13 which can be opened/closed by the cock 14. The warm water stocking water supply pipe 22 can supply warm water into the warm water stocking tank 25 through a warm water stocking valve 24 as a warm water supply valve.

[0045] A first water level sensor 26 and a second water level sensor 27 for detecting the water level of warm water stocked in the warm water stocking tank 25 are arranged in the warm water stocking tank 25 so as to be spaced from each other at a fixed interval in the vertical direction. When warm water in the warm water stocking tank 25 is used and it is detected by the second water level sensor 27 that the water level reaches a predetermined water level, the warm water stocking valve 24 is opened, and warm water in the warm water stocking tank 25 is supplied. Thereafter, it is detected by the first water level

sensor 26 that the water level of the warm water in the warm water stocking tank 25 reaches a predetermined highest water level, the warm water stocking valve 24 is closed, and the supply of the warm water is stopped. As described above, warm water of a predetermined water level or more is allowed to be stocked in the warm water stocking tank 25.

[0046] A overflow water port 28 is formed at the upper portion of the warm water stocking tank 25 (at the upper side of the first water level sensor 26) . The overflow water port 28 leaks surplus warm water to the outside of the warm water stocking tank 25 when warm water of the highest water level or more is supplied to the warm water stocking tank 25 due to a trouble of the first water level sensor 26 or the like. Warm water overflowing from the overflow water port 28 is received by an overflow tank 29, and then discharged to the outside of the machine through a water discharge pipe 30 intercommunicating with the overflow tank 29. An overflow sensor 31 is disposed in the overflow tank 29. When it is detected by the overflow sensor 31 that the water level of water in the overflow tank 29 reaches the highest water level due to clogging of a water discharge pipe 30, the operation of the automatic hair washing machine 1 is stopped.

[0047] An suction pipe 33 is connected to the lowest portion of the warm water stocking tank 25 at one end thereof, and also connected to a main pump 32 at the other end thereof. The main pump 32 is supplied with AC current from an inverter 64 (Fig. 11) to be driven, and sucks warm water in the warm water stocking tank 25 through the suction pipe 33. A shampoo supply pipe 35 reaching a shampoo container 34 for accommodating shampoo liquid and a conditioner supply pipe 37 reaching a conditioner container 36 for accommodating conditioner liquid are connected to some portions of the suction pipe 33. A shampoo pump 38 and a conditioner pump 39 are provided to some portions of the shampoo supply pipe 35 and the conditioner supply pipe 37, respectively. Upon action of each of the shampoo pump 38 and the conditioner pump 39, the contamination amount of each of the shampoo liquid and the conditioner liquid into the warm water passing through the suction pipe 33 is properly adjusted, whereby washing water to be used at that time is sucked into the main pump 32.

[0048] As not shown in Fig. 5, plural other containers for accommodating cleaning agent such as shampoo liquid, conditioner liquid, etc. are provided in addition to the shampoo container 34 and the conditioner container 36. Each of the plural containers is connected to a supply pipe through which cleaning agent liquid flows, and each supply pipe is connected to a pump for supplying cleaning agent liquid accommodated in the corresponding container through the supply pipe to the suction pipe 33.

[0049] The washing water sucked from the suction pipe 32 into the main pump 32 is fed out to a water feeding pipe 40 having six shunt pathways. A filter 41 is provided in the water feed pipe 40, and six valves of an upper nozzle valve 42, a lower nozzle valve 43, a neck nozzle valve 74, a drain valve 44, a head top valve 155 and a side head valve 156 are provided to the six shunt pathways at the downstream side of the filter 41, respectively. A branch paths 46, 47, 75, 48, 158 and 159 are provided so as to extend from the six shunt paths provided with the upper nozzle valve 42, the lower nozzle valve 43, the neck nozzle valve 74, the drain valve 44, the head top valve 155 and the side head valve 156, respectively. The terminal of the branch path 46 extending from the upper nozzle valve 42 is connected to the upper nozzle link 11, the terminal of the branch path 47 extending from the lower nozzle valve 43 is connected to the lower nozzle link 12, and the terminal of the branch path 75 extending from the neck nozzle valve 74 is connected to the neck nozzle link 80.

[0050] The terminal of the branch path 158 extending from the head top valve 155 is connected to the head top massage nozzle 150. The terminal of the branch path 159 extending from the side head valve 156 is branched at some midpoint, and connected to the right side head massage nozzle 151 and the left side head massage nozzle 152.

[0051] A drain port 50 for discharging water in the sink 2 is formed in the bottom surface of the sink 2, and the drain port 50 intercommunicates with the water discharge pipe 30 through a sink-side water discharge trap 51 for preventing reverse flow of odor of sewage water. Accordingly, water discharged from the drain port 50 of the sink 2 is discharged through the water discharge pipe 30 to the outside of the machine. The terminal of the branch path 48 extending from the drain valve 44 is connected to the sink-side water discharge trap 51.

[0052] As shown in Figs. 3, 4 and 5, the automatic hair washing machine 1 of this embodiment is connected to a mist generator 90.

[0053] As shown in Fig. 5, the mist generator 90 is a device for generating mist and supplying the generated mist into the sink 2, and it has a mist tank 90a for stocking warm water used to generate mist, and a mist generator 90b for generating mist from warm water supplied from the mist tank 90a.

[0054] The mist tank 90a is provided with a heater 90c for heating warm water stocked in the mist tank 90a, and a mist thermistor 90d for detecting the temperature of the warm water stocked in the mist tank 90a.

[0055] The mist generator 90b is provided with an ultrasonic generator 90f for vibrating warm water supplied from the mist tank 90a by ultrasonic waves and atomizing the warm water to generate mist, and a fan 90f for feeding out the mist generated by the ultrasonic generator 90f to a mist feeding pipe 91.

[0056] The mist feeing pipe 91 is connected to the mist generator 90 at one end thereof, and also connected to the sink 2 through a sink connection portion 94 (Figs. 3 to 5) at the other end thereof. The mist generated in the mist generator 90 is passed through the mist feed pipe 91, and supplied into the sink 2.

[0057] As shown in Figs. 1, 2 and 4, a mist discharge

pipe 101 is provided to the rear side surface 100 of the sink 2 so as to project to the inside of the sink 2, and a mist discharge port 102 is formed at the opening of the end portion of the mist discharge pipe 101. The mist discharge pipe 101 is connected to the mist feed pipe 91, and the mist supplied form the mist generator 90 is passed through the mist feed pipe 91 and the mist discharge pipe 101 and supplied from the mist discharge port 102 into the sink 2.

[0058] In this embodiment, the mist generator 90, the mist discharge port 102 and the mist feed pipe 91 are cooperated with one another and function as a mist spray unit for spraying mist into the enclosed space 8b.

[0059] As shown in Figs. 3 to 5, a water discharge trap 92 is on the mist feed pipe 91.

[0060] The function of the water discharge trap 92, the flow of mist in the mist feed pipe 91 and the flow of reverse flow water (described later) flowing from the sink 2 into the mist feed pipe 91 will be described hereunder.

[0061] The mist feed pipe 91 is a pipe for supplying the mist generated in the mist generator 90 into the sink 2, and washing water or the like supplied for washing in the sink 2 may flow into the mist feed pipe 91. In the following description, liquid such as washing water or the like flowing from the sink 2 into the mist feed pipe 91 is conveniently referred to as "reverse flow water". In this embodiment, it is assumed that the reverse flow water flows into the mist feed pipe 91 in no small part for a reason described later.

[0062] When the reverse flow water flows into the main body of the mist generator 90 through the mist feed pipe 91, it causes a trouble in the mist generator and also obstructs smooth supply of mist to the sink 2.

[0063] According to this embodiment, in consideration of this fact, a water discharge trap inlet pipe 93 extending downwardly is connected to the mist feed pipe 91. The connection portion between the mist feed pipe 91 and the water discharge trap inlet pipe 93 is disposed to be lower than the sink connection portion 94, and the reverse flow water flowing from the sink 2 to the mist feed pipe 91 flows to the connection portion 95 along the slope of the mist feed pipe 91 and then flows into the water discharge trap inlet pipe 93 at the connection portion 95. Accordingly, the reverse flow water is prevented from reaching the mist generator 90.

[0064] As described above, the water discharge trap inlet pipe 93 is provided on the mist feed pipe 91, whereby the reverse flow water flowing into the mist generator 9 0 is prevented from flowing into the mist generator 90. Therefore, there is a risk that the mist supplied from the mist generator 90 to the sink 2 flows into the water discharge trap inlet pipe 93, which disturb smooth supply of mist to the sink 2.

[0065] According to this embodiment, in consideration of this risk, a water discharge trap 92 comprising a so-called S-shaped trap is provided at the lower portion of the water discharge trap inlet pipe 93. The water discharge trap 92 has a liquid stock portion 96 which is formed so as to be downwardly bent in a U-shape. The reverse flow water is supplied through the water discharge trap inlet pipe 93 into the liquid stock portion 96, and the liquid of a predetermined water level is trapped at all times. The liquid trapped in the liquid stock portion 96 of the water discharge trap 92 serves as a stopper, and the mist supplied from the mist generator 90 to the sink 2 is prevented from flowing into the water discharge trap inlet pipe 93, whereby the disturbance of the smooth mist supply can be prevented.

[0066] The mist feed pipe 91 is a pipe through which the mist supplied to the sink 2 passes. Therefore, drain water occurs in the mist feed pipe 91 due to flow of the mist. The drain water occurring in the mist feed pipe 91 is supplied through the water discharge trap inlet pipe 93 into the water discharge trap 92 as in the case of the reverse flow water flowing into the water discharge trap 92, and thus the flow-in of the drain water into the mist generator 90 can be prevented.

[0067] The drain water occurring in the mist generator 90 in connection with occurrence of mist in the mist generator 90 is discharged from a drain water discharge pipe 97 connected to the mist generator 90 to the outside of the mist generator 90, and the other end of the drain water discharge pipe 97 is connected to the water discharge trap inlet pipe 93. Accordingly, the drain water discharged from the mist generator 90 is properly supplied to the water discharge trap 92, and the liquid is more surely trapped in the water discharge trap 92.

[0068] As described above, according to this embodiment, the treatment of the drain water can be performed without providing any dedicated passage for discharging drain water, any electromagnetic valve to be provided on the passage, any equipment provided to control the electromagnetic vale, etc. Therefore, the manufacturing cost can be reduced, and the manufacturing easiness can be enhanced.

[0069] A water discharge trap outlet pipe 98 is connected to the exit side of the water discharge trap 92.

[0070] As shown in Figs. 3 to 5, the other end of the water discharge trap outlet pipe 98 is connected to the water discharge pipe 30 described above, and liquid which exceeds the predetermined water level in the liquid stock portion 96 of the water discharge trap 92 and flows into the water discharge trap outlet pipe 98 flows out through the water discharge trap outlet pipe 98 to the water discharge pipe 30 and then is discharged to the outside of the machine through the water discharge pipe 30. That is, the reverse flow water flowing into the mist feed pipe 91 and the drain water caused by occurrence of mist are discharged to the outside of the machine through the existing water discharge pipe 30. As described above, the reverse flow water and the drain water are discharged to the outside of the machine by using the existing facilities such as the water discharge pipe 30 of the sink 2, etc., and thus the cost can be reduced and the manufacturing easiness can be enhanced as compared with a case where a mechanism for discharg-

ing liquid to the outside of the machine is newly provided.

[0071] Here, in this embodiment, the mist discharge port 102 is set to be exposed to the inside of the sink 2, and it is not adopted to provide an umbrella portion or the like to the mist discharge port 102 so that the reverse flow water is prevented from flowing into the mist discharge port 102. The reason for this is as follows.

[0072] That is, in this embodiment, mist is supplied into the sink 2 for the purpose of achieving a treatment effect by bringing mist containing a predetermined cleaning agent component into contact with the head portion of a user in the sink 2 and also achieving a relaxation effect by bringing warm mist having a good flavor into contact with the head portion of the user. Accordingly, the above effects can be achieved at maximum when the mist is directly sprayed to the head portion of the user from the mist discharge port 102 while keeping some degree of warmth.

[0073] When an umbrella or the like is provided at the position corresponding to the mist discharge port 102, the reverse flow water can be prevented from flowing into the mist discharge port 102. However, the umbrella portion disturbs direct spray of mist from the mist discharge port 102 to the head portion of the user, and also mist is sprayed to the head portion of the user while bypassing the umbrella, so that the temperature of the mist may be reduced by this bypass.

[0074] According to this embodiment, in consideration of the above fact, the mist discharge port 102 is set to be exposed in the sink 2, and the mist is directly sprayed from the mist discharged port 102 to the head portion laid in the internal space of the sink 2, whereby the treatment effect and the relaxation effect can be effectively achieved. When the umbrella is not provided at the position corresponding to the mist discharge port 102, the reverse flow water flows into the mist discharge port 102 in no small measure. However, the reverse flow water can be surely prevented from flowing into the mist generator 90 by the function of the water discharge trap 92, etc. and also the smooth mist supply can be prevented from being disturbed as described above.

[0075] Fig. 6 is a perspective view showing the sink connection portion 94 when the sink connection portion 94 is viewed from the inside of the sink2. Fig. 7 is an explodedperspective view of the sink connection portion 94.

[0076] As shown in Figs. 1, 2 and 6, the hollow cylindrical mist discharge pipe 101 is provided so as to project to the inside of the sink 2. The mist discharge port 102 is formed at the opening of the end portion of the mist discharge pipe 101. The mist discharge pipe 101 is connected to the mist feed pipe 91 described above, and mist supplied from the mist generator 90 is passed through the mist feed pipe 91 and the mist discharge pipe 101 and supplied from the mist discharge port 102 into the sink 2.

[0077] As described above, as shown in Figs. 1, 2 and 6, the mist discharge port 102 is set to be exposed to the inside of the sink 2, and it is not provided with any umbrella portion for preventing flow-in of the reverse water flow into the mist discharge port 102. The reason for this is described above.

[0078] In this embodiment, mist is sprayed from the "hollow cylindrical" mist discharge pipe 101. Accordingly, the mist is sprayed to the head portion with some degree of directivity, and thus the treatment effect and the relaxation effect can be further enhanced.

[0079] Particularly, as shown in Figs. 1 and 2, the mist discharge port 102 is provided at the center lower portion of the rear side surface 100 of the sink 2, and atomized mist having a characteristic that it ascends in air is discharged from the mist discharge port 102 so that the mist prevails over the whole area of the head portion of a user who turns up. That is, when the mist is sprayed from the mist discharge port 102 provided at the center lower portion of the rear side surface 100 of the sink 2 to the neighborhood of the rear head portion of the user who turns up, the mist prevails to the overall area of the head portion along the shape of the head portion while ascending upwardly.

[0080] Furthermore, in this embodiment, the rear head portion of the user is supported on the head support net 70 in the sink 2 during the automatic hair washing treatment (see Figs. 2 and 4). In this case, the hair hangs vertically down from the head support net 70. In consideration of this fact, the mist discharge port 102 is provided at the center lower portion of the rear side surface 100 of the sink 2, and the mist can be sprayed from the side to the hair hanging down in the vertical direction, so that the mist can be made to suitably prevail over the whole area of the hair containing the hair hanging down.

[0081] Figs. 8A and 8B are perspective views showing respective members constituting the sink connection portion 94. Fig. 8A shows a mist discharge portion 110, and Fig. 8B are partially cross-sectional views of a front side discharge portion fixing member 111 at the left side of Fig. 8B and also shows a rear side discharge portion fixing member 112 at the right side of Fig. 8B. Fig. 9 is a partially cross-sectional view of the sink connection portion 94.

[0082] As shown in Fig. 7, the sink connection portion 94 has the mist discharge portion 110, the front side discharge portion fixing member 111 and the rear side discharge portion fixing member 112. The front side discharge portion fixing member 111 is fixed to the sink 2, and has a disc-shaped front side flange portion 114 , a hollow cylindrical contact portion 113 which has a diameter smaller than the diameter of the front side flange portion 114 and projects from the front side flange portion 114 to the front side, and a hollow cylindrical projecting portion 115 which has a diameter smaller than the contact portion 113 and projects from the contact portion 113 to the front side as shown in Fig. 8B.

[0083] Here, in the rear side surface 100 of the sink 2, a through hole 116 (Fig. 7) is provided so as to penetrate through the rear side surface 100 at the position where

the sink connection portion 94 is provided. The diameter of the through hole 116 is substantially equal to the diameter of the projecting portion 115 . Therefore, the projecting portion 115 can penetrate through the through hole 116, however, the contact portion 113 cannot penetrate through the through hole 116.

[0084] The front side discharge portion fixing member 111 is fixed to the sink 2 under the state that the projecting portion 115 is fitted (penetrate) in the through hole 116 and the front surface of the contact portion 113 is brought into contact with the back surface of the rear side surface 100. More specifically, a male screw portion is formed on the outer periphery of a part of the projecting portion 115 which penetrates through the through hole 116 and extends to the inside of the sink 2. A nut 117 is threaded on the male screw portion as shown in Fig. 7, and the rear side surface 100 of the sink 2 is pinched by the nut 117 and the front surface of the contact portion 113, whereby the front side discharge portion fixing member 111 is fixed to the sink 2.

[0085] A front side discharge portion accommodating unit 119 (the left side of Fig. 8B, Fig. 9) is formed in the front side discharge portion fixing member 111, and this will be described later.

[0086] As shown in Figs. 7 and 8, the rear side discharge portion fixing member 112 has a disc-shaped rear side flange portion 118 having the shape corresponding to the front side flange portion 114 of the front side discharge portion fixing member 111, a base portion 120 which has a diameter smaller than the diameter of the rear side flange portion 118 and projects from the rear side flange portion 118 to the rear side, and a hollow cylindrical pipe connection portion 121 provided at the rear portion of the base portion 120. The mist feed pipe 91 is connected to the pipe connection portion 121 with keeping airtightness.

[0087] Plural front side screw holes 122 are formed in the front side flange portion 114 of the front side discharge portion fixing member 111 so as to be spaced from one another at intervals in the peripheral direction, and rear side screw holes 123 are likewise formed in the rear side flange portion 118 of the rear side discharge portion fixing member 112 at the positions corresponding to the front side screw holes 122. Dedicated bolts and nuts are secured to the front side screw holes 122 and the rear side screw holes 123 under the state that the front side flange portion 114 and the rear side flange portion 118 are overlapped with each other, whereby the rear side flange portion 118 is fixed to the front side flange portion 114, and also the rear side discharge portion fixing member 112 is fixed to the front side discharge portion fixing member 111.

[0088] A rear side discharge portion accommodating portion 124 (the right side of Fig. 8B, Fig. 9) is formed in the rear side discharge portion fixing member 112, and this will be described later.

[0089] The mist discharge portion 110 has the mist discharge pipe 101 described above, and a thin cylindrical positioning member 125 which is connected to base end of the mist discharge pipe 101 and whose axial direction corresponds to a direction perpendicular to the axial direction of the mist discharge pipe 101. As shown in Fig. 9, an inner cavity 126 which is linked to the inner periphery of the mist discharge pipe 101 and extends in the front-and-rear direction is formed in the positioning member 125, and an opening 127 intercommunicating with the inner cavity 126 is formed in the rear surface of the positioning member 125.

[0090] As described later, when the front side discharge portion fixing member 111 and the rear side discharge portion fixing member 112 are joined to each other under the state that the mist discharge portion 110 is installed, the opening 127 and the inner cavity of the pipe connection portion 121 of the rear side discharge portion fixing member 112 intercommunicate with each other as shown in Fig. 9. Accordingly, mist introduced from the mist feed pipe 91 connected to the pipe connection portion 121 flows into the mist discharge pipe 101 through the pipe connection portion 121.

[0091] Bosses 130 which project to the outside along the axial direction of the positioning unit 125 are provided to the centers of the right and left side surfaces of the positioning unit 125.

[0092] As shown in Fig. 9, the front side discharge portion fixing member 111 and the rear side discharge portion fixing member 112 are joined to each other under the state that the mist discharge portion 110 is installed therein.

[0093] Describing in more detail, the front side discharge portion accommodating portion 119 (the left side of Fig. 8B, Fig. 9) formed in the front side discharge portion fixing member 111, and the rear side discharge portion accommodating portion 124 (the right side of Fig. 8B, Fig. 9) formed in the rear side discharge portion fixing member 112 are joined to each other to form a positioning unit accommodating space 131, and the positioning unit 125 of the mist discharge portion 110 is accommodated in the positioning unit accommodating space 131. In addition, the mist discharge pipe 101 of the mist discharge portion 110 extends into the projecting portion 115 of the front side discharge portion fixing member 111, and the tip thereof projects from the tip of the projecting portion 115 . The front side discharge portion fixing member 111 and the rear side discharge portion fixing member 112 are joined to each other while mist discharge pipe 101 is installed under the above state.

[0094] At this time, in the positioning unit accommodating space 131, boss grooves 133 in which the bosses 130 are fitted are formed at the positions corresponding to the bosses 130 formed at the centers of the right and left side surfaces of the accommodated positioning unit 125, and the positioning unit 125 is accommodated in the positioning unit accommodating space 131 under the state that the bosses 130 are fitted in the boss grooves 133.

[0095] Under the construction described above, ac-

cording to this embodiment, the mist discharge pipe 101 is turned in a predetermined range, and after it is turned, the position of the mist discharge pipe 101 is maintained.

[0096] Describing in detail, when the mist discharge pipe 101 projecting from the inside of the projecting portion 115 is gripped and then turned in the direction corresponding to the up-and-down direction (in the direction of an arrow Y in Figs. 6 and 9), the positioning unit 125 of the mist discharge portion 110 is turned around the bosses 130 in the positioning unit accommodating space 131. The mist discharge pipe 101 is turnable until the outer periphery of the mist discharge pipe 101 comes into contact with the inner periphery of the projecting portion 115 and thus the further turning of the mist discharge pipe 101 is restricted.

[0097] In this embodiment, the size and shape of the positioning unit accommodating space 131 and the size and shape of the positioning unit 125 are determined so that the positioning unit 125 comes into contact with the inside of the positioning unit accommodating space 131 and turns while sliding along the inner of the positioning unit accommodating space 131 when the positioning unit 125 is turned in the positioning unit accommodating space 131 in connection with the turning of the mist discharge pipe 101. Accordingly, when the mist discharge pipe 101 turns, the orientation of the mist discharge pipe 101 after turning is maintained by the frictional force caused by the contact between the positioning unit 125 and the positioning unit accommodating space 131.

[0098] As described above, in this embodiment, the orientation (direction) of the mist discharge pipe 101 can be changed in a predetermined range, and also after the change, the changed orientation (direction) of the mist discharge pipe 101 is maintained. Accordingly, the following effect can be obtained.

[0099] That is, the size and shape of the head portion are different among persons (users). Accordingly, the optimum orientation (direction) of the mist discharge port 102 formed at the mist discharge port 101 varies in accordance with the person (user) . The orientation of the mist discharge port 102 can be optimized in accordance with the user (person whose hair is washed) by making the orientation of the mist discharge pipe 101 (i.e., the jetting direction of the mist) changeable in a predetermined range. Particularly, according to this embodiment, the orientation of the mist discharge port 102 of the mist discharge pipe 101 can be changed by a very simple work of griping and turning the mist discharge pipe 101, and thus the workability is excellent and the work needs only a short time, thereby enhancing the convenience of users (containing persons whose hair is washed, operators such as staff of shops, etc.).

[0100] Next, the upper nozzle link 11 and the lower nozzle link 12 will be described.

[0101] The upper nozzle link 11 and the lower nozzle link 12 are configured to be reiteratively movable in synchronization with each other while supported at one ends thereof (i.e., cantilevered).

[0102] Specifically, as shown in Fig. 4B, the upper nozzle link 11 is reiteratively movable so that it starts to turn around the rotational axis A in the direction of the arrow C, turns from the head top position T1 shown in Fig. 4B, reaches a rear head position T2, reversely turns from the rear head position T2 and returns to the head top position T1. Here, when the upper nozzle link 11 is located at the head top position T1, washing water is jetted in the direction of the arrow Y1 from each of the nozzles formed in the upper nozzle link 11, whereby the washing water is jetted to the neighborhood of the head top portion of a user (person whose hair is washed) . When the upper nozzle link 11 is located at the rear head position T2, the washing water is jetted in the direction of the arrow Y2 from each of the nozzles formed in the upper nozzle link 11, whereby the washing water is jetted to the neighborhood of the rear head portion of the user.

[0103] Furthermore, the lower nozzle link 12 is reiteratively movable so that it starts to turn in the direction of an arrow D around the rotational axis B, turns from a hair position T3 shown in Fig. 4B, reaches the neck position T4, reversely from the neck position T4 in the direction of an arrow F and then returns to the hair position T3. Here, when the lower nozzle link 12 is located at the hair position T3, washing water is jetted in the direction of an arrow Y3 from each of the nozzles formed in the lower nozzle link 12, whereby the washing water is jetted to the user's hair handing down from the user's head. Furthermore, when the lower nozzle link 12 is located at the neck position T4, washing water is jetted in the direction of an arrow Y4 from each of the nozzles formed in the lower nozzle link 12, whereby the washing water is jetted to the neighborhood of the neck of the user.

[0104] In this embodiment, the upper nozzle link 11 and the lower nozzle link 12 are synchronously moved in the opposite turning directions (clockwise and counterclockwise in Fig. 4B) by a driving mechanism 189 described later while the jetting directions thereof are set to the same direction with respect to the hair growing direction at the rear head portion as described later.

[0105] That is, as shown in Fig. 4B, when the upper nozzle link 11 is located at the head top position T1, the lower nozzle link 12 is set to be located at the hair position T3. Here, it is assumed that the upper nozzle link 11 is located at the head top position T1 and the lower nozzle link 12 is located at the hair position T3. At this time, when the upper nozzle link 11 starts to turn in the direction of the arrow C (clockwise), the lower nozzle link starts to turn in the direction of the arrow D (counterclockwise) in synchronization with the turning of the upper nozzle link 11. In this case, at the rear head portion (at a rear half portion of the head with respect to the head top) , the upper and lower nozzle links 11 and 12 jet washing water to the head portion in the same direction which is identical to the hair growing direction. That is, the jetting directions of the upper and lower nozzle links 11 and 12 are set to the same direction with respect to the hair growing direction.

[0106] Furthermore, when the upper nozzle link 11 reaches the rear head position T2, the lower nozzle link 12 reaches the neck position T4 substantially at the same time. After the upper nozzle link 11 reaches the rear head position T2 and the lower nozzle link 12 reaches the neck position T4, these nozzle links are reversely moved. That is, it is assumed that the upper nozzle link 11 is located at the rear head position T2 and the lower nozzle link 12 is located at the neck position T4. At this time when the upper nozzle link 11 starts to turn in the reverse direction to the arrow C (i.e., the direction of an arrow E; counterclockwise), the lower nozzle link 12 starts to turn in the reverse direction to the arrow D (i.e., the direction of an arrow F; clockwise). At the rear head portion, the upper and lower nozzle links 11 and 12 jet washing water to the head portion in the same direction which is opposite to the hair growing direction. That is, the jetting directions of the upper and lower nozzle links 11 and 12 are set to the same direction with respect to the hair growing direction. When the upper nozzle link 11 reaches the head top position T1, the lower nozzle link 12 reaches the hair position T3 at the same time.

[0107] Here, for example when the upper nozzle link 11 is moved in the same direction as the hair growing direction while jetting washing water and also the lower nozzle link 12 is moved in the opposite direction to the hair growing direction while jetting washing water, that is, when the moving directions of the upper and lower nozzle links 11 and 12 with respect to the hair growing direction are different from each other, the upper nozzle link 11 and the lower nozzle link 12 jet washing water to the head portion and hair of the user from the different directions with respect to the hair growing direction. Therefore, there occurs a situation that the hair becomes entangled.

[0108] However, as described above, the upper nozzle link 11 and the lower nozzle link 12 are moved in the same direction synchronously with each other, and thus the moving directions of the upper and lower nozzle links 11 and 12 with respect to the hair growing direction are coincident with each other at all times, and thus occurrence of the situation that the hair gets entangled can be prevented.

[0109] In this embodiment, under the control of a microcomputer 89 (controller), the upper nozzle link 11 and the lower nozzle link 12 can make complicate motions in synchronization with each other, for example, they can move synchronously with each other while changing the moving speed, they can temporarily stop after moving in a fixed range, they reiteratively move in a predetermined range, etc.

[0110] Next, the driving mechanism 189 for implementing the synchronous movement between the upper and lower nozzle links 11 and 12 will be described.

[0111] Fig. 10A is a left side view showing the sink 2 under the state that the sink holding table 3 is detached and the side surface of the sink 2 is exposed. In Fig. 10a, a microcomputer 89 is schematically shown. Fig. 10B is a front view of the sink 2 under the above state (a front view showing a substantially left half part of the sink 2 when viewed from the front side).

[0112] As shown in Fig. 10A, a stepping motor 191 is provided at the lower portion of the let side surface 190 of the sink 2. The stepping motor 191 is connected to a motor driving circuit (not shown) . Under the control of the microcomputer 89, driving pulses are input from the motor driving circuit to the stepping motor 191, and the stepping motor 191 rotates in a predetermined direction by a predetermined distance on the basis of the input driving pulses. As well known, the quantity of motion of the stepping motor 191 is defined in proportion to the number of driving pulses, and thus the accurate positioning control can be implemented by the microcomputer 89.

[0113] A power (driving force) transmission mechanism 201 for transmitting the rotational driving force (power) of the stepping motor 191 to the upper nozzle link 11 and the lower nozzle link 12 is connected to the stepping motor 191.

[0114] The power transmission mechanism 201 will be described hereunder in detail.

[0115] A lower gear 193 is provided at the upper side of the stepping motor 191. A lower timing belt 194 for transmitting the rotational driving force of the stepping motor 191 to the lower gear 193 is wound between the lower gear 193 and a pulley (not shown) secured to the rotor shaft of the stepping motor 191, and the lower gear 193 is rotated while decelerated in a predetermined decelerating ratio in accordance with the rotation of the stepping motor 191.

[0116] The lower nozzle link 12 is connected to the output shaft of the lower gear 193, and the lower nozzle link 12 turns in accordance with the rotation of the lower gear 193. Specifically, when the lower gear 193 rotates in the direction of an arrow X shown in Fig. 10A, the lower nozzle link 12 turns from the hair position T3 to the neck position T4 (the direction indicated by the arrow D) . When the lower gear 193 rotates in the direction of an arrow Y shown in Fig. 10A, the lower nozzle link 12 turns from the neck position T4 to the hair position T3 (the direction indicated by the arrow F. Under the control of the microcomputer 89, the lower nozzle link 12 turns between the hair position T3 and the neck position T4 in synchronization with the upper nozzle link 11. This will be described later.

[0117] An upper gear 196 which is engaged with the lower gear 193 is provided at the upper side of the lower gear 193. The upper gear 196 rotates in the opposite direction to the rotational direction of the lower gear 193 in connection with the rotation of the lower gear 193.

[0118] A pulley 197 is provided at the upper side of the upper gear 196, and an upper timing belt 198 for transmitting the rotational driving power of the upper gear 196 to the pulley 197 is wound between the upper gear 196 and the pulley 197, and the pulley 197 rotates in accordance with the rotation of the upper gear 196.

[0119] The upper nozzle link 11 is connected to the

output shaft of the pulley 197, and the upper nozzle link 11 turns in accordance with the rotation of the upper gear 196. Specifically, when the upper gear 196 rotates in the direction of the arrow Y shown in Fig. 10A (at this time, the lower gear 193 rotates in the direction of the arrow X), the upper nozzle link 11 turns from the head top position T1 to the rear head position T2 (the direction indicated by the arrow C) . When the upper gear 196 turns in the direction of the arrow X shown in Fig. 10A (at this time, the lower gear 193 rotates in the direction of the Y direction), the upper nozzle link 11 turns from the rear head position T2 to the head top position T1 (the direction of the arrow E) . Under the control of the microcomputer 89, the upper nozzle link 11 turns between the head top position T1 and the rear head position T2 in synchronization with the lower nozzle link 12. This will be described later.

[0120] Next, the synchronous motion between the upper nozzle link 11 and the lower nozzle link 12 in connection with the operation of the driving mechanism 189 will be described in detail.

[0121] First, it is assumed that the upper nozzle link 11 is located at the head top position T1 and the lower nozzle link 12 is located at the hair position T3. In this case, the microcomputer 89 rotates the stepping motor 191 in the direction of the arrow X of Fig. 10A. In connection with the rotation of the stepping motor 191 in the direction of the arrow X, the lower gear 193 rotates in the direction of the arrow X. In connection with the rotation of the lower gear 193 in the direction of the arrow X, the lower nozzle link 12 located at the hair position T3 turns in the direction of the arrow D.

[0122] Furthermore, in connection with the rotation of the lower gear 193 in the direction of the arrow X, the upper gear 196 turns in the direction of the arrow Y. In connection with the rotation of the upper gear 196 in the direction of the arrow Y, the pulley 197 rotates in the direction of the arrow Y. In connection with the rotation of the pulley 197 in the direction of the arrow Y, the upper nozzle link 11 located at the head top position T1 turns in the direction of the arrow C.

[0123] As described above, in synchronization with the movement of the upper nozzle link 11 from the head top position T1 to the rear head position T2, the lower nozzle link 12 moves from the hair position T3 to the neck position T4.

[0124] Furthermore, when the lower nozzle link 12 turns in the direction of the arrow D and consequently the lower nozzle link 12 reaches the neckposition T4, the upper nozzle link 11 reaches the rear headposition T2 at the same time. That is, in this embodiment, the upper gear 196, the lower gear 193, the pulley 197 and the other members associated with the turning of the nozzle links are designed so that the upper nozzle link 11 reaches the rear head position T2 at the same time when the lower nozzle link 12 reaches the neck position T4.

[0125] When the lower nozzle link 12 reaches the neck position T4 and thus the upper nozzle link 11 reaches the rear head position T2, the stepping motor 191 rotates counterclockwise in Fig. 10A (the direction of the arrow Y in Fig. 10A) under the control of the microcomputer 89.

[0126] In connection with the rotation of the stepping motor 191 in the direction of the arrow Y, the lower gear 193 rotates in the direction of the arrow Y, and in connection with the rotation of the lower gear 193 in the direction of the arrow Y, the lower nozzle link 12 located at the neck position T4 turns in the direction of the arrow F.

[0127] Furthermore, in connection with the rotation of the lower gear 193 in the direction of the arrow Y, the upper gear 196 rotates in the direction of the arrow X, and in connection with the rotation of the upper gear 196 in the direction of the arrow X, the pulley 197 rotates in the direction of the arrow X. In connection with the rotation of the pulley 197 in the direction of the arrow X, the upper nozzle link 11 located at the rear headposition T2 turns in the direction of the arrow E.

[0128] As described above, the lower nozzle link 12 is moved from the neck position T4 to the hair position T3 in synchronization with the movement of the upper nozzle link 11 from the rear head position T2 to the head top position T1.

[0129] The arrival of the lower nozzle link 12 at the hair position T3 and the neck position T4 is suitably detected on the basis of the number of rotation steps calculated from the number of driving pulses input to the stepping motor 191.

[0130] Furthermore, as shown in Fig. 10A, the upper gear 196 is provided with a gear position detecting switch unit 200. The gear position detecting switch 200 is a magnet type sensor for detecting that the upper nozzle link 11 exceeds the head top position T2 and further turns in the direction of the arrow E or that the upper nozzle link 11 exceeds the rear head position T2 and further turns in the direction of the arrow C. When the upper gear 196 rotates in the direction of the arrow X so that the upper nozzle link 11 exceeds the head top position T1 and further turns in the direction of the arrow E, the contact point of the gear position detecting switch unit 200 is conducted by a magnet (not shown) provided to the upper gear 196, and a signal representing this fact is output to a predetermined port of the microcomputer 89. The microcomputer 89 to which the signal concerned is input stops the driving of the stepping motor 191 so that the upper nozzle link 11 is prevented from exceeding the head top position T1 and further turning in the direction of the arrow E. At the same time, the lower nozzle link 12 moving in synchronization with the upper nozzle link 11 is prevented from exceeding the hair position T3 and further turning in the direction of the arrow F.

[0131] Likewise, when the upper gear 196 rotates in the direction of the arrow Y so that the upper nozzle link 11 exceeds the rear head position T2 and further turns in the direction of the arrow C, the contact point of the gear position detecting switch unit 200 is conducted by a magnet (not shown) provided to the upper gear 196, and a signal representing this fact is output to a prede-

termined port of the microcomputer 89. The microcomputer 89 to which the signal concerned is input stops the driving of the stepping motor 191 so that the upper nozzle link 11 is prevented from exceeding the rear head position T2 and further turning in the direction of the arrow C. At the same time, the lower nozzle link 12 moving in synchronization with the upper nozzle link 11 is prevented from exceeding the neck position T4 and further turning in the direction of the arrow D.

[0132] Fig. 11 is a block diagram showing the functional construction of the automatic hair washing machine 1 and the mist generator 90.

[0133] As shown in Fig. 11, the automatic hair washing machine 1 has the microcomputer 89.

[0134] The microcomputer 89 concentrically controls the respective parts of the automatic hair washing machine 1, and has CPU, ROM, RAM and other peripheral circuits. The microcomputer 89 can execute various kinds of time counting operations on the basis of a reference clock generated by an oscillator (not shown).

[0135] Various kinds of detection signals are input to the microcomputer 89 from the first water level sensor 26, the second water level sensor 27, the overflow sensor 31 and the first thermistor 19, and also an operation signal corresponding to an instruction is input to the microcomputer 89 from an operation panel 60 for performing various kinds of instructions.

[0136] The microcomputer 89 is connected to control targets such as the motor 20, the warm water stock valve 24, the shampoo pump 38, the conditioner pump 39, the inverter 64, the upper nozzle valve 42, the lower nozzle valve 43, the drain valve 44, the neck nozzle valve 74, etc.

[0137] The mixing valve 15 is connected to the motor 20, and the microcomputer 89 controls the driving of the motor 20 to open/close the mixing valve 15, whereby the temperature of warm water to be supplied to the water supply pipe 16 can be adjusted.

[0138] Furthermore, the microcomputer 89 is connected to the inverter 64 for supplying AC current to the main pump 32 to control the discharge pressure of washing water to be discharged from the main pump 32. As shown in Fig. 5, the washing water discharged from the main pump 32 is jetted from the nozzles formed in the upper nozzle link 11, the lower nozzle link 12 and the neck nozzle link 80 through the upper nozzle valve 42, the lower nozzle valve 43 and the neck nozzle valve 74. Accordingly, the microcomputer 89 controls the inverter 64 to control the jetting pressure of washing water to be jetted from the nozzles of the respective nozzle links.

[0139] Furthermore, a driving motor 103 for controlling the movement of the upper nozzle link 11 and the lower nozzle link 12 is connected to the microcomputer 89. The driving motor 103 comprises a stepping motor, and controls the movement of the upper nozzle link 11 and the lower nozzle link 12 through the driving mechanism on the basis of a driving signal input from the microcomputer 89. The microcomputer 89 controls the driving motor 103 so as to enable complicated motions of the upper nozzle link 11 and the lower nozzle link 12, for example, change of the moving speed of the upper nozzle link 11 and the lower nozzle link 12, temporarily stop of the upper nozzle link 11 and the lower nozzle link 12, etc.

[0140] In this embodiment, the microcomputer 89, the driving motor 103, the respective nozzle links, etc. are cooperated with one another to function as a jetting unit for jetting washing water to the head portion which is laid so as to protrude in the enclosed space 8b.

[0141] As shown in Fig. 11, the mist generator 90 has a mist generator controller 160. The mist generator controller 160 concentrically controls the respective parts of the mist generator 90, and has CPU, ROM, RAM and other peripheral circuits. A detection signal from the mist thermistor 90 is input to the mist thermistor 90d. Furthermore, the heater 90c, the ultrasonic generator 90f, a fan 90g, etc. are connected as control targets to the mist generator controller 160.

[0142] The microcomputer 89 and the mist generator controller 160 are connected to each other through an interface unit 99, and they can communicate with each other in conformity with a predetermined communication protocol.

[0143] In this embodiment, the microcomputer 89 and the mist generator controller 160 are cooperated with each other to control both the automatic hair washing machine 1 and the mist generator 90.

[0144] Fig. 12 is a diagram showing the operation panel 60.

[0145] As shown in Fig. 12, a power supply switch 220 disposed at the upper left side of the operation panel 60 turns on/off the power source of the automatic hair washing machine 1.

[0146] A tank temperature adjusting switch 221 disposed at the right side of the power supply switch 220 is used to set the temperature of water stocked in the warm water stocking tank 25 . The set temperature set by operating the tank temperature adjusting switch 221 is displayed on a set temperature display panel 226 such as a liquid crystal display panel or the like which is formed between the power supply switch 220 and the tank temperature adjusting switch 221. The microcomputer 89 controls the motor 20 to adjust the opening/closing state of the mixing valve 15 and adjust the mixing ratio between water and hot water so that the temperature of water stocked in the warmwater stocking tank 25 is equal to a set temperature. A heater may be provided in the warm water stocking tank 25 to adjust the temperature of water stocked in the warm water stocking tank 25 by the heater.

[0147] A hot water supply switch 222 for instructing stock of water into the warm water stocking tank 25 is disposed below the power supply switch 220. A tank water discharging switch 223 for instructing discharge of water stocked in the warmwater stocking tank 25 is disposed at the right side of the hot water supply switch 222, and a use-up switch 224 for instructing use-up of water stocked in the warm water stocking tank 25 is disposed at the right side of the tank water discharge switch 223.

Furthermore, an initial water discharge switch 225 for instructing discharge of water trapped in the suction pipe 33, the branch paths 46, 47, 75, 48 (that is, water which may be cooled) from each nozzle link is disposed at the lower side of the hot water supply switch 222.

[0148] A container selecting area 228 is formed at the right side of the initial water discharge switch 225, and plural container selecting switches 229 are disposed in the container selecting area 228. These container selecting switches 229 are provided to select which one of plural containers containing the shampoo container 34 and the conditioner container 36 should be used to use desired cleaning agent in each operation step (described later) contained in a course when a course operation described later is executed.

[0149] A full-course switch 230 is disposed at the lower left side of the container selecting area 228. The full-course switch 230 is a switch for selecting, as a cleaning operation course to be executed, "full course" which is one of cleaning operation courses (hereinafter referred to as "operation courses").

[0150] The operation course has predetermined operation steps which are arranged in a predetermined order. When execution of some operation course is instructed, a series of operation steps contained in the selected operation course are executed in order.

[0151] For example, the operation course contains a shampoo step of washing the head portion of a user with washing water containing shampoo liquid, a conditioning step of conditioning the head portion of a user with washing water containing conditioner liquid, a rinsing step of rinsing the head portion of a user with washing water containing no cleaning agent (i.e., with only water), etc.

[0152] In this embodiment, plural operation courses having different contents (full course, powerful course, scalp care course, hair care course I, hair care course II, etc.) are prepared.

[0153] A shampoo switch 231 as a switch for selecting the shampoo step for washing the head of a user with washing water containing shampoo liquid as an operation step to be executed is disposed at the right side of the full-course switch 230, and a conditioning switch 232 for selecting the conditioning step for conditioning the head portion of a user with washing water containing conditioner liquid as an operation step to be executed is disposed at the right side of the shampoo switch 231. Furthermore, a rinsing switch 233 for selecting the rinsing step for rinsing the head portion of a user with washing water containing no cleaning liquid as an operation step to be executed is disposed below the shampoo switch 231.

[0154] In this embodiment, it is possible to arbitrarily instruct execution of only any one of the shampoo step, the conditioning step and the rinsing step.

[0155] Furthermore, A powerful course switch 234 for selecting the powerful course as an operation course to be executed is disposed at the right side of the rinsing step switch 233.

[0156] Furthermore, a delicate switch 236 is disposed at the right side of the powerful course switch 234. The delicate switch 236 is a switch operated when the hair of a person whose hair is damaged or easily entangled is washed. When the delicate switch 236 is operated, the hair of a person is washed according to a hair washing manner which is suitable for a person whose hair is damaged or easily entangled.

[0157] The scalp care switch 238 is a switch for selecting the scalp care course as an operation course to be executed, and the hair care switch 239 is a switch for selecting the hair care course I or the hair care course II as an operation course to be executed. The scalp care course, the hair care course I and the hair care course II will be described later.

[0158] A hair length selecting switch 241 is disposed below the scalp care switch 238 and the hair care switch 239. The hair length selecting switch 241 is a switch for selecting the length of the hair of the user. In this embodiment, the length of the hair is sectioned into four stages, and any one of the four stages is selectable. The microcomputer 89 controls the movement of each nozzle link in accordance with the length of the hair, and also controls the jetting pressure of washing water to be jetted from the nozzle links.

[0159] A remaining time display panel 242 is formed below the hair length selecting switch 241, and a remaining time adjusting switch 243 is disposed at the right side of the remaining time display panel 242.

[0160] When an operation course is executed, a remaining time until the execution of the operation course is finished is displayed on the remaining time displaypanel 242, and when execution of one operation step is instructed, a remaining time until the operation step concerned is finished is displayed on the remaining time display panel 242. The remaining time adjusting switch 243 is a switch operated when the remaining time is extended or shortened.

[0161] A water pressure adjusting switch 244 is disposed below the remaining time adjusting switch 243. The water pressure adjusting switch 244 is a switch for adjusting the jetting pressure of washing water to be jetted from each nozzle link.

[0162] A start/stop instructing switch 245 is disposed below the water pressure adjusting switch 244.

[0163] In a case where one operation course is selected as an operation course to be executed or in a case where execution of one operation step is instructed as an operation step to be executed, the start/stop instructing switch 245 is a switch operated when the execution of the operation course is actually started or when start of the one operation course is actually instructed. When the start/stop instructing switch 245 is operated, execution of the operation associated with the operation course or the operation associated with the one operation step is started. Furthermore, the start/stop instructing switch 245 is operated when the operation is temporarily stopped during the execution of the operation associated

with the operation course or the operation associated with one operation step. When the start/stop instructing switch 245 is operated during operation of the automatic hair washing machine 1, the operation of the automatic hair washing machine 1 is temporarily interrupted, and when the start/stop instructing switch 245 is operated again, the operation of the automatic hair washing machine 1 is resumed.

[0164] Next, the operation of automatic hair washing machine 1 and the mist generator 90 from the time when the automatic hair washing machine 1 and the mist generator 90 are powered on till any one of the plural operation courses is selected and the selected operation course is started to be executed will be described with reference to the flowchart.

[0165] Fig. 13 is a flowchart showing the above operation.

[0166] The mist generator 90 is powered on (step SA1) and also the automatic hair washing machine 1 is powered on (step SA2) by a user (staff of a shop, a person whose hair is washed or the like). As described above, in this embodiment, the automatic hair washing machine 1 and the mist generator 90 are designed as separate apparatuses, and power is supplied to each of the apparatuses from different power sources. Accordingly, each of the apparatus is individually powered on.

[0167] The automatic hair washing machine 1 and the mist generator 90 are designedas separate apparatuses. Therefore, when the automatic hair washing machine 1 is required to have a function of spraying mist, the mist generator 90 may be connected to the automatic hair washing machine 1 to add the mist spraying function to the automatic hair washing machine 1. Furthermore, when the automatic hair washing machine 1 is not required to have the function concerned, the mist generator 90 is not connected to the automatic hair washing machine 1. There is a tendency that a mechanism for generating mist is designed as a relatively large mechanism, and thus an automatic hair washing machine 1 which does not the mist spraying function can be prevented from being needlessly large in size.

[0168] It is needless to say that a mist generating mechanism for generating mist is miniaturized and then installed in the automatic hair washing machine 1.

[0169] When the automatic hair washing machine 1 is powered on, the microcomputer 89 of the automatic hair washing machine 1 communicates with the mist generator controller 160 on the basis of a predetermined protocol to acquire information concerning the state of each part of the mist generator 90 (step SA3) . Here, the information concerning each part of the mist generator 90 contain information representing whether the mist generator 90 is set to a state that it can normally generate mist and also normally supply the generated mist to the sink 2 of the automatic hair washing machine 1 and information representing what factor makes it impossible to normally supply mist when the mist cannot be normally supplied. As the factor which makes it impossible to normally supply mist, there is a situation that the mist generator 90 is not powered on, a situation that no water is stocked in the mist tank 90a, a situation that error occurs in some equipment such as the ultrasonic generator 90f or the like, or the like.

[0170] Subsequently, an instruction for selecting any operation course as an operation course to be executed is input to the microcomputer 89 (step SA4). As described above, the user operates any switch of the full-course switch 230, the powerful course switch 234, the scalp care switch 238 and the hair care switch 239 of the operation panel 60 to select an operation course to be executed.

[0171] In this embodiment, the full course and the powerful course do not contain the mist spraying operation, and the scalp care course, the hair care course I and the hair care course II contain the mist spraying operation. In the following description, the scalp care course, the hair care course I and the hair care course II are conceptually referred to as "mist interlocking course".

[0172] Subsequently, the microcomputer 89 determines whether the operation course input in step SA4 is the mist interlocking course (= scalp care course, the hear care course I or the hair care course II) (step SA5). When the operation course input in step SA4 is not the mist interlocking course (step SA5; NO), the microcomputer 89 shifts the processing to step SA9.

[0173] When the operation course input in step SA4 is the mist interlocking course (step SA5; YES), the microcomputer 89 determines on the basis of the information acquired in step SA3 whether the mist generator 90 is set to the state that it can normally supply mist to the automatic hair washing machine 1 (step SA6).

[0174] When the mist generator 90 is not set to the state that it cannot normally supply mist to the automatic hair washing machine 1 (step SA6; NO), the microcomputer 89 informs this fact (step SA7).

[0175] For example, the microcomputer 89 performs a predetermined display representing occurrence of some error in the mist generator 90 on the set temperature display panel 226, whereby it is informed to the user that the mist generator 90 falls into the state that it cannot normally supply mist. In this case, the user refers to the display content of the set temperature display panel 226 to recognize occurrence of some error in the mist generator 90, and can take a countermeasure to overcome this error (for example, when the mist generator 90 is not powered on, the power is turned on or the like) on the basis of this recognition.

[0176] On the other hand, when it is determined in step SA6 that the mist generator 90 is set to the state that it can normally supply mist to the automatic hair washing machine 1 (step sA6; YES), the microcomputer 89 outputs information indicating the input operation course to the mist generator 90 (step SA8) , and shifts the processing to step SA9.

[0177] In step SA9, the microcomputer determines whether the operation course input in step SA4 is the

mist interlocking course or not (step SA10) .

[0178] When the operation course input in step SA4 is the mist interlocking course (step SA10; YES), the microcomputer 89 transmits information indicating start of the operation to the mist generator 90 with the operation of the start/stop instructing switch 245 as a trigger (step SA11), and shifts the processing to step SA12.

[0179] On the other hand, when the operation course input in step SA4 is not the mist interlocking course (step SA10; NO) , the microcomputer 89 shifts the processing to step SA12.

[0180] In step SA12, the microcomputer 8 9 starts to execute the operation course input in step SA4.

[0181] Subsequently, the microcomputer 89 determines whether the operation course input in step SA4 is the mist interlocking course or not (step SA13). When the operation course input in step SA4 is the mist interlocking course, that is, when the operation course input in step SA4 corresponds to any one of the scalp care course, the hair care course I and the hair care course II (step SA13; YES), the microcomputer 89 cooperates with the mist generator controller 160 to control the respective parts of the automatic hair washing machine 1 and the mist generator 90 in conformity with the corresponding operation course and executes the corresponding operation course (step SA14) . The operation of the step SA14 will be described in detail.

[0182] On the other hand, when the operation course input in step SA4 is not the mist interlocking course, that is, when the operation course input in step SA4 is any one of the full course and the powerful course (step SA13; NO), the microcomputer 89 controls the respective parts of the automatic hair washing machine 1 in conformity with the corresponding operation course and executes the corresponding operation course (step SA15). The details of the operation of the step SA15 are omitted.

[0183] Next, the detailed operation of the automatic hair washing machine 1 and the mist generator 90 when the scalp care course is executed will be described with reference to the flowchart.

[0184] Fig. 14 is a flowchart showing the operation of the automatic hair washing machine 1 and the mist generator 90 when the scalp care course is executed.

[0185] In this scalp care course, the first operation step and the last operation step out of a series of operation steps constitute a mist step of spraying mist. An effect obtained by this step arrangement will be described later.

[0186] First, as shown in Fig. 14, execution of the scalp care course is started (step SB1).

[0187] First, the scalp care switch 238 is operated to select the scalp care course as an operation course to be executed, the cover 8 is closed under the state that the head portion of a user (a person whose hair is washed) is laid in the sink 2, and then the start/stop instructing switch 245 is operated. Upon execution of these operations as a trigger, the execution of the scalp care course is started.

[0188] As described above, when the cover 8 is closed under the state that the head portion of the user is laid in the sink 2, the cut-out portion 8a is closed by the head portion, and the substantially hermetically sealed enclosed space 8b (Fig. 4) is formed in the space surrounded by the sink 2 and the cover 8, and the head portion is laid to protrude into the enclosed space 8b.

[0189] Subsequently, the microcomputer 89 starts the mist step (step SB2). That is, in the scalp care course, the mist step containing the spray of mist is the first operation step. In other words, in the scalp care course, the mist step is executed before a shampoo step and a rinsing step (a step of jetting washing water) described later.

[0190] Here, the mist step will be described in detail.

[0191] Fig. 15 is a flowchart showing the operation of the automatic hair washing machine 1 and the mist generator 90 when the mist step is executed.

[0192] As shown in Fig. 15, when the mist step is started (step SC1) , the microcomputer 89 controls the main pump 32 through the inverter 64 to jet washing water from each nozzle link under very weak jetting pressure (step SC2) . This jetting of the washing water is continued while the mist is sprayed. Here, the very weak jetting pressure is set to the extent that the washing water jetted from each nozzle link does not reach the head portion laid in the sink 2. Furthermore, the mixing valve 15 is controlled to control the temperature of water stocked in the warm water stocking tank 25 so that the temperature of washing water jetted from each nozzle link is relatively high.

[0193] The operation of this step SC2 has the following purpose.

[0194] That is, when the scalp care course is started, the temperature of the enclosed space 8b surrounded by the sink 2 and the cover 8 is low in some cases, and also the surface temperature of the sink 2 and the enclosed space 8b side of the cover 8 are low in some cases. When mist is filled in the enclosed space 8b under the state that the temperature of the enclosed space 8b or the surface temperature of the sink 2 and the cover 8 is low, the temperature of the mist is reduced, so that the treatment effect and the relaxation effect based on the mist may be lowered. In consideration of this demerit, the operation of the step SC2 aims to increase the temperature of the enclosed space 8b and the surface temperature of the sink 2 and the cover 8 before mist is supplied into the enclosed space 8b of the sink 2.

[0195] After the treatment of the step SC2, the microcomputer 89 outputs a mist spraying processing command to the mist generator controller 160 (step SC3) . The mist spray processing command is a command for instructing start of execution of a series of processing associated with supply of mist to the automatic hair washing machine 1.

[0196] The mist generator controller 160 to which the mist spray processing command is input controls each part of the mist generator 90 to execute mist spray preparation processing (step SC4).

[0197] Specifically, the mist generator controller 160

drives the heater 90c to heat water stocked in the mist tank 90a. When it is detected on the basis of the detection value input from the mist thermistor 90d that the temperature of water stocked in the mist tank 90a reaches a predetermined temperature (for example, 75°C) , the mist generator controller 160 stops the operation of the heater 90c. This series of operations executed until the water stocked in the mist tank 90a is increased to the predetermined temperature corresponds to the mist spray preparation processing.

[0198] A mist temperature range in which the treatment effect and the relaxation effect can be effectively brought out is known, and the predetermined temperature described above is set to a proper value so that the temperature of mist supplied into the sink 2 falls into the temperature range concerned.

[0199] During the execution of the mist spray preparation processing in step SC4, the mist generator controller 160 monitors whether the mist spray preparation processing is finished or not (step SC5).

[0200] When the mist spray preparation processing is finished (step SC5; YES), the mist generator controller 160 starts to spray mist into the enclosed space 8b of the sink 2 (step SC6).

[0201] Specifically, the mist generator controller 160 drives the ultrasonic generator 90f to ultrasonically vibrate water supplied from the mist tank 90a to the ultrasonic generator 90f and atomize the water, thereby generating mist. In addition, the mist generator controller 160 drives the fan 90g to feed the mist generated by the ultrasonic generator 90f through the mist feeding pipe 91 into the enclosed space 8b of the sink 2 . Accordingly, the mist is passed through the mist feeding pipe 91 and the mist discharge pipe 101 and supplied from the mist discharge port 102 into the sink 2.

[0202] At the same time when the spray of mist is started in step SC6, the microcomputer 89 count downs the time until a predetermined time set as a mist executing time for which the mist step is executed is finished (elapses) . That is, the microcomputer 89 counts the remaining time until the mist step is finished (step SC7).

[0203] The predetermined time as the mist executing time is properly set in accordance with the relationship between the degree of attainment of the treatment effect and the relaxation effect and the time for which mist is sprayed, and particularly in this embodiment, it is set to at least 30 seconds.

[0204] Subsequently, the microcomputer 89 monitors whether such abnormality that it is impossible to continue spraying of mist (step SC8) occurs in the mist generator 90, and also monitors whether the remaining time reaches 30 seconds (step SC9).

[0205] The microcomputer 89 detects whether such abnormality that it is impossible to continue spraying of mist occurs as follows. That is, the mist generator controller 160 monitors the state (temperature, amount) of water stocked in the mist tank 90a, the operation state of the ultrasonic generator 90f or the like at all times, and detects such abnormality that it is impossible to continue spraying of mist occurs when it detects abnormal increase of the temperature of water stocked in the mist tank 90a, an abnormal operation of the ultrasonic generator 90f or the like. when detecting that such abnormality that it is impossible to continue spraying of mist occurs, the mist generator controller 160 outputs a signal representing this fact to the microcomputer 89. On the basis of the signal input from the mist generator controller 160, the microcomputer 89 detects that such abnormality that it is impossible to continue spraying of mist occurs.

[0206] When such abnormality that it is impossible to continue spraying of mist occurs in the mist generator 90 during the monitoring in steps SC8 and SC9 (step SC8; YES), the microcomputer finishes the mist step (step SC11). After the mist step is finished, a break-in step is executed (see Fig. 14).

[0207] It may be informed to a user that such abnormality that it is impossible to continue spraying of mist occurs.

[0208] As described above, according to this embodiment, when such abnormality that it is impossible to continue spraying of mist occurs in the mist generator 90 during spraying of mist, the operation of the automatic hair washing machine 1 is not stopped, but the processing associated with the spray of mist is omitted and the operation of the automatic hair washing machine 1 is continued. This is executed in consideration of the following matter. That is, the spray of mist is an additional function as compared with the shampoo step and the conditioning step described later, and thus even when the spray of mist is not executed, the degree of satisfaction of the user is not relatively lost. Therefore, the operation of the automatic hair washing machine 1 is continued with omitting the spray of mist, whereby the operation course can be smoothly and surely executed and the convenience for users can be enhanced.

[0209] When abnormality occurs in the mist generator 90, the operation of the automatic hair washing machine 1 may be temporarily stopped.

[0210] When the remaining time reaches 30 seconds in step SC9 (step SC9; YES), the microcomputer 89 executes the massage operation (step SC12) .

[0211] This massage operation aims to bring a constant massage effect to the user (person whose hair is washed). For example, the microcomputer 89 controls various kinds of valves to jet washing water from a head top massage nozzle 150, a right side head massage nozzle 151 and a left side head massage nozzle 152 so that the washing water is jetted to the head top portion and the right and left side head portions. Here, warm water is used as the washing water to be jetted. As described above, warm water is concentrically jetted to the head top portion and the side head portions of the user, whereby the massage effect can be effectively attained.

[0212] When washing water is jetted from each nozzle, the water washing may be intermittently jetted or jetted while the jetting pressure is varied in magnitude. It is ex-

pected by executing these operations that a higher massage effect can be achieved.

[0213] Subsequently, the microcomputer 89 monitors whether the remaining time is nullified or not (the remaining time = 0 second) (step SC14) while monitoring whether such abnormality that it is impossible to continue spray of mist occurs in the mist generator 90 (step SC13) .

[0214] When it is detected in step SC13 that whether such abnormality that it is impossible to continue spray of mist occurs in the mist generator 90 (step SC13; YES), the microcomputer 89 finishes the mist step (step SC11).

[0215] When the remaining time is nullified (step SC14; YES), the microcomputer 89 controls the inverter 64 and the respective valves to stop the massage operation, and cooperates with the mist generator controller 160 to stop the spray of mist (step SC15), thereby stopping the execution of the mist step (step SC11).

[0216] As described above, according to this embodiment, after the remaining time reaches 30 seconds, the mist spray and the jetting of washing water from each nozzle link in connection with the massage operation are simultaneously executed in parallel.

[0217] This operation can be performed because the head portion is laid to protrude into the enclosed space 8b of the sink 2, washing water is jetted from each nozzle link to the head portion in the enclosed space 8b and also mist is sprayed into the enclosed space 8b. When the spray of mist and the jetting of washing water from each nozzle link in connection with the massage operation are executed simultaneously in parallel to each other, the relaxation effect and the treatment effect caused by mist and the massage effect based on the massage operation can be simultaneously brought to the user, and the degree of attainment of these effects can be synergistically enhanced.

[0218] Furthermore, it is known that when mist is sprayed to the head portion of the user, it brings an effect of making the pores of the head portion open. In this embodiment, the opening of the pores of the head portion caused by mist and the jetting of washing water to the head portion in connection with the massage operation can be simultaneously performed, and the massage effect can be more greatly enhanced.

[0219] Furthermore, in the scalp care course, the mist step is executed prior to the shampoo step described later., whereby the following effect can be attained.

[0220] That is, as described above, when mist is sprayed to the head portion of the user, it brings the effect that the pores of the head portion is opened. Accordingly, the mist step is executed to make the pores of the head portion open before the shampoo step, whereby sebum smudge of the pores can be effectively eliminated by jetting washing water containing shampoo liquid in the subsequent shampoo step.

[0221] Furthermore, the relaxation effect can be brought to the user by jetting mist. By bringing this relaxation effect to the user at the first half of the scalp care course, the user can be relaxed during the scalp care course.

[0222] As shown in Fig. 14, after the mist step of the step SB2 is finished, the microcomputer 89 executes the running-in step (step SB3) .

[0223] This running-in step is an operation step which aims to make the user familiar with jetting of washing water to his/her head portion so that the user is relaxed.

[0224] In the running-in step, the microcomputer 89 moves the upper nozzle link 11 and the lower nozzle link 12 at a very slow speed while jetting washing water under relatively weak jetting pressure, for example. Accordingly, the user feels as if he/she is gently stroked by a human's hand, and thus the user is made to have a feeling of safety. Furthermore, washing water is jetted while each nozzle link is moved at a slow speed in the running-in step which is a step immediately after the scalp care course is started, whereby the user can cast aside such a feeling that his/her hair is washed by a machine without surprising the user, so that the user has a high-class feeling.

[0225] Furthermore, the microcomputer 89 controls the neck nozzle valve 74, etc. to jet washing water from the neck nozzle link 80 to the user's neck. Here, warm water is used as washing water to be jetted. By jetting warm water to the neck of the user as described above, the user has good blood flow at the neck and thus the tension of the overall head portion is loosened, so that the massage effect can be enhanced.

[0226] Subsequently, the microcomputer 89 executes a weak washing step (step SB4).

[0227] The weak washing step is an operation step of washing out smudge (dirt, dust, etc.) attached to hair to some extent with washing water containing neither shampoo liquid nor conditioner liquid (hereinafter referred to as "rinsing step water") before a first shampoo step as the next operation step is executed.

[0228] In this weak washing step, the microcomputer 89 moves the upper nozzle link 11 and the lower nozzle link 12 at a relatively high speed while jetting washing water under relatively high jetting pressure, whereby the rinsing water is jetted to the overall area of the head portion and the hair and the smudge attached to the head portion can be washed out to some degree.

[0229] Subsequently, the microcomputer 89 executes the first shampoo step (step SB5).

[0230] The first shampoo step is a step of washing the head of the user with washing water containing shampoo liquid (hereinafter referredto as "shampoo washing water") . Themicrocomputer 89 controls the shampoo pump 38 to mix washing water with shampoo liquid, thereby generating shampoo washing water.

[0231] In the first shampoo step, for example, the microcomputer 89 moves the upper nozzle link 11 and the lower nozzle link 12 at a relatively high speed while jetting shampoo washing water under relatively high jetting pressure, whereby the shampoo washing water is jetted to the overall area of the headportion and the hair. Accordingly, the shampoo washing water prevails over the

whole area of the head portion, whereby the hair of the overall area of the head portion is washed.

[0232] As described above, according to this embodiment, the upper nozzle link 11 and the lower nozzle link 12 can make complicatedmotions, for example, they are moved synchronously with each other while the moving speed is changed, they are temporarily stopped after moving in a fixed range or they are iteratively moved in a predetermined range. Therefore, by utilizing these complicated motions, the shampoo washing water is concentrically jetted to a predetermined portion of the head portion, and each nozzle link is moved while reciprocating in a predetermined range, whereby the hair of the head portion is washed while the washing efficiency and washing effect of the head portion are enhanced and the massage effect is enhanced. The same operation maybe applied to the other operation steps containing jetting of washing water.

[0233] Subsequently, the microcomputer 89 executes a first rinsing step (step SB6) .

[0234] This first rinsing step is an operation step of washing out (rinsing) shampoo washing water which is jetted to the head portion in the first shampoo step and remains on the head portion and the hair.

[0235] In the first rinsing step , the microcomputer 89 moves the upper nozzle link 11 and the lower nozzle link 12 at a relatively high speed while jetting rinsing step water under relatively high jetting pressure, whereby rinsing step water is jetted to the overall area of the head portion and the hair, thereby washing out the shampoo washing water remaining on the head portion and the hair.

[0236] Subsequently, the microcomputer 89 executes a second shampoo step (step SB7).

[0237] The second shampoo step aims to execute hair washing on the head portion which has been cleaned to some extent because it has been subjected to the first shampoo step and the second rinsing step, whereby the hair of the head portion is washed more accurately.

[0238] In the second shampoo step, for example, the microcomputer 89 moves the upper nozzle link 11 and the lower nozzle link 12 at a relatively high speed while jetting shampoo washing water under relatively high jetting pressure so that the shampoo washing water is jetted to the over area of the head portion and the hair. Accordingly, the shampoo washing water prevails over the overall area of the head portion and the whole area of the head portion is washed.

[0239] Subsequently, the microcomputer 89 executes a finishing rinsing step (step SB8).

[0240] This finishing rinsing step is an operation step of washing out shampoo washing water which has been jetted to the head portion in the second shampoo step and has remained on the head portion and the head. In the finishing rinsing step, for example, the microcomputer 89 moves the upper nozzle link 11 and the lower nozzle link 12 at a relatively high speed while jetting rinsing step water under relatively high jetting pressure so that rinsing water is jetted to the overall area of the head portion and the hair, thereby washing out the shampoo washing water remaining on the head portion and the hair.

[0241] Subsequently, the microcomputer 89 executes the massage step (step SB9) .

[0242] This massage operation aims to bring a constant massage effect to the user. For example, the microcomputer 89 controls the various kinds of valves, etc. to jet washing water from the head top massage nozzle 150, the right side head massage nozzle 151 and the left side head massage nozzle 152 so that the washing water is jetted to the head top portion and the right and left side head portions. Here, warm water is used as the washing water to be jetted. As described above, warm water is concentrically jetted to the head top portion and the side head portions of the user, whereby the massage effect can be effectively attained.

[0243] When washing water is jetted from each nozzle, the water washing may be intermittently jetted or jetted while the jetting pressure is varied in magnitude. It is expected by executing these operations that a higher massage effect can be achieved.

[0244] Subsequently, the microcomputer 89 cooperates with the mist generator controller 160 to start spray of mist (step SB10).

[0245] Subsequently, the microcomputer 89 executes a conditioning step (step SB11).

[0246] The conditioning step is an operation step of jetting washing water containing conditioner liquid (hereinafter referred to as "conditioner washing water") to the head portion and the hair of the user, thereby conditioning the hair of the user.

[0247] In this conditioning step, for example, the microcomputer 89 moves the upper nozzle link 11 and the lower nozzle link 12 at a relatively high speed while jetting conditioner washing water under relatively high jetting pressure so that the conditioner washing water is jetted to the overall area of the head portion and the hair, whereby the conditioner washing water prevails over the overall area of the head portion and the overall area of the head portion is conditioned.

[0248] In step SB10, spray of mist is started, and thus this conditioning step is executed simultaneously with and in parallel to the mist spray.

[0249] Here, it is known that when mist is sprayed to the head portion of a user, an effect that the cuticle of the hair is opened is obtained. Accordingly, according to this embodiment, the spray of mist and the conditioning step are executed simultaneously and in parallel, and thus the opening of the cuticle of hair by the mist and the jetting of the conditioner washing water to the head portion can be performed simultaneously, and thus the conditioning effect can be more greatly enhanced.

[0250] Furthermore, this embodiment is configured so that the head portion is laid to protrude into the enclosed space 8b of the sink 2, washing water is jetted from each nozzle link to the head portion in the enclosed space 8b and mist is sprayed into the enclosed space 8b, and thus

the spray of mist and the conditioning step can be executed simultaneously and in parallel.

[0251] Subsequently, the microcomputer 89 executes a final rinsing step (step SB12).

[0252] This final rinsing step is an operation step of lightly washing out (rinsing) conditioner washing water which has been jetted to the head portion in the conditioning step and remained on the head portion and the hair.

[0253] In the final rinsing step, for example, the microcomputer 89 moves the upper nozzle link 11 and the lower nozzle link 12 while jetting rinsing water under relatively weak jetting pressure so that the rinsing step water is jetted to the overall area of the head portion and the hair, whereby the conditioner washing water remaining on the head portion and the hair is lightly washed out.

[0254] In this step SB10, the spray of mist is started, and thus this final rinsing step is executed simultaneously with and in parallel to the spray of mist.

[0255] Here, ad described above, when mist is sprayed, it makes the user feel relaxed. Accordingly, by executing spray of mist during the final rinsing step, the final rinsing step can be executed while the user is relaxed. In this embodiment, the head portion is laid to protrude into the enclosed space 8b, the washing water is jetted from each nozzle link to the head portion in the enclosed space 8b, and mist is sprayed into the enclosed space 8b, and this enables the spray of mist and the final rinsing step to be performed simultaneously and in parallel.

[0256] Subsequently, the microcomputer 89 stops the spray of mist (step SB13), and finishes the scalp care course (step SB14).

[0257] As described above, in the scalp care course, the mist spray is executed at the last stage of the operation step. Accordingly, the following effect can be attained.

[0258] That is, the spray of mist brings the relaxation effect to the user, and by spraying mist at the last half of the scalp care course, the user for which the scalp care course is completed can be relaxed, and also fatigue of the user can be moderated.

[0259] Next, the detailed operation of the automatic hair washing machine 1 and the mist generator 90 when the hair care course I or the hair care course II is executed will be described with reference to flowcharts.

[0260] Fig. 16 is a flowchart showing the operation of the automatic hair washing machine 1 and the mist generator 90 when the hair care course I or the hair care course II is executed.

[0261] As shown in Fig. 16, execution of the hair care course I or the hair care course II is first started (step SD1).

[0262] The execution of the hair care course I or the hair care course II is started by executing the following operation as a trigger.

[0263] That is, the hair care switch 239 is operated to select the hair care course I or the hair care course II as an operation course to be executed, and also the cover 8 is closed and the start/stop instructing switch 245 is operated under the state that the head portion of a user is laid in the sink 2.

[0264] As described above, when the cover 8 is closed under the state that the head portion of the user is laid in the sink 2, the cut-out portion 8a is closed by the head portion, the substantially hermetically sealed enclosed space 8b (Fig. 4) is formed in the space surrounded by the sink 2 and the cover 8, and the head portion is laid to protrude into the enclosed space 8b.

[0265] Subsequently, the microcomputer 89 executes each of the operation steps such as the running-in step (step SD2) , the weak washing step (step SD3), the first shampoo step (step D4), the first rinsing step (step SD5) , the second shampoo step (step SD6) and the finishing rinsing step (step SD7).

[0266] Subsequently, the microcomputer 89 executes each operation step in the massage step (step SD81), and it cooperates with the mist generator controller 160 at some midpoint of the execution of the massage step to start spray of mist (step SD82).

[0267] Subsequently, the microcomputer 89 determines whether the selected operation course is the hair care course I or the hair care course II (step SD9) .

[0268] When the selected operation course is the hair care course I (step SD9; hair care course I), the microcomputer 89 executes the conditioning step (step SD11), and shifts the processing to SD14.

[0269] As described above, in the hair care course I, the mist spray and the conditioning step are executed simultaneously and in parallel. Here, as described above, it is known that when mist is sprayed to the head portion of a user, an effect that the cuticle of the hair is opened is obtained. Accordingly, according to the hair care course I, the spray of mist and the conditioning step are executed simultaneously and in parallel, and thus the opening of the cuticle of hair by the mist and the jetting of the conditioner washing water to the head portion can be performed simultaneously, and thus the conditioning effect can be more greatly enhanced.

[0270] On the other hand, when the selected operation course is the hair care course II (step SD9; hair care course II) , the microcomputer 89 temporarily stops the operation of the automatic hair washing machine 1 (step SD12).

[0271] During this temporary stop, a user (in this case, this user may be a person such as a beautician or the like who can supply various kinds of services such as treatment of the head portion, etc. to the user (the person whose hair is washed) , and thus may be another person from the user whose hair is washed) may perform a hair treatment on the head portion of the user by his/her hands. Thereafter, the user closes the cover 8 and operates the start/stop instructing switch 245(step SD13) .

[0272] After the temporary stop, the microcomputer 89 shifts the processing to step SD14 upon operation of the start/stop instructing switch 245 as a trigger.

[0273] In step SD14, the microcomputer 89 executes the mist step. In the mist step of the step SD14, the microcomputer 89 continues to execute the spray of mist without stopping the spray of mist in step SC15 even when the remaining time is nullified (step SC; YES) as shown in Fig. 15.

[0274] Furthermore, as described above with reference to Fig. 15, in such a situation that some error occurs in the mist generator and thus it is impossible to supply mist during execution of the mist step, the mist step is omitted, and the final rinsing step as the next step (step SD15) is executed.

[0275] As described above, in the hair care course I, the mist step is executed after the conditioning step, and in the hair care course II, the mist step is executed after the treatment based on a human work. Accordingly, the components of the conditioner which is jetted in the conditioning step and the components of the treatment liquid in the treatment step infiltrate into the hair more effectively due to the opening of the cuticle based on mist spray in the mist step, whereby the conditioning effect and the treatment effect can be more greatly enhanced.

[0276] Subsequently, the microcomputer 89 executes the final rinsing step (step SD15) .

[0277] In step SD14, the mist spray is not stopped, and thus the final rinsing step is executed simultaneously with and in parallel to the mist spray.

[0278] Here, as described above, when mist is sprayed, the user can be relaxed. Furthermore, by executing the mist spray during the final rinsing step, the final rinsing step can be also executed while the user is relaxed. In this embodiment, the head portion is laid to protrude into the enclosed space 8b of the sink 2, the washing water is jetted from each nozzle link to the head portion in the enclosed space 8b and mist is jetted into the enclosed space 8b, whereby the mist spray and the final rinsing step can be executed simultaneously in parallel.

[0279] Subsequently, the microcomputer 89 cooperates with the mist generator controller 160 to stop the mist spray (step SD16) and finish the hair care course I or the hair care course II (step SD17).

[0280] As described above, in the hair care course II, an operation of executing treatment on the hair by user's (beautician's or the like) hand skill immediately after the mist spray and then executing mist spray immediately after the treatment concerned can be performed. On the other hand, it has been difficult for a user (beautician or the like) to perform such an operation by his/her hand.

[0281] As described above, the microcomputer 89 and the mist generator controller 160 cooperate with each other to perform various operations containing the mist spray, whereby the mist spray and the other operations can be continuously performed. This effect can be attained in the other operation courses.

[0282] As described above, the automatic hair washing machine 1 according to this embodiment has the sink 2 in which the head portion of the user is laid, the upper nozzle link 11 for jetting washing water to the head portion laid in the sink 2, and the lower nozzle link 12. Furthermore, the automatic hair washing machine 1 has the mist generator 90 for generating mist, and the mist feeding pipe 91 through which mist generated by the mist generator 90 is introduced. The mist discharge port 102 formed at the end portion of the mist feeding pipe 91 is exposed to the inside of the sink 2, and the water discharge trap 92 is provided in the mist feeding pipe 91. According to this automatic hair washing machine 1, the mist discharge port 102 is exposed in the sink 2, so that mist can be directly sprayed from the mist discharge port 102 to the head portion laid in the sink 2 and thus the treatment effect and the relaxation effect can be prevented from being deteriorated. Furthermore, the mist discharge port 102 is kept to be exposed, and thus the backflow water flows from the mist discharge port 102 into the mist feeding pipe 91. However, the backflow water flowing into the mist feeding pipe 91 can be prevented from flowing into the mist generator 90 by the function of the water discharge trap 92, and thus mist can be smoothly supplied.

[0283] Furthermore, in this embodiment, the mist discharge port 102 is exposed in the sink 2 so that mist can be sprayed to the head portion laid in the sink 2. More specifically, as shown in Figs. 1 and 2, the mist discharge port 102 is provided at the center lower portion of the rear side surface 100 of the sink 2 so that the opening thereof is exposed. Accordingly, atomized mist having a characteristic that it ascends in air is discharged from the mist discharge port 102 so that the mist prevails over the whole area of the head portion of a user who turns up. That is, when the mist is sprayed from the mist discharge port 102 provided at the center lower portion of the rear side surface 100 of the sink 2 to the neighborhood of the rear head portion of the user who turns up, the mist prevails to the overall area of the head portion along the shape of the head portion while ascending upwardly.

[0284] Furthermore, in this embodiment, the rear head portion of the user is supported on the head support net 70 in the sink 2 during the automatic hair washing treatment (see Figs. 2 and 4). In this case, the hair hangs vertically down from the head support net 70. In consideration of this fact, the mist discharge port 102 is provided at the center lower portion of the rear side surface 100 of the sink 2, and the mist can be sprayed from the side to the hair hanging down in the vertical direction, so that the mist can be made to suitably prevail over the whole area of the hair containing the hair hanging down.

[0285] In this embodiment, the orientation (i.e., mist jetting direction) of the mist discharge port 102 can be changed. Here, the size and shape of the head portion is different among persons. Accordingly, the optimum orientation of the mist discharge port 102 formed in the mist discharge pipe 101 is different among persons. The orientation of the mist discharge port 102 can be optimized in accordance with the user by changing the orientation of the mist discharge pipe 101 in a predetermined range. Particularly, in this embodiment, the orientation of the

mist discharge port 102 of the mist discharge pipe 101 can be changed by a very simple work of gripping and turning the mist discharge pipe 101. Therefore, the workability is good and the work is completed in short times, so that the convenience for users can be enhanced.

[0286] Furthermore, in this embodiment, in connection with occurrence of mist in the mist generator 90, drain water occurring in the mist generator 90 is discharged to the outside of the mist generator 90, and the other end of the drain water discharge pipe 97 is connected to the water discharge trap inlet pipe 93. Accordingly, the drain water discharged from the mist generator 90 is arbitrarily supplied to the water discharge trap 92 and thus liquid is more surely stocked in the water discharge trap 92.

[0287] Furthermore, in this embodiment, the exit side of the water discharge trap 92 is connected to the water discharge pipe 30 of the sink 2.

[0288] That is, as shown in Figs. 3 to 5, the other end of the water discharge trap outlet pipe 98 is connected to the water discharge pipe 30, and liquid which exceeds a predetermined water level in the liquid stock portion 96 of the water discharge trap 92 and flows into the water discharge trap outlet pipe 98 flows out through the water discharge trap outlet pipe 98 to the water discharge pipe 30, and is discharged to the outside of the machine through the water discharge pipe 30. That is, the backflow water flowing into the mist feeding pipe 91 and the drain water occurring in connection with occurrence of mist in the mist generator 90 are discharged to the outside of the machine through the existing water discharge pipe 30. As described above, the backflow water and the drain water are discharged to the outside of the machine by using the existing equipment such as the water discharge pipe 30 of the sink 2. Therefore, as compared with a case where a mechanism for discharging liquid to the outside of the machine is newly provided, the cost can be reduced and the facilitation of the manufacturing can be enhanced.

[0289] Furthermore, according to the automatic hair washing machine 1 of this embodiment, when the head portion of a user is laid in the sink 2, the enclosed space 8b is formed in the sink 2, and the head portion is laid so as to protrude into the enclosed space 8b. This automatic hair washing machine 1 is provided with the water jetting unit for jetting washing water to the head portion laid in the enclosed space 8b (in this embodiment, the microcomputer 89, the driving motor 103, each nozzle link, etc. cooperate with one another to function as the water jetting unit), and the mist spraying unit for spraying mist into the enclosed space 8b (in this embodiment, the mist generator 90, the mist discharge port 102 and the mist feeding pipe 91 cooperate with one another to function as the mist spraying unit).

[0290] Accordingly, by jetting washing water to the head portion in the enclosed space 8b, mist can effectively sprayed by utilizing the characteristic of the automatic hair washing machine 1 that the head portion is automatically washed by jetting washing water to the head portion in the enclosed space 8b. That is, in the automatic hair washing machine 1, the washing water is jetted from each nozzle link to wash the head portion of the user. Accordingly, the enclosed space 8b is formed in the sink 2, and washing water is jetted from each nozzle link in the enclosed space 8b to wash the head portion under the state that the head portion of the user is laid to protrude into the enclosed space 8b. In this embodiment, mist is filled in the enclosed space 8b by using the enclosed space 8b to spray mist to the head portion of the user. Therefore, the mist spray can be optimally implemented by using the enclosed space 8b, and mist can be surely brought into contact with the head portion of the user.

[0291] Furthermore, in this embodiment, the microcomputer 89 controls the respective parts of the automatic hair washing machine so that the jetting of washing water and the spray of the mist are executed interlockingly with eachother. Accordingly,mistcan besprayed after washing water is jetted, or washing water can be jetted after mist is sprayed. That is, the mist spray can be executed so as to bring out the mist spray effect more effectively by adjusting the timing of the jetting of the washing water.

[0292] Still furthermore, in this embodiment, the microcomputer 89 executes the jetting of washing water to the head portion and the mist spray simultaneously. More specifically, as shown in Fig. 15, the mist spray and the jetting of washing water from each nozzle link which is executed in connection with the massage operation are executed simultaneously and in parallel.

[0293] A shown in Fig. 14, in the scalp care course, the mist spray, the conditioning step and the rinsing step are executed simultaneously and in parallel.

[0294] As shown in Fig. 16, in the hair care course I, the mist spray, the conditioning step and the final rinsing step are executed simultaneously and in parallel. In the hair care course II, the mist spray, the treatment to a user (person whose hair is washed) by a user's hand (staff's hand, beautician's hand or the like) and the final rinsing step are executed simultaneously and in parallel.

[0295] The simultaneous and parallel execution of the jetting of washing water to the head portion and the mist spray can be performed on the assumption of the construction that the head portion is laid to protrude into the enclosed space 8b of the sink 2, washing water is jetted from each nozzle link to the head portion in the enclosed space 8b and mist is sprayed in the enclosed space 8b.

[0296] When the mist spray and the jetting of washing water are executed simultaneously and in parallel, by using the relaxation effect based on mist, the treatment effect and the opening of pores caused by mist, the relaxation effect, the treatment effect, the washing effect, the massage effect, etc. can be effectively brought to the users (persons whose hair is washed).

[0297] Furthermore, the automatic hair washing machine 1 according to this embodiment has the operation panel 60 (instructing unit) for instruction execution of the

operation courses (the scalp care course, the hair care course I, the hair care course II) in which plural steps containing at least the operation steps containing the jetting of washing water (for example, the first shampoo step, the first rinsing step, the conditioning step, etc.) and the mist step containing the mist spray are arranged in a predetermined order. When execution of any operation course is instructed, the microcomputer 89 controls the respective parts of the automatic hair washing machine 1 so that the jetting of washing water and the mist spray are executed in a predetermined timing corresponding to the order of each step in the operation course concerned.

[0298] Accordingly, by executing the operation course, the head portion of the user can be washed with jetted washing water while the user is brought with the relaxation effect based on mist and the massage effect.

[0299] The automatic hair washing machine 1 according to this embodiment is configured so that washing water mixed with shampoo liquid can be jetted. In the scalp care course, the order to the respective steps is set so that the mist step containing the mist spray is executed prior to the shampoo step containing the jetting of washing water mixed with shampoo liquid. According to this course, the following effect can be attained.

[0300] That is, as described above, when mist is sprayed to the head portion of the user, the pores of the head portion is opened. Accordingly, the mist step is executed to open the pores of the head portion in the mist step before the shampoo step is executed, whereby the washing power of sebum smudge can be enhanced by jetting washing water containing shampoo liquid in the subsequent shampoo step.

[0301] The automatic hair washing machine 1 according to this embodiment can be configured so that washing water mixed with conditioner liquid can be jetted. In the scalp care course, the hair care course I and the hair care course I, the mist spray is executed during execution of the conditioning step containing the jetting of the washing water mixed with the conditioner liquid.

[0302] According to the above operation, the following effect can be attained.

[0303] That is, when mist is sprayed to the head portion of the user, the cuticle of the hair is opened. By executing the mist spray and the conditioning step simultaneously and in parallel, the opening of the cuticle caused by the mist spray and the jetting of conditioner washing water to the head portion are simultaneously performed, whereby the conditioning effect can be enhanced.

[0304] Furthermore, in the hair care course I, the mist step after the conditioning step is executed. In the hair care course II, the mist step is executed after the treatment based on the human's hand. Accordingly, the component of the conditioner jetted in the conditioning step and the component of treatment liquid in the treatment step infiltrate into the hair more greatly in connection with the opening of the cuticle caused by the mist spray in the mist step, whereby the conditioning effect and the treatment effect can be more enhanced.

[0305] The microcomputer 89 is connected to the mist generator controller 160 for controlling the mist generator 90 so that communications can be performed therebetween, and controls the respective parts of the automatic hair washing machine 1 and the respective parts of the mist generator 90 in cooperation with the mist generator controller 160 so that the jetting of washing water and the spray of mist are executed interlockingly with each other. Accordingly, even when the automatic water washing machine 1 and the mist generator 90 are designed as separate bodies, the jetting of washing water and the spray of mist can be smoothly and surely executed interlockingly with each other.

[0306] The automatic hair washing machine 1 according to this embodiment has the upper nozzle link 11 and the lower nozzle link 12 which jet washing water to different sites of the head portion, and the upper nozzle link 11 and the lower nozzle link 12 are configured to be movable in synchronization with each other through the power transmission mechanism 201 connected to a single stepping motor 191.

[0307] Accordingly, each of the upper nozzle link 11 and the lower nozzle link 12 is moved through the power transmission mechanism 201 connected to the single stepping motor 191, whereby these nozzle links can be moved synchronously with each other.

[0308] As compared with a case where a stepping motor 191 is provided every nozzle link and these stepping motors 191 are controlled to control the movement of each nozzle link, the number of stepping motors can be reduced, so that the manufacturing cost can be reduced. In addition, a program for control can be simplified, and thus the manufacturing facilitation can be enhanced.

[0309] The automatic hair washing machine 1 according to this embodiment has the upper nozzle link 11 which is configured to be iteratively moved between the head top position T1 corresponding to the head top portion of the head portion laid in the sink 2 and the rear head position T2 corresponding to the rear head portion, and the lower nozzle link 12 which is configured to be iterativelymovedbetween the hair position T3 corresponding to the hair hanging from the head portion laid in the sink 2 and the neck position T4 corresponding to the neck. The lower nozzle link 12 is moved in the direction from the hair position T3 to the neck position T4 in synchronization with the movement of the upper nozzle link in the direction from the head top position T1 to the rear head position T2, and also the lower nozzle link 12 is moved in the direction from the neck position T4 to the hair position T3 in synchronization with the movement of the upper nozzle link 11 in the direction from the rear head position T2 to the head top position T1.

[0310] Here, for example, when the upper nozzle link 11 is moved in the same direction as the hair growing direction while jetting washing water and also the lower nozzle link is moved in the opposite direction to the hair growing direction while jetting washing water, that is,

when the moving directions of the upper and lower nozzle links 11 and 12 with respect to the hair growing direction are different from each other, the upper and lower nozzle links 11 and 12 jet washing water to the head portion and hair of the user in directions which are different with respect to the hair growing direction. In this case, there occurs such a situation that the hair is entangled.

[0311] However, according to this embodiment, the upper and lower nozzle links 11 and 12 are synchronously moved in the same direction with respect to the hair growing direction. Therefore, the moving directions of the upper and lower nozzle links 11 and 12 with respect to the hair growing direction are coincident with each other at all times, and thus occurrence of the situation that the hair is entangled can be prevented. Furthermore, the upper and lower nozzle links 11 and 12 can be surely prevented from coming into contact with each other during the movement of the upper and lower nozzle links 11 and 13.

[0312] Furthermore, the power transmission mechanism 201 has the lower gear 193 and the upper gear 196 which rotate according to the driving of the stepping motor 191, and the upper nozzle link 11 and the lower nozzle link 12 can be moved synchronously with each other by using the rotation of these gears in connection with the driving of the stepping motor 191, whereby accurate positioning control can be performed.

[0313] As described above, the power transmission mechanism 201 has the lower gear 193 and the upper gear 196, whereby the rotational driving force (power) of the stepping motor 191 can be properly transmitted to the upper and lower nozzle links 11 and 12 through these gears. Particularly, in this embodiment, it is required to rotate the upper and lower nozzle links 11 and 12 synchronously with each other in opposite directions. Accordingly, under the state that the lower gear 193 and the upper gear 196 are engaged with each other, the lower nozzle link 12 is turned in accordance with rotation of the lower gear 193, and the upper nozzle link 11 is turned in accordance with the rotation of the upper gear 196. Accordingly, the upper and lower nozzle links 11 and 12 can be properly and surely turned synchronously with each other in the opposite directions.

[0314] In this embodiment, the upper gear 196 is provided with a gear position detecting switch 200, and the microcomputer 89 controls the operation of the stepping motor 191 on the basis of a detection value of the gear position detection switch 200.

[0315] More specifically, when the upper gear 196 is rotated in the direction of the arrow X so that the upper nozzle link 11 exceeds the head top position T1 and is further turned in the direction of the arrow E, the contact point of the gear position detection switch 200 is conducted by a magnet (not shown) provided to the upper gear 196, and a signal indicating this fact is output to a predetermined port of the microcomputer 89. The microcomputer 89 to which the signal is input stops the operation of the stepping motor 191, whereby the upper nozzle link 11 is prevented from exceeding the head top position T1 and being further turned in the direction of the arrow E. At the same time, the lower nozzle link 12 which is moved in synchronization with the upper nozzle link 11 is prevented from exceeding the hair position T3 and being further turned in the direction of the arrow F.

[0316] Likewise, when the upper gear 196 is turned in the direction of the arrow Y so that the upper nozzle link 11 exceeds the rear head position T2 and is further turned in the direction of the arrow C, the contact point of the gear position detecting switch 200 is conducted by a magnet (not shown) provided to the upper gear 196, and a signal indicating this fact is output to a predetermined port of the microcomputer 89. The microcomputer 89 to which the signal is input stops the operation of the stepping motor 191, whereby the upper nozzle link 11 is prevented from exceeding the rear head position T2 and being further turned in the direction of the arrow C. At the same time, the lower nozzle link which is moved in synchronization with the upper nozzle link 11 is prevented from exceeding the neck position T4 and being further turned in the direction of the arrow D.

[0317] Furthermore, in this embodiment, the power transmission mechanism 201 is provided to the left side surface 190 of the sink 2.

[0318] More specifically, as shown in Fig. 10, the power transmission mechanism 201 is provided to the left side surface 190 of the sink 2 so that the surfaces of the lower gear 193 and the upper gear 196 as discs are arranged along the left side surface 190 of the sink 2. Accordingly, the thickness of the power transmission mechanism 201 can be reduced, and the power transmission mechanism 201 can be accommodated by effectively using a space at the left side of the left side surface 190 of the sink 2, and also miniaturization of the automatic hair washing machine 1 can be implemented. Furthermore, the output shafts of the lower gear 193 and the pulley 197 can be made coincident with the rotating shafts of the upper nozzle link 11 and the lower nozzle link 12.

[0319] Various modifications and applications can be made on the above-described embodiment within the scope of the present invention.

[0320] For example, in the above-described embodiment, the automatic hair washing machine 1 has the upper nozzle link 11 and the lower nozzle link 12, and these nozzle links 11 and 12 cooperate with each other. However, the number of nozzle links and the shapes thereof are not limited to those of the above embodiment. That is, the present invention is broadly applicable to the automatic hair washing machine 1 for supplying mist into the sink 2.

<Second Embodiment>

[0321] Next, a second embodiment will be described.

[0322] The automatic hair washing machine 301 according to the second embodiment has a physical constructional different from the automatic hair washing ma-

chine 1 according to the first embodiment in that it has a cleaning agent jetting mechanism 390.

[0323] In Fig. 17, reference numeral 301 represents an automatic hair washing machine according to the second embodiment.

[0324] The automatic hair washing machine 301 has a sink 302 in which the head portion of a user (person whose hair is washed) is laid, a sink holding table 303 for holding the sink 302, a seat 304 which is disposed in front of the sink holding table 303 and on which the user sits, and a seat holding table 305 for holding the seat 304.

[0325] As shown in Fig. 18, the sink 302 is a bowl-shaped member having an opening at the top thereof.

[0326] As shown in Fig. 18, the sink 302 is a bowl-shaped member having an opening at the upper side thereof. A head support net 370 for supporting the rear head portion of a user so that the head portion faces the inside of the sink 302 under the state that the user turns up is disposed at the front portion of the sink 302. Furthermore, a neck table 307 is disposed on a front surface portion 302A of the sink 302, and the user can put his/her neck on the neck table under the state that the user sits on the seat 304 and turns up so that the rear head portion is mounted on the head support net 370. The opening at the top of the sink 302 can be covered by a cover 308. The rear end of the cover 308 is linked to the rear end of the sink 2 through a link portion 309 so as to be rotatable about the link portion 309 within a vertical plane. When hair washing (cleaning) or the like is executed, the user who sits on the seat 304 puts his/her neck on the neck table 307 while the cover 308 is opened, and then the cover 308 is closed, whereby the head portion of the user can be laid in the sink 302.

[0327] In the sink 302 are arranged the upper nozzle link 311 and the lower nozzle link 312 for jetting cleaning agent liquid or washing water to the head portion and hair of the user. In this embodiment, the cleaning agent liquid means liquid mixed with shampoo or conditioner liquid, and the washing water means liquid (water) which is not mixed with any cleaning agent containing shampoo liquid or conditioner liquid. In the following description, when the cleaning liquid and the washing water are not clearly discriminated from each other, they are arbitrarily represented as "washing water".

[0328] The upper nozzle link 311 comprises a pipe-shaped member which is curved so as to be convex to the obliquely upper right side in Fig. 18B and have a substantially arcuate shape along the head portion of the user and has plural nozzles arranged at predetermined intervals. The upper nozzle link 311 is supported at one end (left end) thereof (i.e., cantilevered) so as to be turnable (swingable) around the one end as indicated by arrows C and E in Fig. 18B so that the washing water can be jetted to the head portion of the user.

[0329] The lower nozzle link 312 comprises a pipe-shaped member which is wholly designed to be substantially M-shaped and curved so as to be convex (arcuate) toward the left side in Fig. 18B at the center portion of the M-shape and has plural nozzles arranged at predetermined intervals. The lower nozzle link 312 is supported at one end thereof (i.e., cantilevered) at the lower side of the upper nozzle link 12 so as to be turnable (swingable) around the one end (left end) thereof below the upper nozzle link 311 as indicated by arrows D and F in Fig. 18B. The lower nozzle link 12 jets washing water toward the rear side thereof to wash the user's hair which hangs down from the user's head at the rear side of the lower nozzle link 312. Furthermore, a neck nozzle link 380 for jetting washing water to the neck of the user turning up is disposed in the sink 302.

[0330] The upper and lower nozzle links 311 and 312 and the neck nozzle link 380 are provided with plural nozzles, and cleaning agent and washing water fed into the upper and lower nozzle links 311, 312 and the neck nozzle link 380 are jetted from each nozzle. The upper and lower nozzle links 311 and 312 are turned, and the neck nozzle link 380 is fixed. The overall head portion and hair of the user can be washed by jetting cleaning agent and washing water from the respective nozzles. A hand shower 313 is disposed at the upper rear side in the sink 302. An operator (staff of a beauty salon or the like) turns the cock 314 disposed at the right side of the hand shower 313, whereby the amount of water discharged from the hand shower 313 can be adjusted, and hair can be washed by hand.

[0331] Water used for the automatic hair washing machine 301 is supplied from tap water facilities and how water supply facilities (not shown) at the outside of the machine through the mixing valve 315 and the water supply pipe 316. Water is supplied from the tap water facilities through the water supply portion 317 into the mixing valve 315, and also warm water is supplied from the hot water supply facilities through the hot water supply portion 318 into the mixing valve 315. The mixing valve 315 mixes the water and the hot water supplied form the water supply portion 317 and the hot water supply portion 318, and feeds out warm water to the water supply pipe 316. A thermistor 319 for detecting the temperature of the warm water fed out from the mixing valve 315 is disposed at some midpoint in the water supply pipe 316. A motor 320 is operated on the basis of the detection result of the thermistor 315 to open/close the mixing valve 315, whereby the mixing rate between the water and the hot water is adjusted and thus hot water having a set temperature is generated. The mixing valve 315 is an electrically-operated type whose opening degree is adjusted by the motor 320. The motor 320 is a DC motor or a DC electrical motor and has a brush, etc.

[0332] An operation panel 360 (Fig. 18) is provided at a side of the sink 302, and the set temperature is determined by operator's (user's) operation of the operation panel 360. The water supply pipe 316 is branched to a water supply pipe 321 for the hand shower and a water supply pipe 322 for stocking warm water from a some midpoint portion (a downstream side from the thermistor 319). The hand shower water supply pipe 321 intercom-

municates with the hand shower 313 through a hand shower valve 323 which can be opened/closed by a cock 314. Furthermore, the water supply pipe 322 for stocking warm water can supply warm water into the warm water stocking tank 325 through the warm water stocking valve 324 as a warm water supply valve.

[0333] A first water level sensor 326 and a second water level sensor 327 for detecting the water level of warm water stocked in the warm water stocking tank 325 are arranged so as to be spaced from each other at a fixed interval in the vertical direction. When the warm water in the warm water stocking tank 325 is used and it is detected by the second water level sensor 327 that the water level reaches a predetermined lowest water level, the warm water stocking valve 324 is opened, and warm water is supplied into the warm water stocking tank 325. Thereafter, when it is detected by the first water level sensor 326 that the warm water in the warm water stocking tank 325 reaches a predetermined highest water level, the warm water stocking valve 324 is closed to sop the supply of warm water. As described above, warm water is kept to be stocked between the lowest water level and the highest water level in the warm water stocking tank 325.

[0334] A water overflow port 328 is formed at the upper portion of the warm water stocking tank 325 (above the first water level sensor 326). When warm water of the highest water level or more is supplied into the warm water stocking tank 325 due to a trouble of the first water level sensor 326 or the like, extra warm water is made to overflow to the outside of the warm water stocking tank 325 through the water overflow port 328. The warm water overflowing from the water overflow port 328 is received by an overflow tank 329, and it is passed through a water discharge pipe 330 intercommunicating with the overflow tank 329 to the outside of the machine. An overflow sensor 331 is disposed in the overflow tank 329. For example, when it is detected by the overflow sensor 331 that the water discharge pipe 330 is clogged and thus the water level in the overflow tank 329 reaches the highest water level, the operation of the automatic water washing machine 301 is stopped.

[0335] A suction pipe 333 which is connected to a main pump 332 at one end thereof and also connected to the lowest portion of the warm water stocking tank 325 is provided. The main pump 332 is supplied with AC current from the inverter 364 to be operated, and warm water is sucked through the suction pipe 333 into the warm water stocking tank 325. A shampoo supply pipe 335 reaching a shampoo container 334 for stocking shampoo liquid and a conditioner supply pipe 337 reaching a conditioner container 336 for stocking conditioner liquid are connected to some midpoint of the suction pipe 333. Treatment liquid may be stocked in the conditioner container 336. A shampoo pump 338 and a conditioner pump 339 are provided at some midpoints of the shampoo supply pipe 335 and the conditioner supply pipe 337. Upon action of the shampoo pump 338 and the conditioner pump 339, the mixing amount of shampoo liquid and conditioner liquid into warmwater passing through the suction pipe 333 is properly adjusted, whereby washing water to be used at that time is sucked into the main pump 332.

[0336] Washing water sucked from the suction pipe 333 into the main pump 332 is fed out to a water feeding pipe 340 having plural (for example, four) distribution paths. A filter 341 is provided in the water feed pipe 340, and four valves of an upper nozzle valve 342, a lower nozzle valve 343, a neck nozzle valve 374 and a water discharging valve 344 are provided to the four distribution paths at the downstream side. Branch paths 346, 347, 375 and 348 are provided to the four distribution paths in which the upper nozzle valve 342, the lower nozzle valve 343, the neck nozzle valve 374 and the water discharge valve 344 are provided. The terminal of the branch path 346 extending from the upper nozzle valve 342 is connected to the upper nozzle link 311, the terminal of the branch path 347 extending from the lower nozzle valve 343 is connected to the lower nozzle link 312, and the terminal of the branch path 375 extending from the neck nozzle valve 374 is connected to the neck nozzle link 380.

[0337] A discharge port 350 for discharging water into the sink 302 is formed in the bottom surface of the sink 302, and the discharge port 350 intercommunicates with the water discharge pipe 330 through a water discharge trap 351 for preventing backflow. Accordingly, water discharged from the discharge port 350 of the sink 302 is passed through the water discharge pipe 330, and discharged to the outside of the machine. The terminal of the branch path 48 extending from the water discharge valve 344 is connected to the water discharge trap 351.

[0338] As shown in Fig. 19, the automatic hair washing machine 301 according to this embodiment has a cleaning agent jetting mechanism 390 for jetting menthol type cleaning agent to the head portion of a user laid in the sink 302.

[0339] The cleaning agent jetting mechanism 390 has a cleaning agent stocking container 391 for stocking menthol type cleaning agent, and a cleaning agent jetting nozzle 393 which is connected through a cleaning agent feeding pipe 392 to the cleaning agent stocking container 391 and jets the cleaning agent stocked in the cleaning agent stocking container 391 to the head portion of the user. The cleaning agent feeding pipe 392, the cleaning agent supply pump 394 and the cleaning agent nozzle valve 395 are successively connected to the cleaning agent feeding pipe 392. When the menthol type cleaning agent is jetted to the head portion of the user, the cleaning agent nozzle valve 395 is set to an open state, the cleaning agent supply pump 394 is operated, and the menthol type cleaning agent stocked in the cleaning agent stocking container 391 is fed through the cleaning agent feeding pipe 392 to the cleaning agent jetting nozzle 393, whereby the cleaning agent is jetted from the cleaning agent jetting nozzle 393 to the head portion of the user.

[0340] When the menthol type cleaning agent is jetted

to the headportion, the user can be brought with an exhilarating feeling and sensation of coolness, thereby making the user more comfortable.

[0341] Fig. 20 is a diagram showing the relationship between the head support net 370 and the neck nozzle link 380. As shown in Fig. 20A, the neck nozzle link 380 is a pipe-shaped member which is bent in a substantially M-shape. Brackets 381 are fixed to two corner portions of the neck nozzle link 380 by weld, and the neck nozzle link 380 is fixed to the inner wall at the front side of the sink 302 through the brackets 381. A horizontal portion 382 of the neck nozzle link 380 is curved to be convex downwardly along the neck of the user, and three nozzles 383 are secured to the upper center portion of the horizontal portion 382 to be spaced from one another at suitable intervals. As shown in Fig. 20B, two support rods 384 extending horizontally to the inside of the sink 302 are fixed to the horizontal portion 382 by weld so as to be vertical to the horizontal portion 382. Support portions 371 at both the ends of the head support net 370 are mounted on the two support rods 384.

[0342] The head support net 370 is formed of a resin molded member, and it has the support portions 371 to which the support rods 384 are fitted as shown in Figs. 21A and 21B. The head support net 370 is designed so that the mesh size 372A in the neighborhood of the center portion 372 corresponding to the apex of the rear head portion of the user is larger and the mesh size 371A becomes smaller as it approaches to the support portions 371 at both the ends of the head support net 370. As shown in Fig. 18, the head portion support net 370 is fixed to a position at which it does not disturb the operation of the upper and lower nozzle links 311 and 312, that is, at such a position as to avoid the moving locus of each of the links 311 and 312.

[0343] The upper and lower nozzle links 311 and 312 are iteratively movable synchronously with each other while supported at only one ends thereof (cantilevered).

[0344] Specifically, as shown in Fig. 18B, the upper nozzle link 311 iteratively moves so as to start to turn around the rotational shaft A in the direction of the arrow C, turn from the head top position T1 shown in Fig. 18A, reach the rear head position T2, reversely turns from the rear head position T2 in the direction of the arrow E and then return to the head top position T1. Here, when the upper nozzle link 311 is located at the head top position T1, washing water is jetted from each nozzle formed in the upper nozzle link 311 in the direction of an arrow Y1, whereby the washing water is jetted to the neighborhood of the head top portion of the user. Furthermore, when the upper nozzle link 311 is located at the rear head position T2, washing water is jetted from each nozzle formed in the upper nozzle link 311 in the direction of an arrow Y2, whereby the washing water is jetted to the neighborhood of the rear head portion of the user.

[0345] Furthermore, the lower nozzle link 312 iteratively moves so as to start to turn around the rotational shaft B in the direction of the arrow D, turn from the hair position T3 shown in Fig. 18B, reach the neck position T4, reversely turn from the neck position T4 in the direction of the arrow F and return to the hair position T3. Here, when the lower nozzle link 312 is located at the hair position T3, washing water is jetted from each nozzle formed in the lower nozzle link 312 in the direction of the arrow Y3, whereby the washing water is jetted to the hair hanging from the head portion of the user. Furthermore, when the lower nozzle link 312 is located at the neck position T4, washing water is jetted from each nozzle formed in the lower nozzle link 312 in the direction of the arrow Y4, whereby the washing water is jetted to the neighborhood of the neck of the user.

[0346] In this embodiment, the upper nozzle link 311 and the lower nozzle link 312 are synchronously moved in the same direction with respect to the hair growing direction by a driving mechanism (not shown). That is, as shown in Fig. 18B, when the upper nozzle link 311 is located at the head top position T1, the lower nozzle link 312 is set to be located at the hair position T3. Here, it is assumed that the upper nozzle link 311 is located at the head top position T1 and the lower nozzle link 312 is located at the hair position T3. At this time, when the upper nozzle link 311 starts to turn in the direction of the arrow C, the lower nozzle link 312 starts to turn in the direction of the arrow D in synchronization with the turning of the upper nozzle link 311. When the upper nozzle link 311 reaches the rear head position T2, the lower nozzle link 312 reaches the neck position T4 substantially at the same time. Furthermore, after the upper nozzle link 311 reaches the rear head position T2 and the lower nozzle link 312 reaches the neck position T4, these nozzle links reversely move. That is, it is assumed that the upper nozzle link 11 is located at the rear head position T2 and the lower nozzle link 312 is located at the neck position T4. At this time when the upper nozzle link 11 starts to turn in the reverse direction to the arrow C (i.e., the direction of an arrow E), the lower nozzle link 312 starts to turn in the reverse direction to the arrow D (i.e., the direction of an arrow F). When the upper nozzle link 311 reaches the head top position T1, the lower nozzle link 312 reaches the hair position T3 at the same time.

[0347] Here, for example when the upper nozzle link 311 is moved in the same direction as the hair growing direction while jetting washing water and also the lower nozzle link 312 is moved in the opposite direction to the hair growing direction while jetting washing water, that is, when the moving directions of the upper and lower nozzle links 311 and 312 with respect to the hair growing direction are different from each other, the upper nozzle link 311 and the lower nozzle link 312 jet washing water to the head portion and hair of the user from the different directions with respect to the hair growing direction. Therefore, there occurs a situation that the hair becomes entangled.

[0348] However, as described above, the upper nozzle link 311 and the lower nozzle link 312 are moved in the same direction synchronously with each other, and thus

the moving directions of the upper and lower nozzle links 311 and 312 with respect to the hair growing direction are coincident with each other at all times, and thus occurrence of the situation that the hair gets entangled can be prevented.

[0349] Furthermore, the upper and lower nozzle links 311 and 312 can be surely prevented from coming into contact with each other while they are moved. In this embodiment, under the control of the microcomputer 389, the upper and lower nozzle links 311 and 312 make complicated motions like they are synchronously moved while changing the speed, temporarily stopped after moving in a fixed range, or iteratively moved in a predetermined range.

[0350] In this embodiment, according to the above construction, when the head portion of the user is placed at the head support net 370 in the sink 302, the user's neck faces the inside of the sink 302. The washing water is jetted from the neck nozzle link 380 to the neck of the user, and thus the automatic hair washing containing the washing of the neck can be performed in cooperation with the operation of the movement of the upper and lower nozzle links 311 and 312. Furthermore, the head support net 370 is disposed so as to avoid the moving locus of each of the nozzle links 311 and 312, so that the head support net 370 does not obstruct the operation of the nozzle links 311 and 312 and thus the interference can be avoided. Furthermore, the head support portion is formed of a net 370, and thus washing water from each of the nozzle links 311 and 312 easily prevail over the rear head portion. Still furthermore, the support portions 371 at both the ends of the head support net 370 is joined to the support rods 384 of the neck nozzle link 380. Therefore, it is unnecessary to perform an additional working on the sink 302 to secure the head support net 370, and the head support net 370 can be easily secured.

[0351] The neck nozzle link 380 is supported at both the ends thereof by the sink 302. Therefore, a space can be secured around the neck nozzle link 380, and when hair is washed by the hand shower 313, the neck nozzle link 380 does not disturb the hair washing and thus the hand motion is not disturbed during hair washing. Furthermore, the head support net 370 and the neck nozzle link 380 are joined to each other below the neck of the user, and thus the hair washing space can be secured at the right and left sides of the user's head.

[0352] Still furthermore, the mesh size of the head support net 370 is larger at the center portion 372 corresponding to the apex (top) of the rear head portion, and washing water from each of the nozzle links 311, 312 easily prevails to the neighborhood of the apex of the rear head portion. Furthermore, the mesh size is reduced as it approaches to the support portions 371 at both the ends, and thus the mechanical strength around both the ends is enhanced, so that the support strength is enhanced.

[0353] Fig. 22 is a block diagram showing the electrical construction of the automatic hair washing machine 301.

[0354] The operation of the automatic hair washing machine 301 is controlled by the microcomputer 389. The microcomputer 389 is supplied with signals from the first water level sensor 326, the second water level sensor 327, the overflow sensor 331, the first thermistor 319 and the operation panel 360 for setting and operating the operation content of the automatic hair washing machine 301. The microcomputer 389 is connected to the motor 320, the warm water stocking valve 324, the shampoo pup 338, the conditioner pump 339, the upper nozzle valve 342, the lower nozzle valve 343, the neck nozzle valve 374, the water discharge valve 344, the cleaning agent supply pump 394, the cleaning agent nozzle valve 395, etc. as control targets. the mixing valve 315 is connected to the motor 320, and the microcomputer 389 controls the operation of the motor 320 to open/close the mixing valve 315, whereby the temperature of warm water to be fed to the water supply pipe 316 can be adjusted.

[0355] Furthermore, as shown in Fig. 22, the microcomputer 389 is connected to the inverter 364 for controlling the discharge pressure of washing water which is discharged from the main pump 332 by supplying AC current to the main pump 332. As shown in Fig. 19, the washing water discharged from the main pump 332 is jetted from the nozzles of the upper and lower nozzle links 311 and 312 through the upper and lower nozzle valves 342 and 343. Accordingly, the microcomputer 389 controls the inverter 364 to control the jetting pressure of the washing water to be jetted from the nozzles of each nozzle link.

[0356] Furthermore, the microcomputer 389 is connected to a driving motor 398 for controlling the movement of each of the upper and lower nozzle links 311 and 312. The driving motor 398 comprises a stepping motor, and controls the movement of the upper and lower nozzle links 311 and 312 through a driving mechanism (not shown) on the basis of a driving signal input from the microcomputer 389. The microcomputer 389 controls the driving motor 398 so as to enable the upper and lower nozzle links 311 and 312 to make complicated motions by changing the moving speed of the upper and lower nozzle links 311 and 312, temporarily stopping them, etc. The specific operation for the movement of the upper and lower nozzle links 311 and 312 under the automatic hair washing operation of the automatic hair washing machine 301 will be described later.

[0357] Fig. 23 is a flowchart showing the basic operation under the automatic hair washing operation of the automatic hair washing machine 301.

[0358] As shown in Fig. 23, the automatic hair washing machine 301 according to this embodiment successively executes the relaxation step, the first rinsing step, the shampoo step, the second rinsing step, the conditioner step, the third rinsing step, the menthol cleaning agent jetting step and the fourth rinsing step in this order when user's hair is automatically washed. The operation of the automatic hair washing step in each step will be described with reference to Figs. 24 to 26.

[0359] In the following description, the direction from the head top portion to the neck side along the head portion is referred to as "down direction (downward)", and conversely the direction from the neck side to the head top is referred to as "up direction (upward)". In other words, with respect to the upper nozzle link 311, the direction from the head top position T1 to the rear head position T2 corresponds to the "down direction", and the opposite direction thereto corresponds to the "up direction". With respect to the lower nozzle link 312, the direction from the hair position T3 to the neck position T4 corresponds to the "down direction", and the opposite direction thereto corresponds to the "up direction". At the rear head portion of the user, the hair grows in the down direction.

[0360] As described above, the upper and lower nozzle links 311 and 312 are moved interlockingly with each other. However, in the following description, only the motion of one nozzle link will be described for convenience of description in some cases. Furthermore, in the following description, the microcomputer 389 functions as a controller.

[0361] In this embodiment, the jetting pressure of washing water jetted from the upper and lower nozzle links 311 and 312 can be changed at 12 stages from the lowest level 1 to the highest level 12.

[0362] Fig. 24a is a diagram showing the relaxation step. This relaxation step is a step of jetting washing water to the head of a user for the first time, and mainly aims to make the user accustomed to washing water by jetting washing water to the user's head portion to relax the user. In order to attain this aim, in the relaxation step, the jetting pressure is controlled so that the average value of the jetting pressure level is lower than the average value of the jetting pressure in the shampoo step and the conditioner step described later. Specifically, in this embodiment, the average value of the jetting pressure level in the shampoo step is set to level 9, and the average value of the jetting pressure level in the conditioner step is set to level 8. On the other hand, the average value of the jetting pressure level in the relaxation step is set to about level 6.

[0363] First, as shown in A1 of Fig. 24A, the microcomputer 389 controls the driving motor 398 to move the lower nozzle link 312 to a position where washing water is jetted to a point PD1 of the head portion (rear head portion), and then controls the inverter 364 so that washing water is jetted from the lower nozzle link 312 to the point PD1 for three seconds, for example.

[0364] Subsequently, as shown in A2 of Fig. 24A, the microcomputer 389 moves the lower nozzle link 312 to the neck position T4 while jetting washing water. At this time, the microcomputer 389 moves the lower nozzle link 312 at a very slow speed. This operation makes the user feel as if he/she is gently stroked by a human's hand and thus provides a sense of ease to the user. Furthermore, since washing water is jetted to the head portion while the lower nozzle link 312 is moved at such a slow speed in the relaxation step immediately after the automatic hair washing process is started, the user can cast aside such a feeling that his/her hair is washed by a machine without surprising the user, so that the user has a high-class feeling.

[0365] Here, in A2, the microcomputer 389 sets the jetting pressure to a higher value when washing water is jetted to the neighborhood of the rear head portion of the user by the lower nozzle link 312 (i.e., when washing water is jetted in the directions of the arrows E and F) as compared with cases where washing is jetted in the other jetting directions.

[0366] The reason for this is as follows. When washing water is jetted to the neighborhood of the rear head portion of the user, the washing water must be upwardly jetted, and thus the water pressure of the washing water which has just reached the rear head portion of the user is weakened. Therefore, the washing water to be jetted must be increased. Furthermore, when washing water is jetted to the neighborhood of the rear head portion of the user, the washing water jetted from the lower nozzle link 312 is obstructed from reaching the rear head portion by the hair hanging from the rear head portion, and thus the water pressure of the washing water reaching the rear head portion of the user is weakened. Therefore, the washing water to be jetted must be increased. Still furthermore, with respect to the human's head portion, there is a tendency that the rear head portion is duller than the other places, and thus the massage effect caused by the jetting of washing water to the user can be surely brought by increasing the jetting pressure of washing water to the neighborhood of the rear head portion.

[0367] Particularly,inthisembodiment,the microcomputer389controls the jetting pressure of washing water so that the jetting pressure of washing water jetted to the head portion located at a position where the head portion support net 370 exists (the jetting pressure of washing water jetted in the direction of the arrow F) is set to be larger than the jetting pressure of washing water jetted to the head portion at a position where the head portion support net 370 does not exist. In this embodiment, the microcomputer 389 controls the jetting pressure of washing water so that the jetting pressure of washing water jetted to the head portion at the position where the head portion support net 370 exists is set to the level 9, and the jetting pressure of washing water jetted to the head portion at the other positions is set to the level 7.

[0368] This is to prevent occurrence of such a situation that existence of the net causes washing water to be weakly jetted to the head portion at the position where the net exists. Furthermore, in this embodiment, the hair sandwiched between the head portion support net 370 and the rear head portion moves hardly, and washing water jetted from the lower nozzle link 312 is disturbed from reaching the rear head portion by the hair sandwiched between the head portion support net 370 and the rear head portion. However, according to this invention, by increasing the jetting pressure of the washing

water, the washing water which reaches the rear head portion of the user is prevented from being weakened in jetting pressure by the above disturbance of the jetting of the washing water by the sandwiched hair.

[0369] In this embodiment, the same control as the lower nozzle link 312 is applied to the upper nozzle link 311. This control is executed while the automatic hair washing operation is executed by the automatic hair washing machine 301.

[0370] It may be detected on the basis of the driving signal output from the microcomputer 389 to the driving motor 398 whether the upper nozzle link 311 and the lower nozzle link 312 jet washing water to the neighborhood of the rear head portion, for example. Furthermore, a position detecting sensor for detecting the positions of the upper nozzle link 311 and the lower nozzle link 312 may be connected to the microcomputer 389, and detect the position on the basis of the output value of the position detecting sensor.

[0371] Subsequently, the microcomputer 389 controls the neck nozzle valve 374, etc. to jet washing water from the neck nozzle link 380 to a point PK1 at the neck of the user. Here, the jetted washing water is set to warm water. By jetting warm water to the neck of the user as described above, the blood flow of the neck is made good, and the tension of the overall head portion is loosened, so that the massage effect can be enhanced. Subsequently, the jetting of warm water from the neck nozzle link 380 is executed until the relaxation step is finished. Accordingly, the warm water is jetted to the neck of the user over a long time, and thus the above effect can be effectively brought. In A3 of Fig. 24A, the microcomputer 389 moves the upper nozzle link 311 to the head top position T1 as indicated by a chain line, and also moves the lower nozzle link 312 to the hair position T3.

[0372] Subsequently, as shown in A4 of Fig. 24A, the microcomputer 389 drives the upper nozzle link 311 so that the upper nozzle link 311 iteratively moves between the head top position T1 and the rear head position T2 while jetting washing water. At this time, the microcomputer 389 sets the jetting pressure of washing water so that the jetting pressure of washing water when the upper nozzle link 311 is moved downwardly is set to be higher than the jetting pressure when the upper nozzle link 311 is moved upwardly. In this embodiment, the microcomputer 389 controls the jettingpressure so that the jetting pressure level when the upper nozzle link 311 is moved downwardly is set to the level 8, and the jetting pressure level when the upper nozzle link 311 is moved upwardly is set to the level 5.

[0373] Here, when the head portion is massaged (kneaded) by human's hands, in order to perform a smooth massage in accordance with the hair growing direction, the massage (kneading) force is stronger when the head portion is massaged (kneaded) in the same direction as the hair growing direction than when the head portion is massaged (kneaded) in the opposite direction to the hair growing direction.

[0374] In the above control, the jetting pressure when the upper nozzle link 311 is moved downwardly, that is, when the washing water is successively jetted in the same direction as the hair growing direction is higher than when the upper nozzle link 311 is moved in the opposite direction, that is, when the washing water is successively jetted in the opposite direction to the hair growing direction. Therefore, the user can be brought with such a feeling that the user is massaged by human's hands.

[0375] Furthermore, according to the above control, the jetting pressure when the washing water is successively jetted in the opposite direction to the hair growing direction is weak. Therefore, a teased hair state hardly occurs, the hair can be prevented frombeing entangled and also comfort of the user can be enhanced.

[0376] In A4 of Fig. 24A, the upper nozzle link 311 repeats the above movement (motion) twice. Subsequently, as indicated in A5 of Fig. 25A, the microcomputer 389 moves the upper nozzle link 311 so that the upper nozzle link 311 iteratively moves between the head top position T1 and the rear head position T2, and also moves the lower nozzle link 312 so that the lower nozzle link 312 iteratively moves between the hair position T3 and the neck position T4. During the movement, the microcomputer 389 jets washing water from both the nozzle links.

[0377] Subsequently, as indicated in A6 of Fig. 24A, the microcomputer 389 controls the upper nozzle link 311 as follows.

[0378] That is, first, the upper nozzle link 311 is moved to the head top position T1, and temporarily stopped. During temporary stop, the microcomputer 389 controls the inverter 364, etc. to jet washing water from the upper nozzle link 311 to the point PU1 while switching the jetting pressure between high and low levels at a time interval of 0.5 second. The level switching of the jetting pressure is performed so that each of the high level state and the low level state of the jetting pressure is applied every twice. In this embodiment, the microcomputer 389 controls the jetting pressure so that the jetting pressure level under the state that the jetting pressure is high is set to the level 8, and the jetting pressure level under the state that the jetting pressure is low is set to the level 5. Thereafter, the microcomputer 389 jets washing water from the upper nozzle link 311 so as to switch the jetting pressure between the high and low levels at a time interval of one second. The switching operation of the jetting pressure level is performed so that each of the high level state and the low level state is set every once.

[0379] As described above, when washing water is jetted to some site of the user's head portion while switching the jetting pressure between the high and low level states at a predetermined interval, the user is brought with such a feeling as if he/she is massaged (kneaded) to be alternately stronger and weaker in strength by human's hands.

[0380] Particularly, in this embodiment, the jetting pressure level is switched during the temporary stop of

the upper nozzle link 311, and thus during the temporary stop, washing water is jetted to the same site of the head portion while the jetting pressure level is switched. Therefore, the user is brought with such a strong feeling as if he/she is massaged (kneaded) at the site concerned alternately more strongly and more weakly by human's hands.

[0381] Here, when the kneading massage is executed by human's hand, the kneadingmassage is executedwhile the alternating interval between the strong level and the weak level of the kneading massage is gradually increased. In this embodiment, as the washing water jetting time elapses, the switching interval between the high level and the low level of the jetting pressure is also increased. Accordingly, the user is brought with such a feeling as if he/she is massaged (kneaded) at his/her washing water jetted site by human's hands.

[0382] Furthermore, after the microcomputer 389 temporarily stops the upper nozzle link 311 at the position corresponding to the point PU1, the microcomputer 389 releases the temporary stop, and moves the upper nozzle link 311 downwardly to a position at which washing water is jetted to the point PU2. Thereafter, the microcomputer 389 temporarily stops the upper nozzle link 311 at the position corresponding to the point PU2, and jets the washing water while switching the jetting pressure between the high level and the low level as in the case of the position corresponding to the point PU1. As described above, the microcomputer 389 moves the upper nozzle link 311 from the position corresponding to PU1 to the position corresponding to the PU5, and at each of the positions corresponding to the PU1 to PU5, the microcomputer 389 temporarily stops the upper nozzle link 311 and jets washing water while switching the jetting pressure between the high level and the low level during the temporary stop.

[0383] According to the above operation, at the plural sites of the user's head portion, the user can be brought with such a feeling as if he/she is massaged (kneaded) alternately more strongly and more weakly by human's hands.

[0384] Fig. 24B is a diagram showing the first rinsing step.

[0385] The first rinsing step is a step for washing out smudge attached to hair with washing water (containing neither shampoo liquid nor conditioner liquid) before the shampoo step as the next step.

[0386] In this first rinsing step, as in the case of the relaxation step, the jetting pressure is controlled so that the average value of the jetting pressure level is lower than the average value in the shampoo step and the average value in the conditioner step. Accordingly, the user is accustomed with the jetting of washing water to his/her head portion.

[0387] In B1 of Fig. 24B, the same operation as the operation described with reference to A1 is executed.

[0388] Subsequently, as shown in B2 of Fig. 24B, the microcomputer 389 moves the upper nozzle link 311 so that the upper nozzle link 311 iteratively moves between the head top position T1 and the rear head position T2 while jetting washing water, and also moves the lower nozzle link 312 so that the lower nozzle link 312 iteratively moves between the hair position T3 and the neck position T4. During the operation, the microcomputer 389 controls the jetting pressure of washing water so that the jetting pressure of washing water when the upper nozzle link 311 is moved downwardly is set to be higher (stronger washing pressure: S) than the jetting pressure of washing water when the upper nozzle link 311 is moved upwardly (weaker washing pressure: W). Likewise, the microcomputer 389 controls the jetting pressure of washing water so that the jetting pressure of washing water when the lower nozzle link 312 is moved downwardly is set to be higher than the jetting pressure of washing water when the lower nozzle link 312 is moved upwardly.

[0389] Subsequently, as indicated in B3 of Fig. 24B, the microcomputer 389 moves the upper nozzle link 311 to the head top position T1, and then reciprocates the upper nozzle link 311 at four times within such a range that washing water is jetted to the site corresponding to a range H1 (hereinafter referred to as "range H1", and the same motion is applied to ranges H2 to H9). Thereafter, the microcomputer 389 moves the upper nozzle link 311 downwardly, and then reciprocates the upper nozzle link 311 at four times within the range H2 while washing water is jetted. As described above, the microcomputer 389 reciprocates the upper nozzle link 311 at four times within each of the ranges H1 to H4 while jetting washing water. Accordingly, the washing water is concentrically jetted in each of the ranges H1 to H4, whereby smudge attached to the hair can be surely washed out in each of these ranges.

[0390] In B4 of Fig. 24B, the same operation as described with reference to A4 is executed.

[0391] Fig. 24C is a diagram showing the shampoo step.

[0392] The shampoo step is a step for washing the hair of a user by cleaning liquid containing shampoo liquid. The microcomputer 389 controls the shampoo pump 338 to mix water with shampoo liquid, thereby generating cleaning liquid.

[0393] In this shampoo step, the microcomputer 389 moves the upper nozzle link 311 and the lower nozzle link 312 at a higher speed than that in the relaxation step described above. Accordingly, the user is brought with a suitable stimulation and also is made to feel comfortable, and also the hair washing can be efficiently performed.

[0394] Furthermore, in the shampoo step, the jetting pressure is controlled so that the average value of the jetting pressure level is higher than that in the relaxation step, the conditioner step, the rinsing step, etc.. As described above, a stronger stimulation is applied to the user whose hair is washed as compared with the other steps, whereby the massaging interval is made remarkable, and the user recognizes that the massage peak comes, and also the comfort of the user is enhanced. In

this embodiment, the microcomputer 389 controls the jetting pressure so that the average value of the jetting pressure level in the shampoo step is set to the level 9.

[0395] In C1 of Fig. 24C, the same operation as described with reference to A6 is executed. The operation shown in C1 is called as "finger-press washing". By executing the operation indicated in C1, the same effect as described with reference to A6 can be attained. Furthermore, cleaning liquid containing shampoo liquid is concentrically jetted to the points PU1 to PU5, whereby the shampoo liquid is made to prevail over the overall head portion. In addition, the shampoo liquid can be made to infiltrate into the base of the hair.

[0396] In C2 of Fig. 24C, an operation called as "reciprocating washing" is executed in C2 of Fig. 24C.

[0397] That is, after moving he upper nozzle link 311 to the head top position T1, the microcomputer 389 stops the movement of the upper nozzle link 311 at the head top position T1 for a predetermined time period, and jets cleaning liquid containing shampoo liquid from the upper nozzle link 311 to the point PO1. The point PO1 corresponds to "high position of the head portion laid in the sink 302".

[0398] Subsequently, the microcomputer 389 moves the upper nozzle link 31 while jetting washing water containing neither shampoo liquid nor conditioner liquid from the upper nozzle link 311. At this time, the microcomputer 389 moves the upper nozzle link 311 downwardly while controlling the movement of the upper nozzle link 311 so that washing water is jetted to the position of dropping cleaning liquid (shampoo liquid) in conformity with trickling of the cleaning liquid (shampoo liquid) attached to the point PO1 along the head portion. Here, the trickling speed of the cleaning liquid attached to the point PO1 along the head portion, the relationship between the after-jetting lapse time and the position of the washing water on the head portion when the lapse time concerned elapses, etc. are calculated by experiments, simulation or the like in advance, and also it is found out how the upper nozzle link 311 should be moved when the upper nozzle link 311 is moved so that washing water is jetted in conformity with trickling cleaning agent. Accordingly, a program for implementing the motion described above is programmed and stored in a storage unit of the microcomputer 389.

[0399] When the upper nozzle link 311 is moved to the rear head position T2, the microcomputer 389 upwardly moves the upper nozzle link 311 to the head top position T1 while jetting washing water.

[0400] Subsequently, the microcomputer 389 moves the upper nozzle link 311 downwardly while controlling the movement of the upper nozzle link 311 so that cleaning liquid containing shampoo liquid is jetted to the point PO1 at the head top position T1 again, and further washing water containing neither shampoo liquid neither conditioner liquid is jetted to the position of the cleaning liquid (shampoo liquid) trickling along the head portion (i.e., trickling position) in conformity with the trickling of the cleaning liquid (shampoo liquid) attached to the point PO1 along the head portion. The microcomputer 389 repeats the reciprocating movement of the upper nozzle link 311 as described above at plural times.

[0401] As described above, according to this embodiment, when the upper nozzle link 311 is located at the head top portion, the microcomputer 389 jets the cleaning liquid containing the shampoo liquid, and moves the upper nozzle link 311 downwardly while controlling the movement of the upper nozzle link 311 so that the washing water is jetted to the position of the cleaning agent liquid (shampoo liquid) trickling along the head portion in conformity with the trickling of the cleaning agent liquid (shampoo liquid) attached to the point PO1. Accordingly, the following effect can be obtained.

[0402] That is, under the condition that the cleaning agent containing the shampoo liquid is jetted to the point PO1, in other words, to the highest position in the range where the cleaning agent liquid is jetted from the upper nozzle link 311, the washing water is jetted to the position of the cleaning agent liquid (shampoo liquid) trickling along the headportion in conformity with the trickling of the cleaning agent liquid (shampoo liquid) attached to the point PO1. Therefore, the infiltration of the trickling cleaning agent liquid into the hair and the bubbling of the trickling cleaning agent liquid are promoted over the whole area of the head portion. Therefore, the cleaning agent liquid containing the shampoo liquid can be made to properly prevail over the overall headportion by utilizing the trickling characteristic of the cleaning agent liquidbased on the gravitational force at maximum.

[0403] Furthermore, the cleaning agent liquid containing the shampoo liquid is jetted while the upper nozzle link 311 is located at the head top position T1, and the consumption amount of the shampoo liquid can be reduced as compared with a case where the cleaning agent liquid containing the shampoo liquid is also jetted at the other positions, and thus the running cost can be reduced. That is, according to this embodiment, the running cost can be suppressed with maintaining the state that the cleaning agent liquid containing the shampoo liquid prevails over the overall head portion.

[0404] In the above case, the cleaning agent liquid containing the shampoo liquid is jetted only when the upper nozzle link 311 is located at the head top position T1. For example, the cleaning agent liquid may be also jetted when the upper nozzle link 311 is located at an intermediate position between the head top position T1 and the rear head position T2. That is, the above effect can be attained insofar as the cleaning agent liquid is concentrically jetted at a high position of the head portion such as the point PO1, etc.

[0405] Subsequently, the following operation is executed in C3 of Fig. 24C. The operation shown in C3 is referred to as "knead-washing".

[0406] Fig. 24D is an enlarged view of C3 of Fig. 24C. That is, after moving the upper nozzle link 311 to the head top position t1, the microcomputer 389 stops the

movement of the upper nozzle link 311 at the head top position T1 for a predetermined time and jets the cleaning agent liquid containing the shampoo liquid to the point PO1 (see C2) from the upper nozzle link 311.

[0407] Subsequently, after the microcomputer 389 moves the upper nozzle link 311 to the head top position T1, the microcomputer 389 stops the movement of the upper nozzle link 311 at the head top position T1 for a predetermined time, and jets the cleaning agent liquid containing the shampoo liquid from the upper nozzle link 311 to the point PO1 (see C2 of Fig. 24C).

[0408] Subsequently, the microcomputer 389 moves the upper nozzle link 3121 downwardly by only a predetermined distance while jetting washing water containing neither shampoo liquid nor conditioner liquid as indicated by an arrow G1. Subsequently, the microcomputer 389 moves the upper nozzle link 311 upwardly by only a shorter distance than the predetermined distance while jetting washing water containing neither shampoo liquid nor conditioner liquid as indicated by an arrow Y1. Here, the microcomputer 389 controls the jetting pressure of washing water so that the jetting pressure of the washing water jetted in the direction of the arrow G is set to be higher than the jetting pressure of the washing water jetted in the direction of the arrow Y1. Therefore,asdescribed above,the effectofpreventing entangling of the hair, etc. can be achieved. Thereafter, the microcomputer 389 moves the upper nozzle link 311 to the rear head position T2 while alternately repeating the downward movement and the upward movement of the upper nozzle link 311 as indicated by the arrows G2, Y2, G3, Y3, G4. Likewise, the microcomputer 389 moves the lower nozzle link 312 to the hair position T3, and then controls the lower nozzle link 312 to make the same motion as the upper nozzle link 311 until it reaches the neck position T4.

[0409] When the above operation is executed, the microcomputer 389 alternately repeats the downward and upward movement of the upper nozzle link 311 while controlling the movement of the upper nozzle link 311 so that washing water is jetted to the position of cleaning agent liquid (shampoo liquid) trickling along the head portion in conformity with the trickling of the cleaning agent liquid (shampoo liquid) attached to the point PO1 (see C2). Specifically, as shown in Fig. 24d, a series of operations indicated by the arrows G1 and Y1 are executed while the cleaning agent liquid trickling along the head portion exists in the range H10, a series of operations indicated by the arrows G2 and Y2 are executed while the cleaning agent liquid trickling along the head portion exists in the range H11, a series of operations indicated by the arrows G3 and Y3 are executed while the cleaning agent liquid trickling along the head portion exists in the range H12, and an operation indicated by the arrow G4 is executed while the cleaning agent liquid trickling along the head portion exists in the range H13. a program for controlling the movement of the upper nozzle link 311 so that the upper nozzle link 311 makes the above motion is developed by an experiment, a simulation or the like in advance, and the microcomputer 389 controls the movement of the upper nozzle link 311 by the microcomputer 389 on the basis of this program.

[0410] The same effect as described with reference to C2 can be attained through the above operation. Under the condition that the cleaning agent containing the shampoo liquid is jetted to the point PO1, in other words, the highest position in the range where the cleaning agent liquid is jetted from the upper nozzle link 311, washing water is jetted to the position of the cleaning agent liquid (shampoo liquid) trickling along the head portion in conformity with the trickling of the cleaning agent liquid (shampoo liquid) attaching to the point PO1. Therefore, the infiltration of the trickling cleaning agent liquid into the hair and the bubbling of the cleaning agent liquid are promoted over the overall area of the head portion. Accordingly, the cleaning agent liquid containing the shampoo liquid can be made to prevail over the whole area of the head portion by using the trickling characteristic based on the gravitational force at maximum. Particularly, with respect to the motions indicated by the arrows Y1, Y2 and Y3, the washing water is jetted against the flow of the cleaning agent liquid along the head portion, so that the cleaning agent liquid containing the shampoo liquid can be infiltrated into the head portion and also the cleaning agent liquid can be bubbled more greatly.

[0411] Furthermore, the cleaning agent liquid containing the shampoo liquid is jetted while the upper nozzle link 311 is located at the head top position T1. Therefore, as compared with the case where the cleaning agent liquid is also jetted in the other cases (i.e., in a case where the upper nozzle link 311 is located at positions other than the head top position T1), the consumption amount of the shampoo liquid can be reduced, and the running cost can be suppressed.

[0412] In the foregoing example, the cleaning agent liquid containing the shampoo liquid is jetted only when the upper nozzle link 311 is located at the head top position T1. However, the cleaning agent liquid may be jetted from the upper nozzle link 311 during the movement indicated by the arrow G3. That is, the above effect can be attained by concentrically jetting the cleaning agent liquid at a high position of the head portion.

[0413] An operation called as "rubbing-washing" is executed in C4 of Fig. 24D.

[0414] After moving the upper nozzle link 311 to the head top position T1, the microcomputer 389 stops the movement of the upper nozzle link 311 at the head top position T1 for a predetermined time , and jets the cleaning agent liquid containing the shampoo liquid from the upper nozzle link 311 to the point PO1 (see C2). Subsequently, the microcomputer 3899 reciprocates the upper nozzle link 311 at plural times in a range H5 corresponding to a narrow range of the head portion of the user while jetting washing water containing neither shampoo liquid nor conditioner liquid. Here, the narrow range of the head portion of the user is defined as a range which is located from O.5cm to 3cm in the vertical direction (in this em-

bodiment, about 2cm), and the washing water is jetted within this range in a reciprocating style. In this embodiment, the microcomputer 389 reciprocates the upper nozzle link 311 at eight times for 2 seconds so that washing water is jetted in the range of about 2cm of the head portion. At this time, the microcomputer 389 sets the jetting pressure of the washing water to a relatively high value, and sets the moving speed of the upper nozzle link 311 to a relatively high value. In this embodiment, the microcomputer 389 controls the level of the jetting pressure to the level 8.

[0415] As described above, the washing water having a high jetting pressure is jetted from the upper nozzle link 311 which reciprocates at a high speed, whereby a proper stimulus can be applied to the site concerned and the user can be brought with such a feeling as if the site of his/her head is massaged by human's hands. Furthermore, such a feeling that an itchy site of the head portion is scratched by a human's hand, and thus the comfort of the user can be enhanced.

[0416] Furthermore, as compared with the relaxation step and the first rinsing step, the washing water is jetted under stronger jetting pressure. Therefore, a proper stimulus can be applied to a user who has been accustomed to the jetting of washing water to his/her head portion through the relaxation step and the first rinsing step. The user feels a proper stimulus and thus he/she can have a strong massage sense.

[0417] Thereafter, the microcomputer 389 moves the upper nozzle link 311 downwardly by only a predetermined distance. In the range H6, the microcomputer 389 controls the upper nozzle link 311 to execute the same operation as the range H5. As described above, the microcomputer 389 reciprocates the upper nozzle link 311 at plural times in each of the ranges H5 to H9 while jetting washing water. Accordingly, the above effect can be attained at plural different sites on the head portion.

[0418] Furthermore, when the above operation is executed, the microcomputer 389 reciprocates the upper nozzle link 311 while controlling the movement of the upper nozzle link 3121 so that washing water is jetted to the position of the cleaning agent liquid (containing shampoo liquid) trickling along the head portion in conformity with the trickling of the cleaning agent liquid (shampoo liquid) attached to the point PO1 (see C2) . Specifically, the upper nozzle link 311 is moved in the range H5 in a reciprocating style (hereinafter referred to as "reciprocatively) while the cleaning agent liquid trickling along the head portion is located at the place corresponding to the range H5, the upper nozzle link 311 is reciprocatively moved in the range H6 while the cleaning agent liquid trickling along the head portion is located at the place corresponding to the range H6, the upper nozzle link 311 is reciprocatively moved in the range H7 while the cleaning agent liquid trickling along the head portion is located at the place corresponding to the range H7, the upper nozzle link 311 is reciprocatively moved in the range H8 while the cleaning agent liquid trickling along the head portion is located at the place corresponding to the range H8, and the upper nozzle link 311 is reciprocatively moved in the range H9 while the cleaning agent liquid trickling along the head portion is located at the place corresponding to the range H9. A program for controlling the movement of the upper nozzle link 311 so that the upper nozzle link 311 make the above motion has been developed in advance by experiments, simulations, etc., and the motion of the upper nozzle link 311 is controlled by the microcomputer 389 on the basis of this program.

[0419] The same effect as described with reference to C2 can be obtained through the above operation. That is, under the condition that the cleaning agent containing the shampoo liquid is jetted to the point PO1, in other words, the highest position in the range where the cleaning agent liquid is jetted from the upper nozzle link 311, washing water is jetted to the position of the cleaning agent liquid (shampoo liquid) trickling along the head portion in conformity with the trickling of the cleaning agent liquid (shampoo liquid) attached to the point PO1. Therefore, the infiltration of the trickling cleaning agent liquid into the hair and the bubbling of the cleaning agent liquid are promoted over the overall area of the head portion, and thus the cleaning agent liquid containing the shampoo liquid can be made to suitably prevail over the whole area of the head portion by using the trickling characteristic of the cleaning agent liquid based on the gravitational force at maximum. Particularly, in the series of operations shown in C4 of fig. 24C, washing water may be jetted against flow of the cleaning agent liquid along the head portion, the cleaning agent liquid containing the shampoo liquid can be more greatly infiltrated into the head portion, and the cleaning agent liquid is more bubbled.

[0420] Furthermore, the cleaning agent liquid containing the shampoo liquid is jetted while the upper nozzle link 311 is located at the head top position T1. Therefore, as compared with the case where the cleaning agent liquid containing the shampoo liquid is jetted not only at the head top position T1, but also at the other positions, the consumption amount of the shampoo liquid can be reduced, and the running cost can be suppressed.

[0421] Furthermore, in this embodiment, the five ranges from the range H5 to the range H9 exist. However, the number of ranges is not limited to five, and it may be set to four or less or to six or more.

[0422] Furthermore, in the above example, the cleaning agent liquid containing the shampoo liquid is jetted only when the upper nozzle link 311 is located at the head top position T1. However, the cleaning agent liquid may be also jetted when the upper nozzle link 311 is located at the position corresponding to the range H7. That is, the above effect can be attained by concentrically jetting the cleaning agent liquid at a high position of the head portion such as the point PO1 or the like.

[0423] The same operation as described with reference to C2 of Fig. 24C is executed in C5 of Fig. 24C.

[0424] Fig. 25A is a diagram showing the second rinsing step.

[0425] This second rinsing step is a step of washing out cleaning agent liquid containing shampoo liquid which is jetted to the head portion in the shampoo step and remains on the head portion and the hair. In this second rinsing step, the jetting pressure is controlled so that the average value of the jetting pressure level is lower than the average value in the shampoo step. In this embodiment, the average value of the jetting pressure level in the second rinsing step is set to the level 8.

[0426] The same operation as described with reference to A3 of Fig. 24A is executed in D1 of Fig. 25A, the same operation as described with reference to B2 of Fig. 24B is executed in D2 of Fig. 25A, and the same operation as described with reference to C3 of Fig. 24C is executed in D3 of Fig. 25A.

[0427] Subsequently, after moving the lower nozzle link 312 to the neck position T4, the microcomputer 389 moves the lower nozzle link 312 upwardly by only a predetermined distance while jetting washing water as indicated by an arrow I. Thereafter, the microcomputer 389 moves the lower nozzle link downwardly by a distance shorter than the predetermined distance wile jetting washing water as indicated by an arrow J. At this time, the microcomputer 389 controls the jetting pressure of washing water so that the jetting pressure of the washing water when the lower nozzle link 312 is moved downwardly is set to be higher than the jetting pressure of the washing water when the lower nozzle link 312 is moved upwardly. The microcomputer 389 repeats the above operation until the lower nozzle link 312 reaches the hair position T3.

[0428] The same operation as described with reference to C3 of Fig. 24C is executed in D5 of Fig. 25A, and the upper nozzle link 311 jets no washing water. The same operation as described with reference to A5 of Fig. 24A is executed in D7 of Fig. 25A. The upper nozzle link 311 executes the same operation as described with reference to A6 of Fig. 24A in D8 of Fig. 25A, and the lower nozzle link 312 executes substantially the same operation as the upper nozzle link 311 in A6 of Fig. 24A.

[0429] Fig. 25B is a diagram showing the conditioner step.

[0430] The conditioner step is a step of jetting washing water containing conditioner liquid to the head portion and hair of a user to perform so-called conditioning. The microcomputer 389 controls the conditioner pump 339 to mix washing water with conditioner liquid. The average value of the jetting pressure level in the conditioner step is set to be lower than the average value of the jetting pressure level in the shampoo step, and also set to be higher than the average value of the jetting pressure level in the relaxation step. In this embodiment, the microcomputer 389 controls the jetting pressure so that the average value of the jetting pressure level in the conditioner step is set to the level 8.

[0431] In Fig. E1 of Fig. 25B, the same operation as described with reference to A3 of fig. 24A is executed.

[0432] The same operation as described with reference to C2 of Fig. 24C is executed in E2 of Fig. 25B.

[0433] After moving the upper nozzle link 311 to the head top position T1, the microcomputer 389 stops the movement of the upper nozzle link 311 at the head top position T1 for a predetermined time, and jets the cleaning agent liquid containing the conditioner liquid from the upper nozzle link 311 to the point PO1. The point PO1 corresponds to "a high place of the head portion laid in the sink 302".

[0434] Subsequently, the microcomputer 389 moves the upper nozzle link 311 downwardly while jetting washing water containing neither shampoo liquid nor conditioner liquid. At this time, the microcomputer 389 moves the upper nozzle link 311 downwardly while controlling the movement of the upper nozzle link 311 so that washing water is jetted to the position of the cleaning agent liquid (conditioner liquid) trickling along the head portion in conformity with the trickling of the cleaning agent liquid (conditioner liquid) attached to the point PO1. Accordingly, as in the case of the effect described with reference to C2 of Fig. 24C, the running cost can be suppressed with keeping the state that the cleaning agent liquid containing the conditioner liquid prevails over the overall area of the head portion.

[0435] The same operation as described with reference to C3 of Fig. 24C is executed in E3 of Fig. 25B, and the same operation as described with reference to C2 of Fig. 24C is executed in E4 of Fig. 25B. Through the operations shown in E3 and E4 of Fig. 25B, the running cost can be suppressed with keeping the state that the cleaning agent liquid containing the conditioner liquid prevails over the overall head portion as described with reference to C3 and C3 of Fig. 24C, and further the infiltration of the conditioner liquid into the headportion can be promoted.

[0436] Fig. 25C is a diagram showing the third rinsing step.

[0437] The third rinsing step is a step for washing out washing water containing conditioner liquid which is jetted to the head portion in the conditioner step and remains on the head portion and the hair.

[0438] In the third rinsing step, the jetting pressure is controlled so that the average value of the jetting pressure level is lower than the average value in the shampoo step. In this embodiment, the jetting pressure is controlled so that the average value of the jetting pressure level in the second rinsing step is equal to the level 8.

[0439] The same operation as described with reference to A3 of Fig. 24A is executed in F1 of Fig. 25C, the same operation as described with reference to D8 of Fig. 25A is executed in F2 of Fig. 25C, the same operation as described with reference to B2 of Fig. 24B is executed in F3 of Fig. 25C, the same operation as described with reference to C3 of Fig. 24c is executed in F4 of Fig. 25C, and the same operation as described with reference to B2 of Fig. 24B is executed in F5 of Fig. 25C.

[0440] Fig. 26A is a diagram showing the menthol cleaning agent jetting step.

[0441] This menthol cleaning agent jetting step is a step for jetting menthol type cleaning agent to a user. In the menthol cleaning agent jetting step, the jetting pressure is controlled so that the jetting pressure under jetting of the cleaning agent is low so that the user feels as if the menthol type cleaning agent is gently squirted to the user. For example, the jetting pressure is set to the level 6.

[0442] As indicated in G1 of Fig. 26A, the same operation as described with reference to A7 of Fig. 24A is executed. At this time, the microcomputer 389 moderates the movement of the upper nozzle link 311, and the jetting pressure of washing water jetted from the upper nozzle link 311 is lowered.

[0443] Subsequently, as indicated in B2 of Fig. 26A, the microcomputer 389 controls the cleaning agent supply pump 394, the cleaning agent nozzle valve 395, etc. to jet the menthol type cleaning agent to the head portion of the user as indicated by arrows. When the menthol type cleaning agent is jetted to the head portion, it refreshes the user and gives pleasant cooling sensation to the user.

[0444] Fig. 26B is a diagram showing the fourth rinsing step.

[0445] The fourth rinsing step is a step for rinsing the menthol type cleaning agent which is jetted to the user in the menthol type jetting step and remains on the head portion and hair of the user.

[0446] As indicated in H1 of Fig. 26B, the same operation as described with reference to A4 of Fig. 24A is executed. At this time, the microcomputer 389 gradually reduces the jetting pressure of washing water, whereby the user is made to recognize that the series of operations for automatic hair washing has been finished.

[0447] As described above, the automatic hair washing machine 301 according to this embodiment has the sink 302 in which the head portion of the user is laid, and the head portion laid in the sink 302 is washed. Then, the automatic hair washing machine 301 has the upper nozzle link 311 which can jet washing water or cleaning agent liquid while moved along the head portion laid in the sink 302, and the microcomputer 389 for controlling the upper nozzle link 311 so that the upper nozzle link 311 concentrically jets the cleaning agent liquid when the upper nozzle link 311 is located at a position where it can jet liquid to a high place of the head portion laid in the sink 302 as compared with a case where the upper nozzle link 311 is located at other positions.

[0448] Accordingly, the cleaning agent liquid jetted to the high place trickles along the head portion and the hair, and thus prevails over the overall head portion. Therefore, the cleaning agent liquid containing the shampoo liquid can be made to suitably prevail over the overall head portion by using the trickling characteristic of the cleaning agent liquid according to the gravitational force at maximum.

[0449] Furthermore, in this embodiment, the microcomputer 389 jets the cleaning agent liquid to a high place of the head portion laid in the sink 302, and then controls the movement of the upper nozzle link 311 and the jetting of the liquid from the upper nozzle link 311 in accordance with the trickling of the cleaning agent liquid attached to the head portion along the head portion.

[0450] According to this operation, the cleaning agent liquid can be made to suitably prevail over the whole area of the head portion by using the cleaning agent liquid trickling along the head portion, and furthermore the running cost can be suppressed more greatly as compared with a case where shampoo is jetted to the whole area of the head portion.

[0451] In this embodiment, the microcomputer 389 jets the cleaning agent liquid to a high place of the head portion laid in the sink 302, and then controls the movement of the upper nozzle link 311 and the jetting of the liquid from the upper nozzle link 311 so that washing water is jetted to the place corresponding to the position of the cleaning agent liquid of the head portion in accordance with trickling of the cleaning agent liquid attached to the head portion along the head portion.

[0452] Accordingly, the infiltration of the trickling cleaning agent liquid into the head portion and the bubbling of the cleaning agent liquid are promoted over the whole area of the headportion. Therefore, the cleaning agent liquid containing the shampoo liquid (or the conditioner liquid) can be made to suitably prevail over the whole area of the head portion by utilizing the trickling characteristic of the cleaning agent liquid according to the gravitational force at maximum. Particularly, in this embodiment, the cleaning agent liquid containing the shampoo liquid is jetted during a period when the upper nozzle link 311 is located at the head top position T1. Therefore, as compared with the case where the cleaning agent liquid containing the shampoo liquid is also jetted during the other periods than the above period, the consumption amount of the shampoo liquid can be reduced, and the running cost can be suppressed. That is, according to this embodiment, the running cost can be suppressed with maintaining the state that the cleaning agent liquid containing the shampoo liquid prevails over the whole area of the head portion.

[0453] Furthermore, according to this embodiment, the microcomputer 389 jets the cleaning agent liquid to a high place of the head portion laid in the sink 302, and then controls the movement of the upper nozzle link 311 and the jetting of the liquid from the upper nozzle link 311 so that the washing water is jetted to the place corresponding to the position of the cleaning agent liquid of the head portion while controlling the upper nozzle link so that the washing water is jetted in a reciprocating fashion within a predetermined range in accordance with the trickling of the cleaning agent liquid attached to the head portion along the head portion.

[0454] Accordingly, the washing water is jetted to the position of the cleaning agent liquid (shampoo liquid or conditioner liquid) trickling along the head portion in accordance with the trickling of the cleaning agent liquid (shampoo liquid or conditioner liquid) . Therefore, the in-

filtration of the trickling cleaning agent liquid into the hair and the bubbling of the cleaning agent liquid on the hair are promoted over the whole area of the head portion, and thus the cleaning agent liquid containing the shampoo liquid can be made to suitably prevail over the whole area of the head portion by using the trickling characteristic of the cleaning agent liquid according to the gravitational force at maximum. Particularly, thewashingwater is jetted in a reciprocating style, and thus the washing water is jetted against the trickling of the cleaning agent liquid along the head portion, so that the cleaning agent liquid containing the shampoo liquid can be made to infiltrate into the head portion more greatly and also the shampoo liquid can be more bubbled when the cleaning agent liquid contains the shampoo liquid.

[0455] Furthermore, in this embodiment, the cleaning agent liquid containing the shampoo liquid is jetted while the upper nozzle link 311 is located at the head top position T1, and thus as compared with the case where the cleaning agent liquid containing the shampoo liquid is also jetted in the other cases, the consumption amount of the shampoo liquid can be reduced, and the running cost can be suppressed.

[0456] Still furthermore, after jetting the cleaning agent liquid to a high place of the head portion laid in the sink 302, the microcomputer 389 jets the controls the jetting pressure of the liquid to be jetted from the nozzle link in accordance with the trickling of the cleaning agent liquid attached to the head portion along the head portion.

[0457] That is, according to this embodiment, in the "knead-washing" described with reference to C3 of Fig. 24C, the jetting pressure of washing water in the case of the movement in the direction of the arrow G1 is set to be higher than the jetting pressure of washing water in the case of the movement in the direction of the arrow Y1. Accordingly, as described above, the jetting pressure when the washing water is successively jetted in the same direction as the hair growing direction is higher than the jetting pressure when the upper nozzle link 311 is moved in the opposite direction, that is, the washing water is successively jetted in the opposite direction to the hair growing direction. Therefore, the user feels as if his/her head is massaged by human's hands during automatic hair washing. Furthermore, the jetting pressure when the washing water is successively jetted in the opposite direction to the hair growing direction is weak. Therefore, a teased hair state hardly occurs, and also the hair is prevented from being entangled, so that the comfort of the user (the person whose hair is washed) can be enhanced.

[0458] Furthermore, in this embodiment, the upper nozzle link 311 is designed to be reciprocable between the head top position T1 corresponding to the head top portion of the head portion laid in the sink 302 and the rear head position T2 corresponding to the rear head portion, and the microcomputer 389 concentrically jets the cleaning agent liquid when the upper nozzle link 311 is located at the head top position T1 . Accordingly, the cleaning agent liquid can be suitably jetted to the head top portion as a high position of the head portion at the head top position T1 as the highest position in the range where the cleaning agent liquid is jetted from the upper nozzle link 311.

[0459] The present invention is not limited to the above-described embodiments, and any modification and application can be made within the scope of the present invention.

[0460] For example, the above embodiment relates to an example of the operation associated with the automatic hair washing of the automatic hair washing machine 301 by using Figs. 23 to 26, however, the present invention is not limited to the operation concerning automatic hair washing. For example, the order of the respective operations may be changed or each operation may be repeated. Furthermore, after the fourth rinsing step, the wet hair of the user whose hair has been washed may be manually dried with warm air or the like by his/her own hands or hands of another person such as staff of a shop or the like, however, a hair drying step for automatically drying wet hair by blowing warm air or the like to the head portion of the user while adjusting the temperature of the warm air may be added.

[0461] Furthermore, the construction of the cleaning agent jetting mechanism 390 is not limited to the construction of the above-described embodiments, and the menthol type cleaning agent may be jetted from the upper nozzle link 311 and the lower nozzle link 312.

[0462] Still furthermore, in the rinsing step, the washing water may be concentrically jetted to the high (or highest) position of the head portion. In this case, the consumption amount of the washing water can be suppressed and thus the running cost can be suppressed with maintaining the state that the washing water prevails over the whole area of the head portion for the same reason as described above.

Claims

1. An automatic hair washing machine comprising:

a sink in which a head portion of a user is laid, the sink having an enclosed space that is formed when the head portion is laid in the sink;
a nozzle link unit for jetting liquid containing at least one of washing water and cleaning agent liquid; and
a mist spraying unit for spraying mist into the enclosed space.

2. The automatic hair washing machine according to claim 1, wherein the mist spraying unit has a mist generator for generating mist, a mist feeding pipe for introducing the mist generated in the mist generator into the sink, a mist discharge port that is provided in the sink to spray out the mist fed through the mist

feeding pipe into the sink, and a water discharging trap provided to the mist feeding pipe.

3. The automatic hair washing machine according to claim 2, wherein the mist discharge port is configured so that a spray direction of the mist is changeable.

4. The automatic hair washing machine according to claim 2, wherein drain water occurring in connection with the generation of the mist in the mist generator is trapped in the water discharging trap.

5. The automatic hair washing machine according to any one of claims 1 to 4, further comprising a jetting unit for jetting the liquid from the nozzle link unit to the head portion laid in the enclosed space, and a controller for controlling the mist spraying unit and the jetting unit, wherein the controller controls the jetting unit and the mist spraying unit so that the jetting of the liquid by the jetting unit and the spray of the mist by the mist spraying unit are executed interlockingly with each other.

6. The automatic hair washing machine according to claim 5, further comprising a cleaning operation course indicating unit for indicating one of cleaning operation courses each comprising a plurality of steps that contain at least a washing step based on jetting of liquid executed by the jetting unit and a mist step based on spray of mist executed by the mist spraying unit, and are arranged in a predetermined step order, wherein when any one of the cleaning operation courses is indicated through the indicating unit, the controller controls the jetting unit and the mist jetting unit so that the jetting of the liquid by the jetting unit and the spray of the mist by the mist spraying unit are executed at a predetermined timing corresponding to the order of each step of the cleaning operation course.

7. The automatic hair washing machine according to claim 6, wherein the jetting unit has a mixing unit for mixing washing water with any one of shampoo liquid and rinsing liquid to generate the liquid to be jetted from the nozzle link unit, and the cleaning operation courses contain a first cleaning course whose step order is set so that the mist step is executed before a shampoo step for jetting the liquid containing the shampoo liquid, a second cleaning course whose step order is set so that the mist step is executed after a conditioning step for jetting the liquid containing the conditioner liquid, and a third cleaning course whose step order is set so that the conditioning step and the mist step are executed in parallel to each other.

8. The automatic hair washing machine according to claim 5, wherein the mist spraying unit has a mist generator for generating mist, and the controller is connected to a mist generator controller for controlling the mist generator so that communications can be performed between the controller and the mist generator controller, and controls the jetting unit and the mist spraying unit in cooperation with the mist generator controller so that the liquid jetting of the jetting unit and the mist spray of the mist spraying unit are executed interlockingly with each other.

9. The automatic hair washing machine according to claim 1, wherein the nozzle link unit is configured to jet the liquid while moving along the head portion laid in the sink, and when the nozzle link unit is located at a position where the nozzle link unit jets the liquid to a high position of the head portion laid in the sink, the controller controls the nozzle link unit to concentrically jet the liquid.

10. The automatic hair washing machine according to claim 1, wherein the controller controls movement of the nozzle link unit and jetting of the liquid from the nozzle link unit so that the liquid is jetted to a place corresponding to a position of the liquid trickling along the head portion in conformity with the trickling of the liquid attached to the head portion.

11. The automatic hair washing machine according to claim 9, wherein after the liquid is jetted to the high place of the head portion laid in the sink, the controller controls the movement of the nozzle link unit and the jetting of the liquid from the nozzle link unit so that the liquid is jetted to a place corresponding to a position of the liquid trickling along the head portion while controlling the nozzle link unit so that the liquid is jetted within a predetermined range in a reciprocating style in conformity with the trickling of the liquid attached to the head portion.

12. The automatic hair washing machine according to claim 9, wherein after the liquid is jetted to the high place of the head portion laid in the sink, the controller controls the jetting pressure of the liquid jetted from the nozzle link unit in conformity with the trickling of the liquid attached to the head portion along the head portion.

13. The automatic hair washing machine according to claim 9, wherein the nozzle link unit is reciprocable between a head top position corresponding to a head top portion of the head portion laid in the sink and a rear head position corresponding to a rear head portion, and the controller concentrically jets the liquid when the nozzle link unit is located at the head top position.

14. The automatic hair washing machine according to claim 1, wherein the nozzle link unit comprises a plu-

rality of nozzle links that jet liquid to different sites of the head portion respectively, and are connected to a single motor through a power transmission mechanism so that the plurality of nozzle links are movable in synchronization with one another.

15. The automatic hair washing machine according to claim 1, wherein the nozzle link unit comprises an upper nozzle link that is reciprocable between a head top position corresponding to a head top portion of the head portion laid in the sink and a rear head position corresponding to a rear head portion of the head portion, and a lower nozzle link that is reciprocable between a hair position corresponding to a hair hanging from the head portion laid in the sink and a neck position corresponding to a neck, wherein the lower nozzle link is moved in a direction from the hair position to the neck position in synchronization with movement of the upper nozzle link in a direction from the head top position to the rear head position, and the lower nozzle link is moved in a direction from the neck position to the hair position in synchronization with movement of the upper nozzle link in a direction from the rear headposition to the head top position.

16. The automatic hair washing machine according to claim 14, the power transmission mechanism has a gear rotating according to driving of the motor, wherein the plurality of nozzle links are moved synchronously with each other through the gear that is rotated by driving the motor.

17. The automatic hair washing machine according to claim 14, wherein the power transmission mechanism is provided to one side surface of the sink.

FIG.1

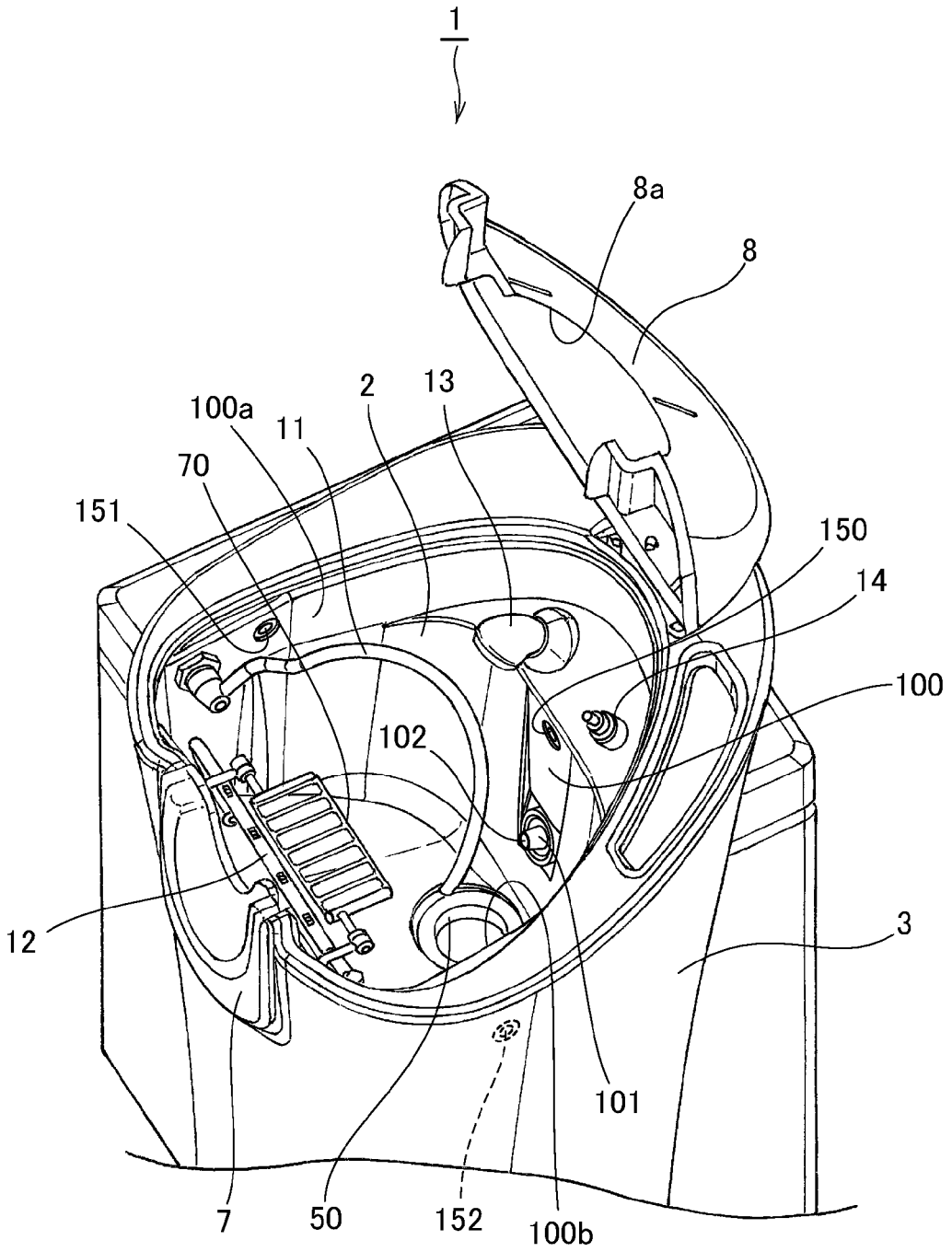


FIG.2

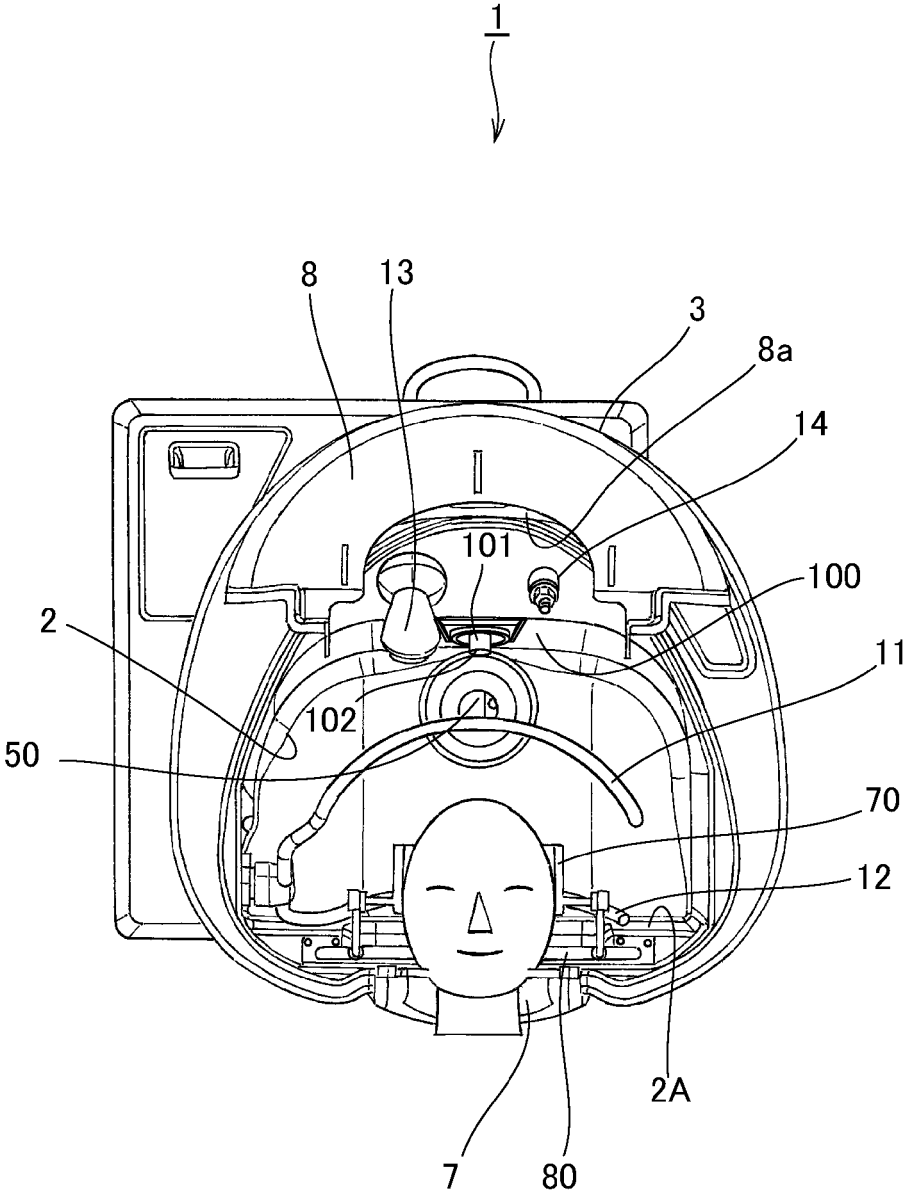


FIG.3

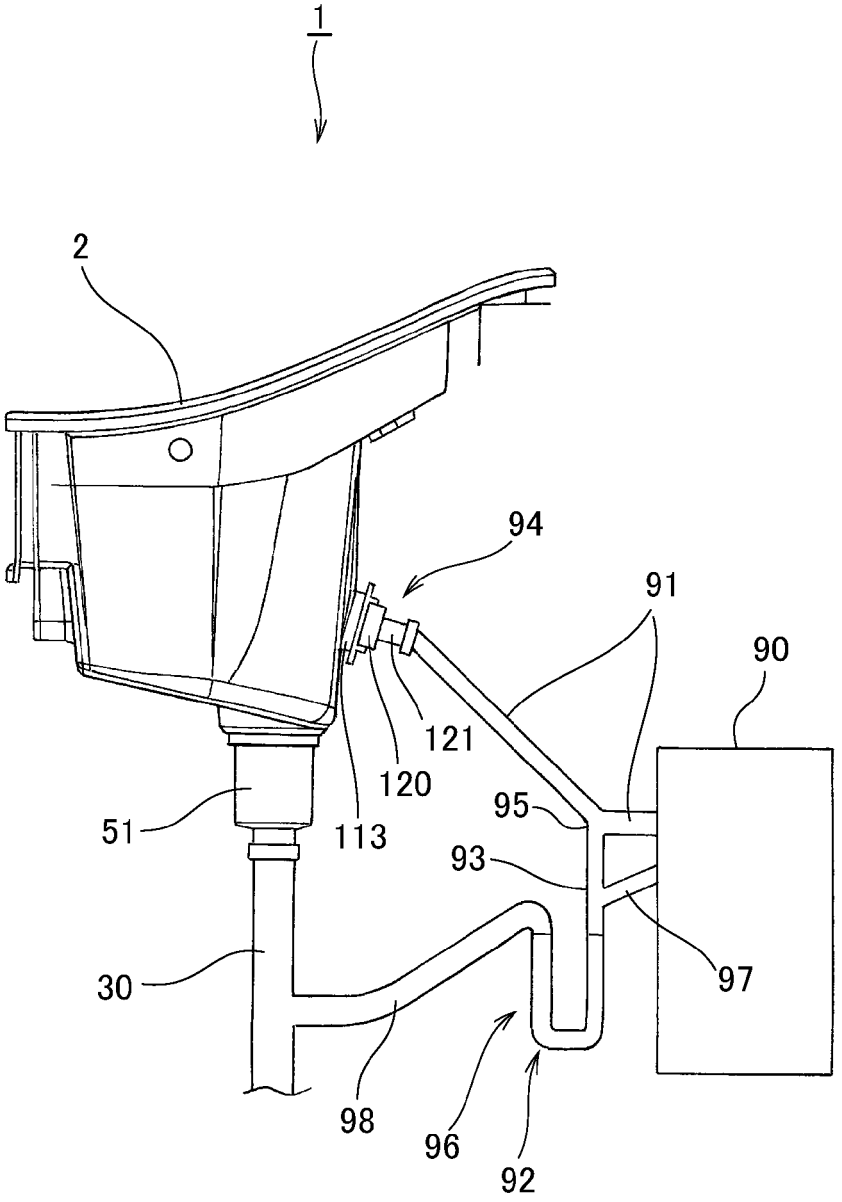


FIG.4A

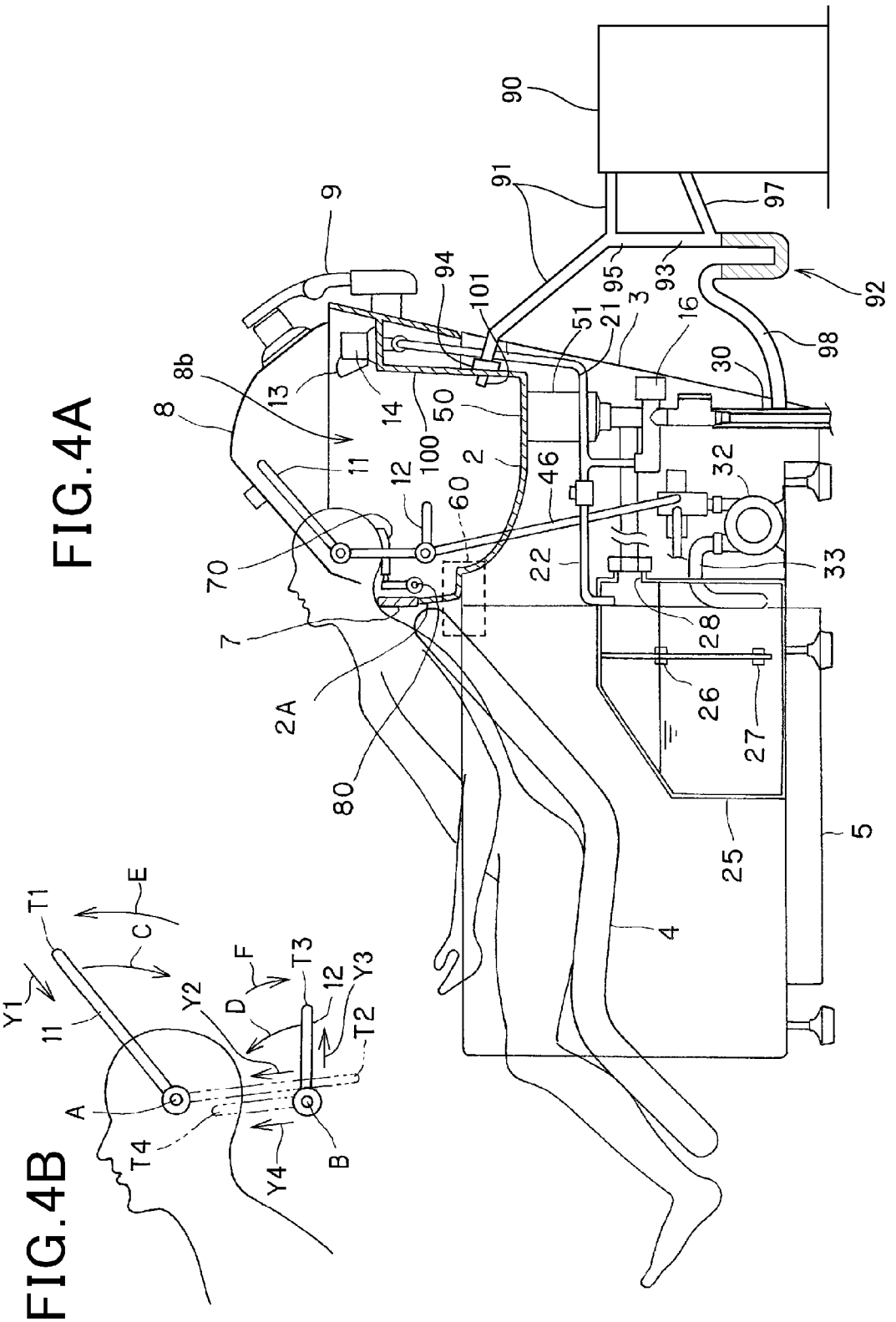
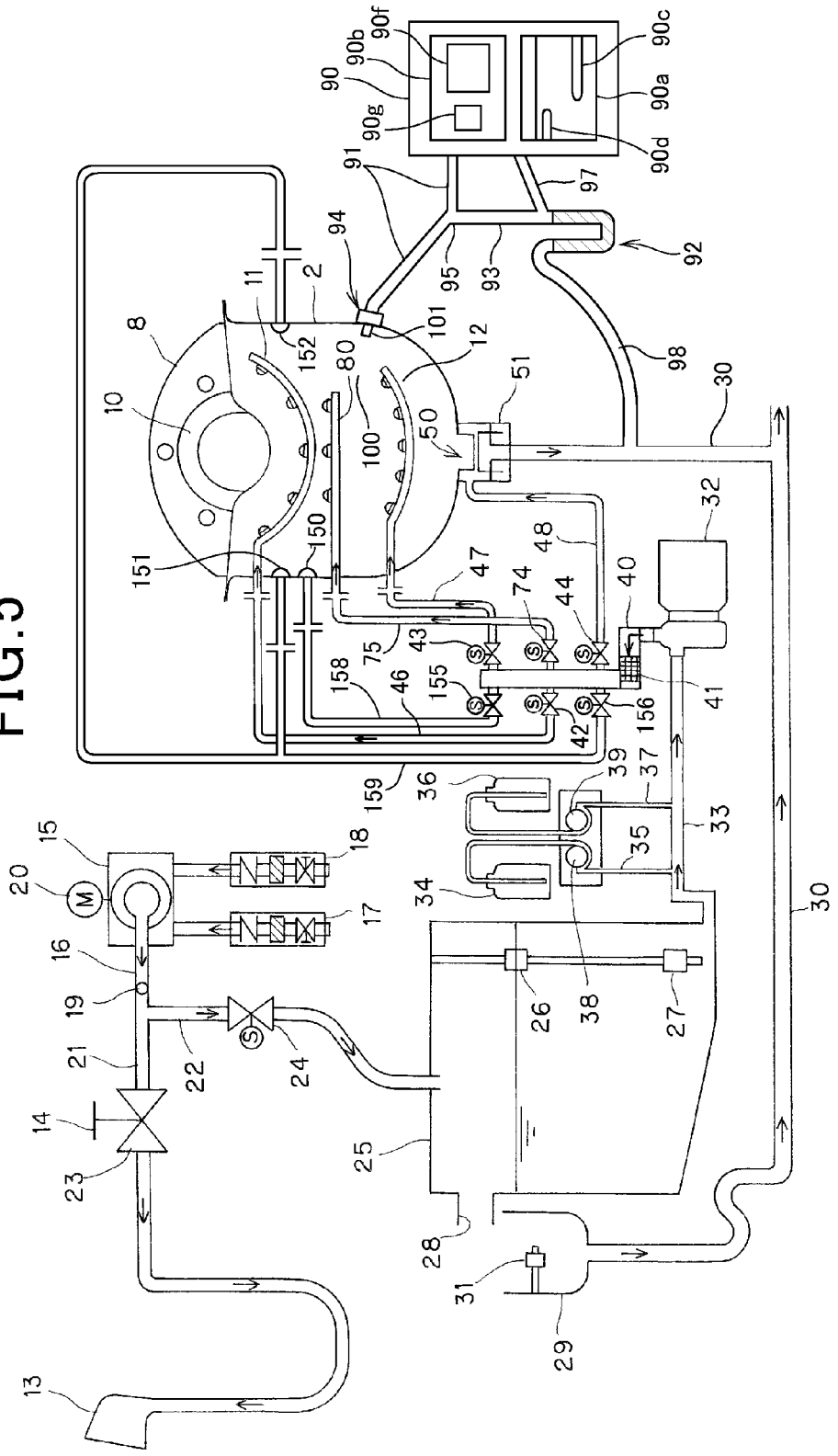

90
91
97
9
94
101
95
93
92
3
51
21
16
98
30
8b
8
13
14
50
11
12
100
2
46
32
60
70
22
33
7
28
2A
26
27
80
25
5
4

FIG.4B

T1
E
C
Y1
11
Y2
D
F
T3
12
Y3
T2
A
T4
Y4
B

FIG.5


90
90a
90b
90c
90d
90f
90g
91
92
93
94
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97
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101
2
8
10
11
12
13
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74
75
80
100
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159

FIG.6

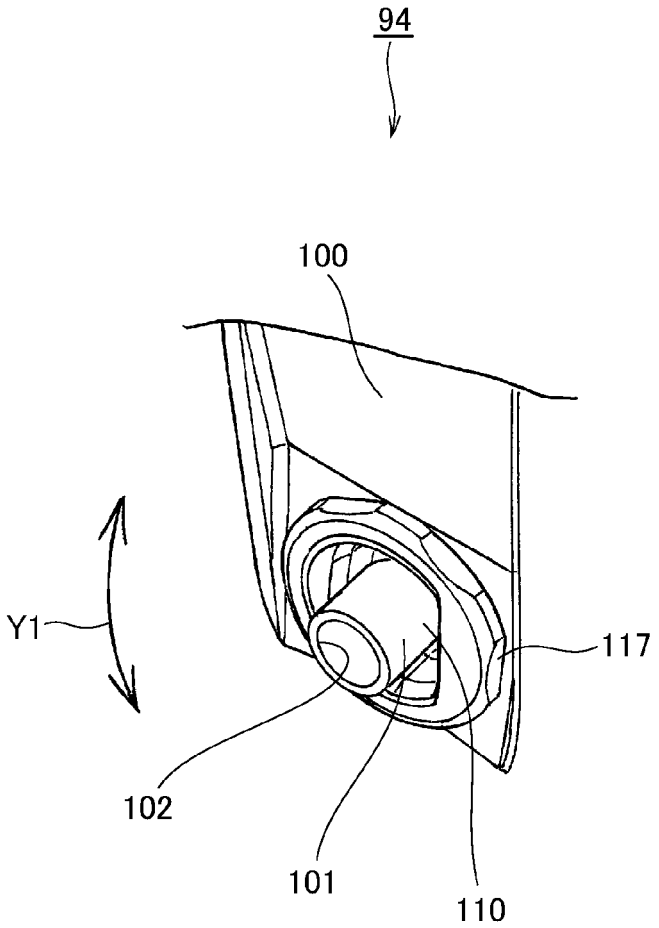


FIG.7

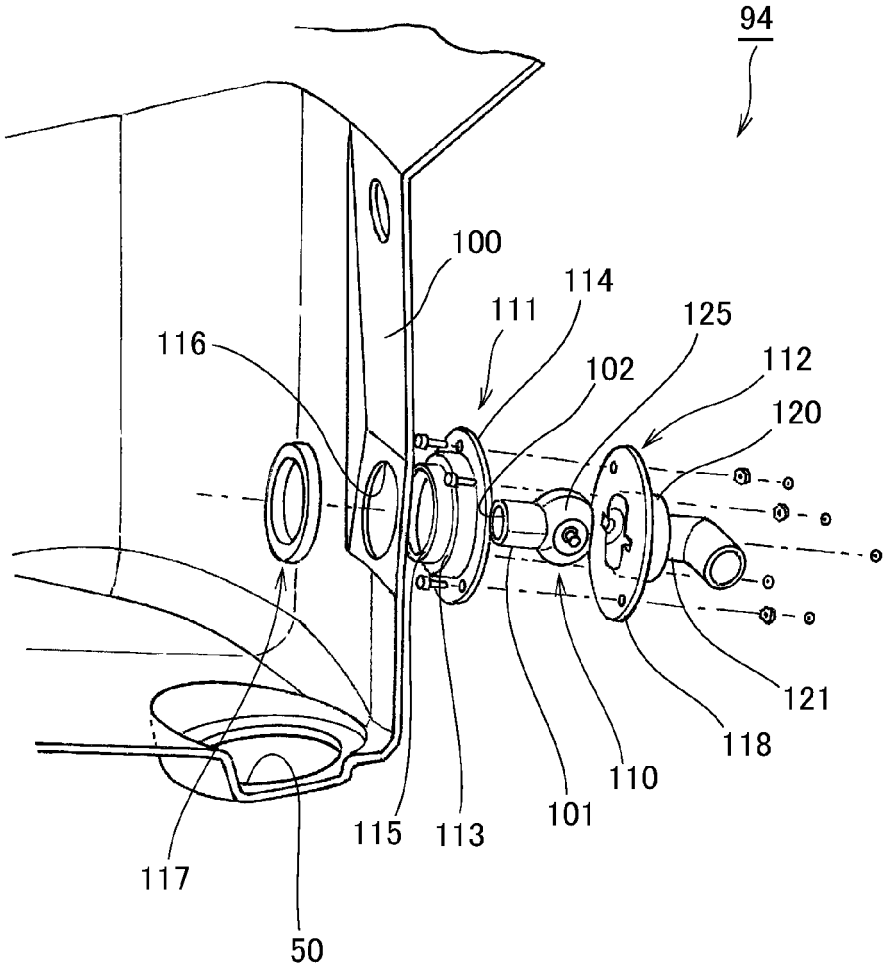


FIG.8B

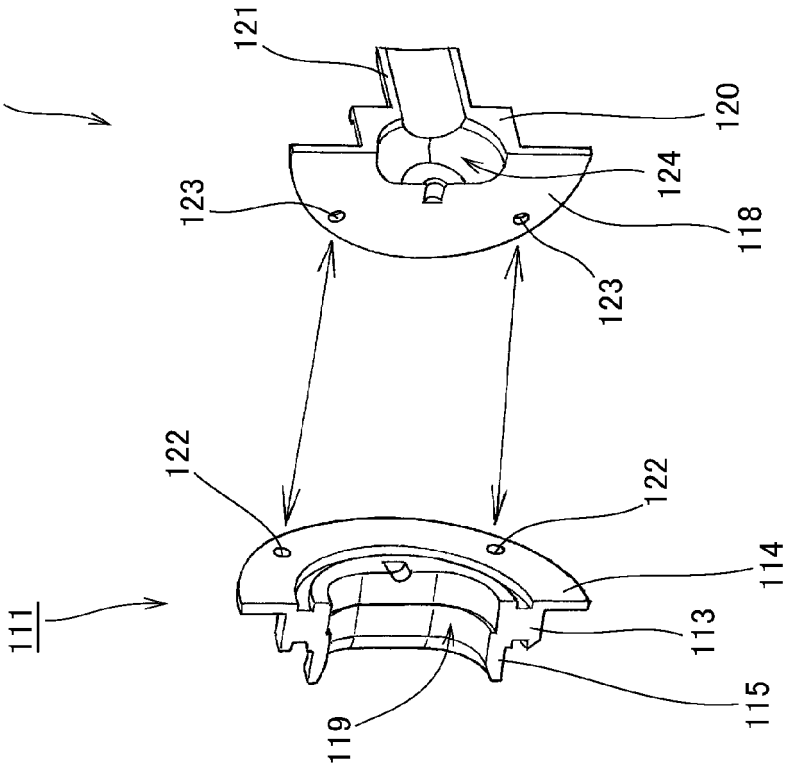

112
121
120
123
124
118
123
122
122
114
111
113
115
119

FIG.8A

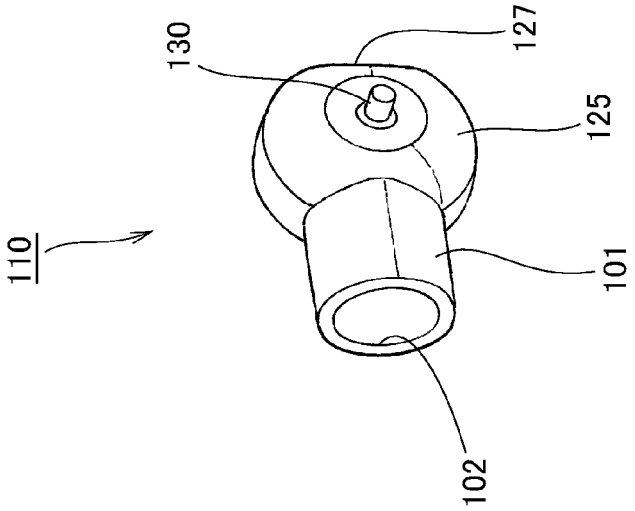

130
127
125
110
101
102

FIG.9

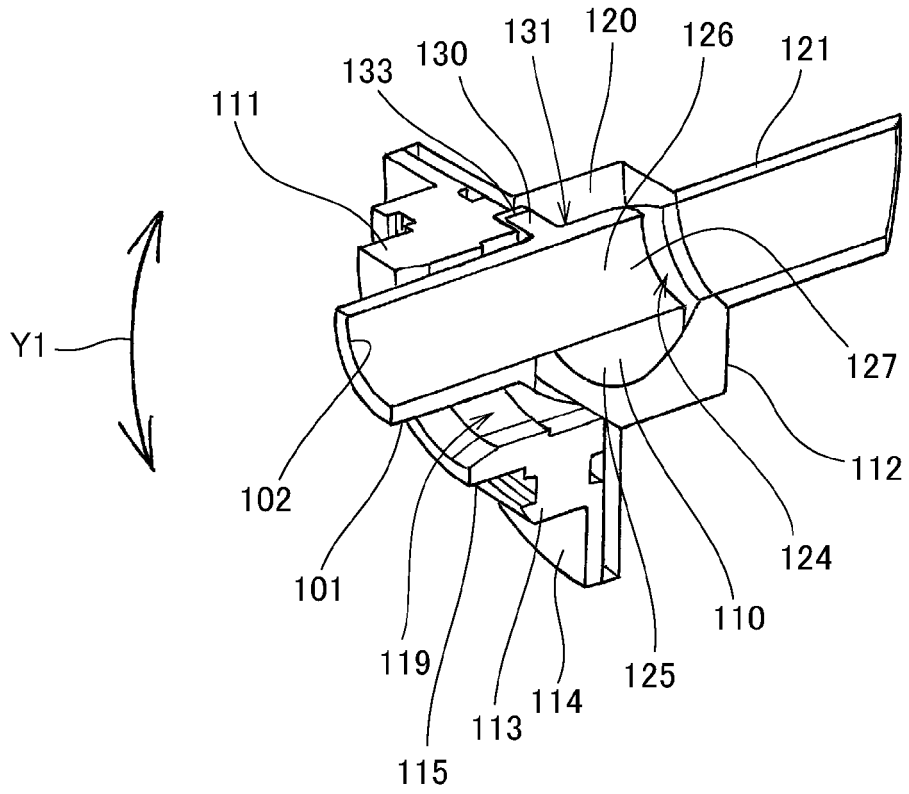

131
120
126
121
130
133
111
Y1
127
112
102
124
101
110
119
125
114
113
115

FIG.10B

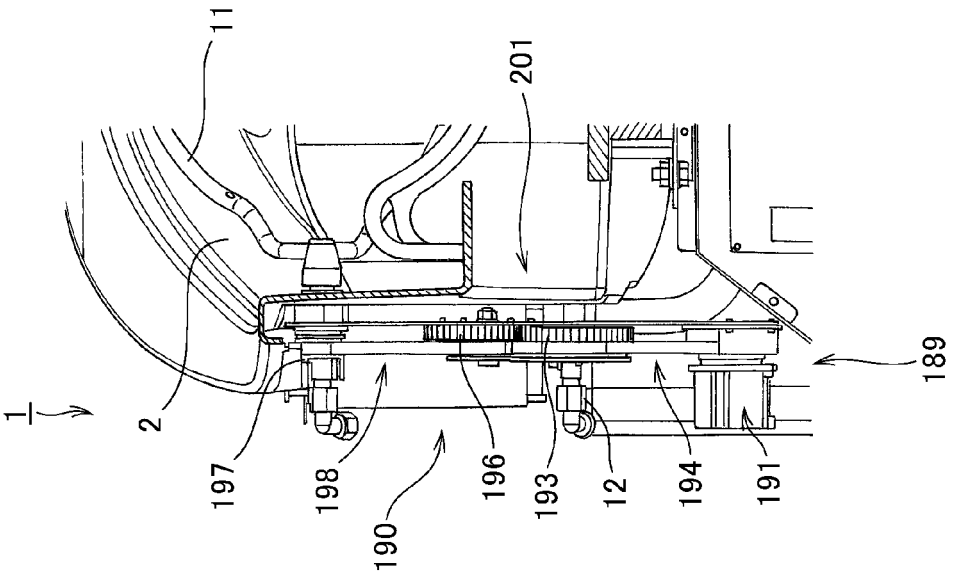


FIG.10A

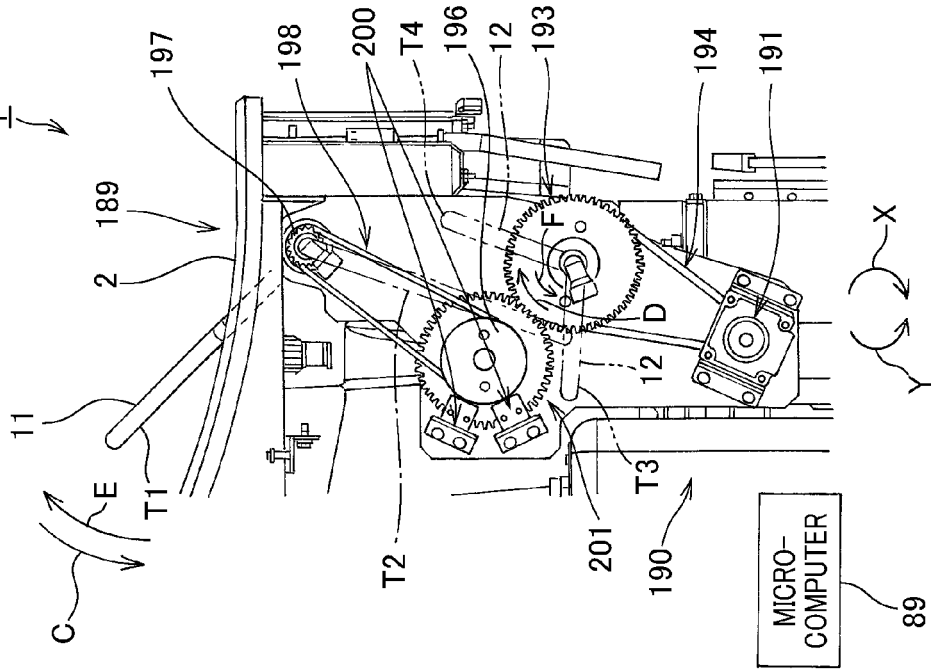


FIG.11

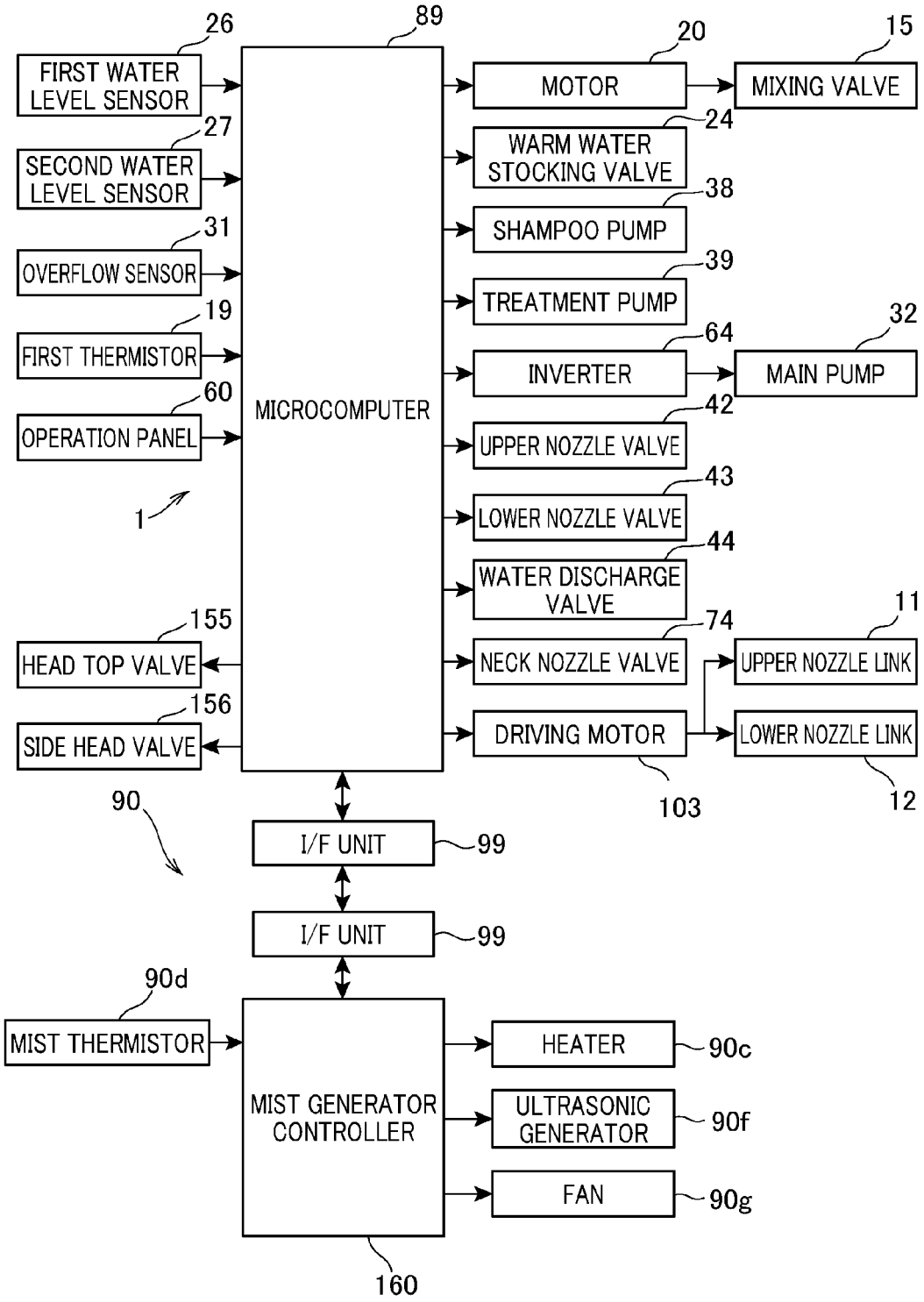

26
FIRST WATER LEVEL SENSOR
27
SECOND WATER LEVEL SENSOR
31
OVERFLOW SENSOR
19
FIRST THERMISTOR
60
OPERATION PANEL
1
89
MICROCOMPUTER
155
HEAD TOP VALVE
156
SIDE HEAD VALVE
20
MOTOR
15
MIXING VALVE
24
WARM WATER STOCKING VALVE
38
SHAMPOO PUMP
39
TREATMENT PUMP
64
INVERTER
32
MAIN PUMP
42
UPPER NOZZLE VALVE
43
LOWER NOZZLE VALVE
44
WATER DISCHARGE VALVE
74
NECK NOZZLE VALVE
11
UPPER NOZZLE LINK
DRIVING MOTOR
LOWER NOZZLE LINK
103
12
90
I/F UNIT
99
I/F UNIT
99
90d
MIST THERMISTOR
MIST GENERATOR CONTROLLER
160
HEATER
90c
ULTRASONIC GENERATOR
90f
FAN
90g

FIG.12

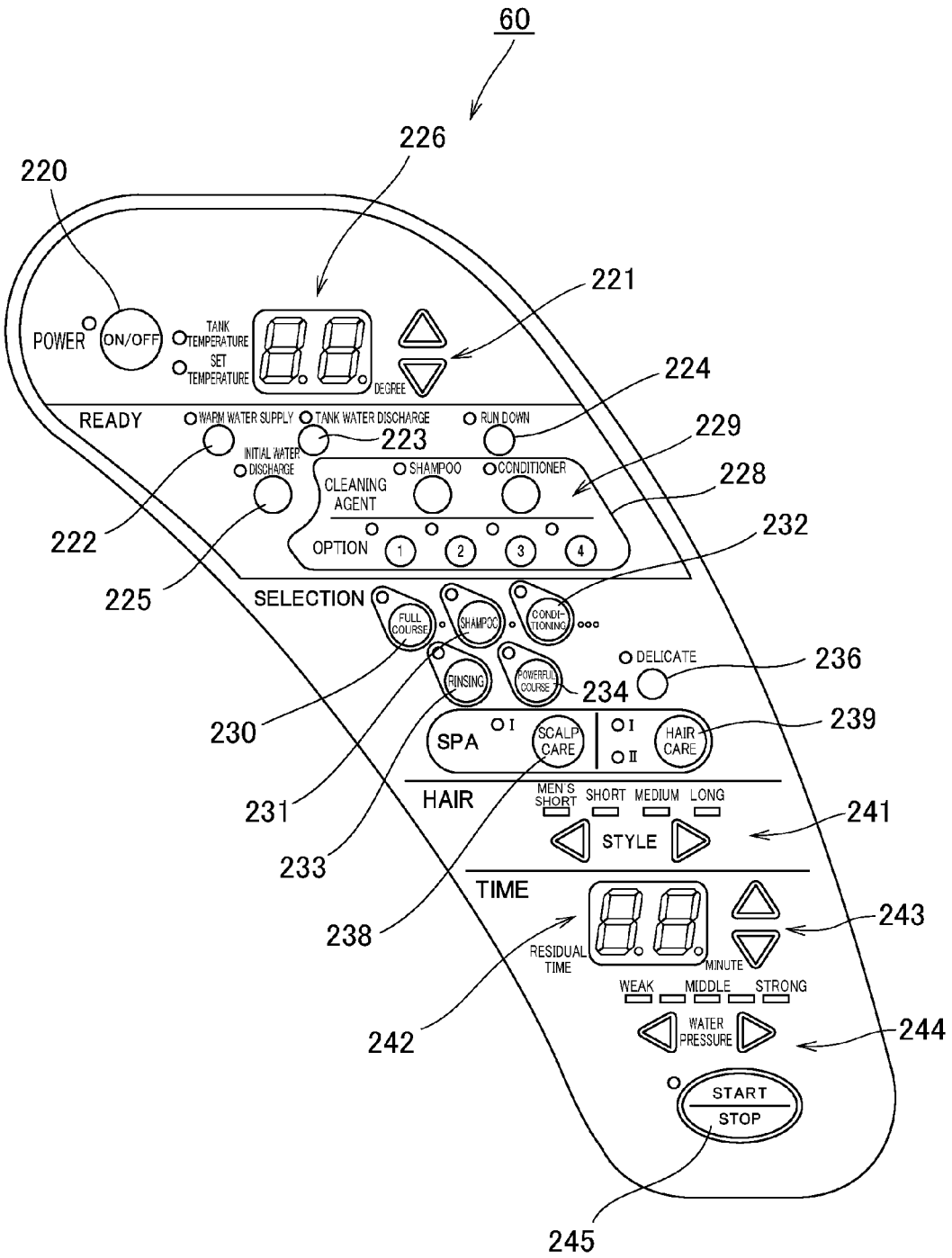

60
226
220
221
224
229
228
223
222
232
225
230
236
234
239
231
233
238
241
243
242
244
245
POWER
ON/OFF
TANK TEMPERATURE
SET TEMPERATURE
DEGREE
READY
WARM WATER SUPPLY
TANK WATER DISCHARGE
RUN DOWN
INITIAL WATER DISCHARGE
SHAMPOO
CONDITIONER
CLEANING AGENT
OPTION
1
2
3
4
SELECTION
FULL COURSE
SHAMPOO
CONDITIONING
RINSING
POWERFUL COURSE
DELICATE
SPA
I
SCALP CARE
I
II
HAIR CARE
HAIR
MEN'S SHORT
SHORT
MEDIUM
LONG
STYLE
TIME
RESIDUAL TIME
MINUTE
WEAK
MIDDLE
STRONG
WATER PRESSURE
START
STOP

FIG.13

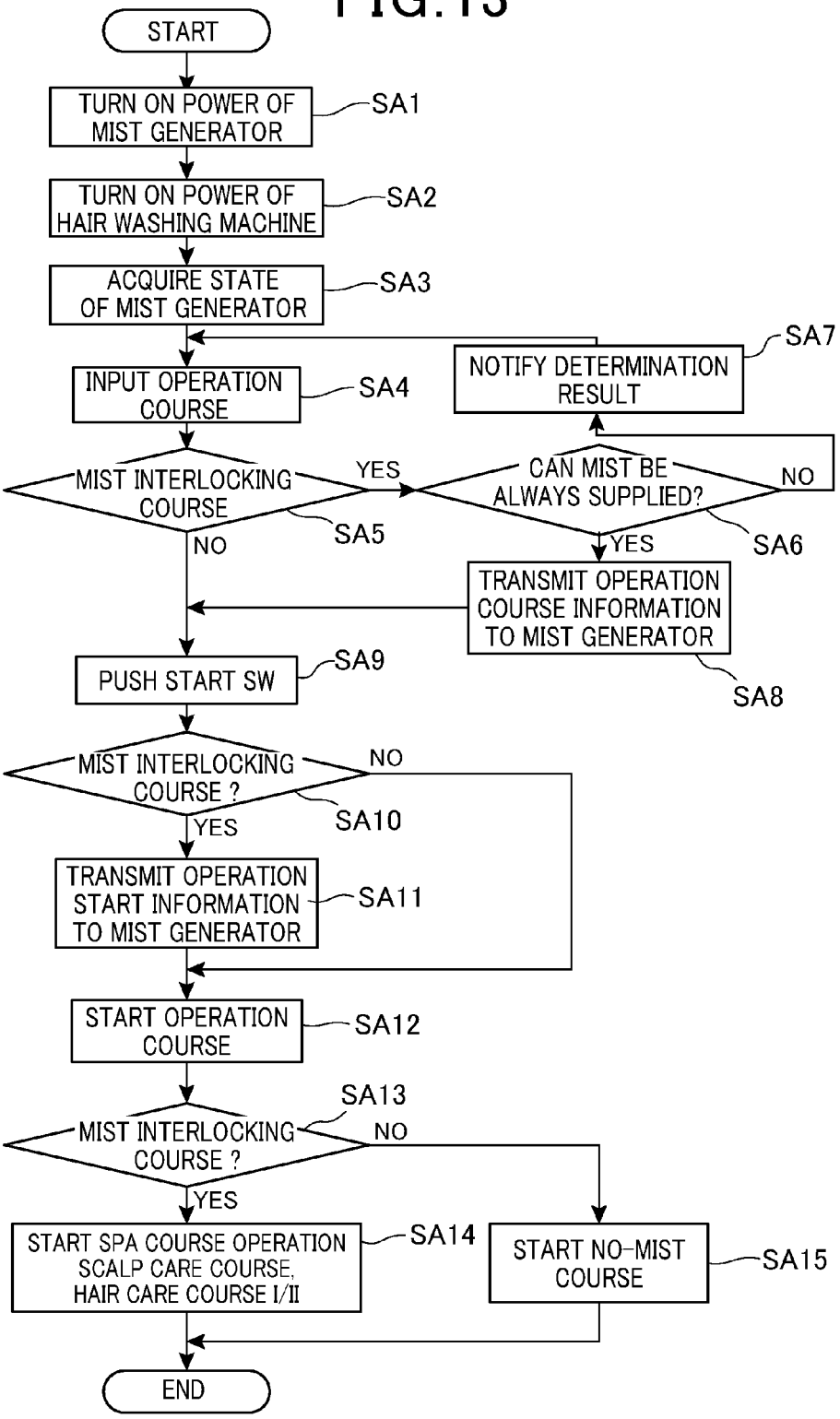

START
TURN ON POWER OF MIST GENERATOR
SA1
TURN ON POWER OF HAIR WASHING MACHINE
SA2
ACQUIRE STATE OF MIST GENERATOR
SA3
INPUT OPERATION COURSE
SA4
MIST INTERLOCKING COURSE
YES
SA5
NO
CAN MIST BE ALWAYS SUPPLIED?
NO
YES
SA6
NOTIFY DETERMINATION RESULT
SA7
TRANSMIT OPERATION COURSE INFORMATION TO MIST GENERATOR
SA8
PUSH START SW
SA9
MIST INTERLOCKING COURSE ?
NO
YES
SA10
TRANSMIT OPERATION START INFORMATION TO MIST GENERATOR
SA11
START OPERATION COURSE
SA12
SA13
MIST INTERLOCKING COURSE ?
NO
YES
START SPA COURSE OPERATION SCALP CARE COURSE, HAIR CARE COURSE I/II
SA14
START NO-MIST COURSE
SA15
END

FIG.14

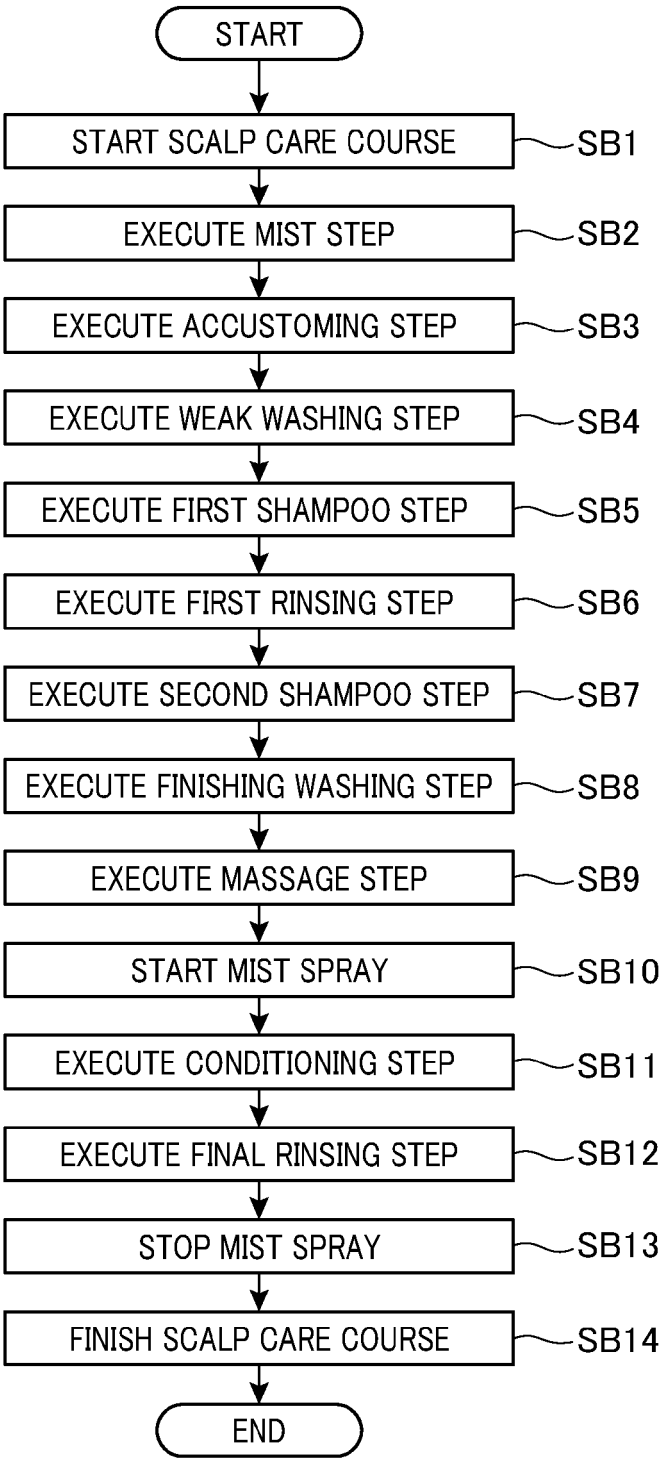

START
START SCALP CARE COURSE
SB1
EXECUTE MIST STEP
SB2
EXECUTE ACCUSTOMING STEP
SB3
EXECUTE WEAK WASHING STEP
SB4
EXECUTE FIRST SHAMPOO STEP
SB5
EXECUTE FIRST RINSING STEP
SB6
EXECUTE SECOND SHAMPOO STEP
SB7
EXECUTE FINISHING WASHING STEP
SB8
EXECUTE MASSAGE STEP
SB9
START MIST SPRAY
SB10
EXECUTE CONDITIONING STEP
SB11
EXECUTE FINAL RINSING STEP
SB12
STOP MIST SPRAY
SB13
FINISH SCALP CARE COURSE
SB14
END

FIG.15

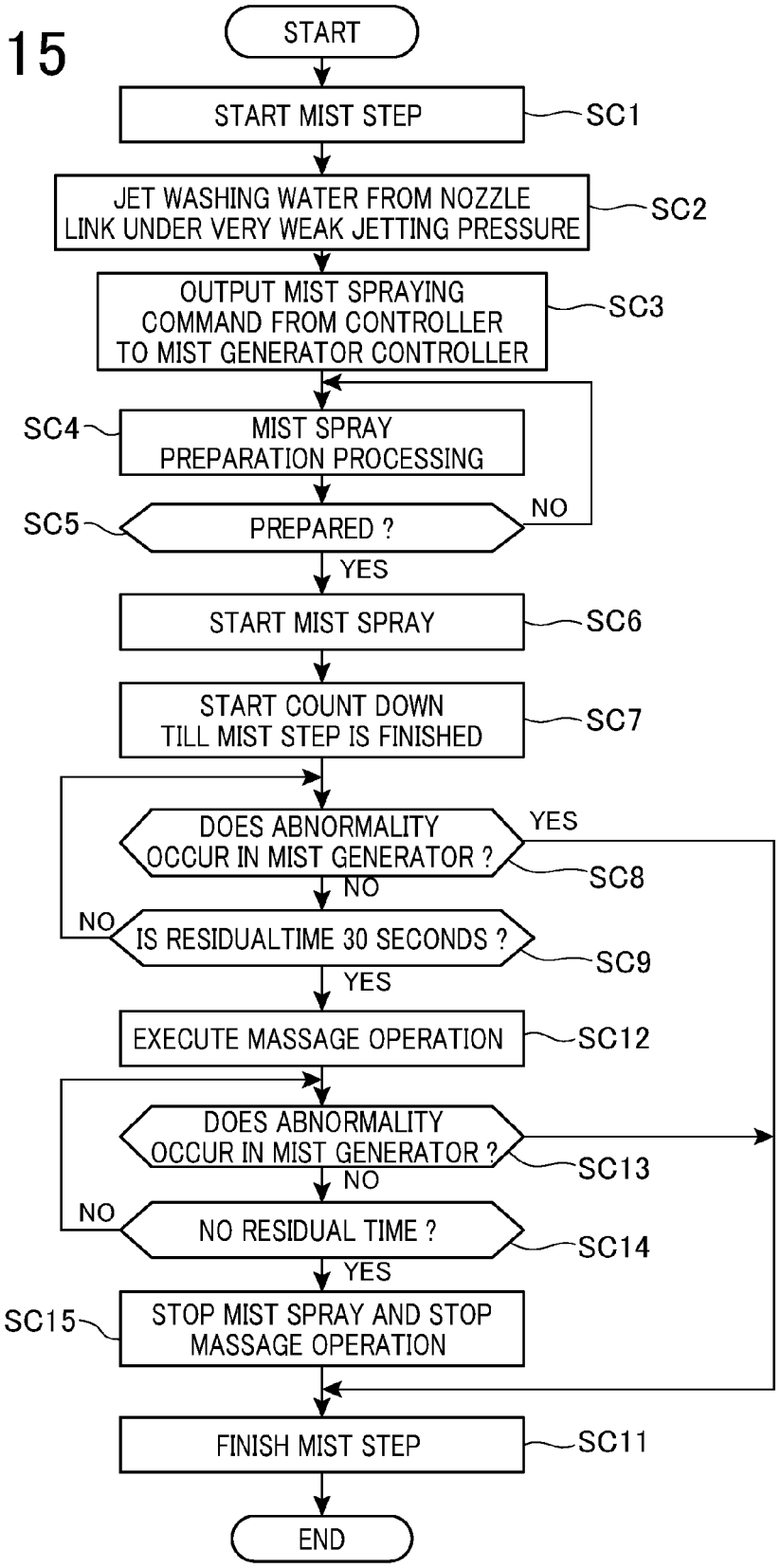

START
START MIST STEP
SC1
JET WASHING WATER FROM NOZZLE LINK UNDER VERY WEAK JETTING PRESSURE
SC2
OUTPUT MIST SPRAYING COMMAND FROM CONTROLLER TO MIST GENERATOR CONTROLLER
SC3
SC4
MIST SPRAY PREPARATION PROCESSING
SC5
PREPARED ?
NO
YES
START MIST SPRAY
SC6
START COUNT DOWN TILL MIST STEP IS FINISHED
SC7
DOES ABNORMALITY OCCUR IN MIST GENERATOR ?
YES
SC8
NO
NO
IS RESIDUALTIME 30 SECONDS ?
SC9
YES
EXECUTE MASSAGE OPERATION
SC12
DOES ABNORMALITY OCCUR IN MIST GENERATOR ?
SC13
NO
NO
NO RESIDUAL TIME ?
SC14
YES
SC15
STOP MIST SPRAY AND STOP MASSAGE OPERATION
FINISH MIST STEP
SC11
END

FIG.16

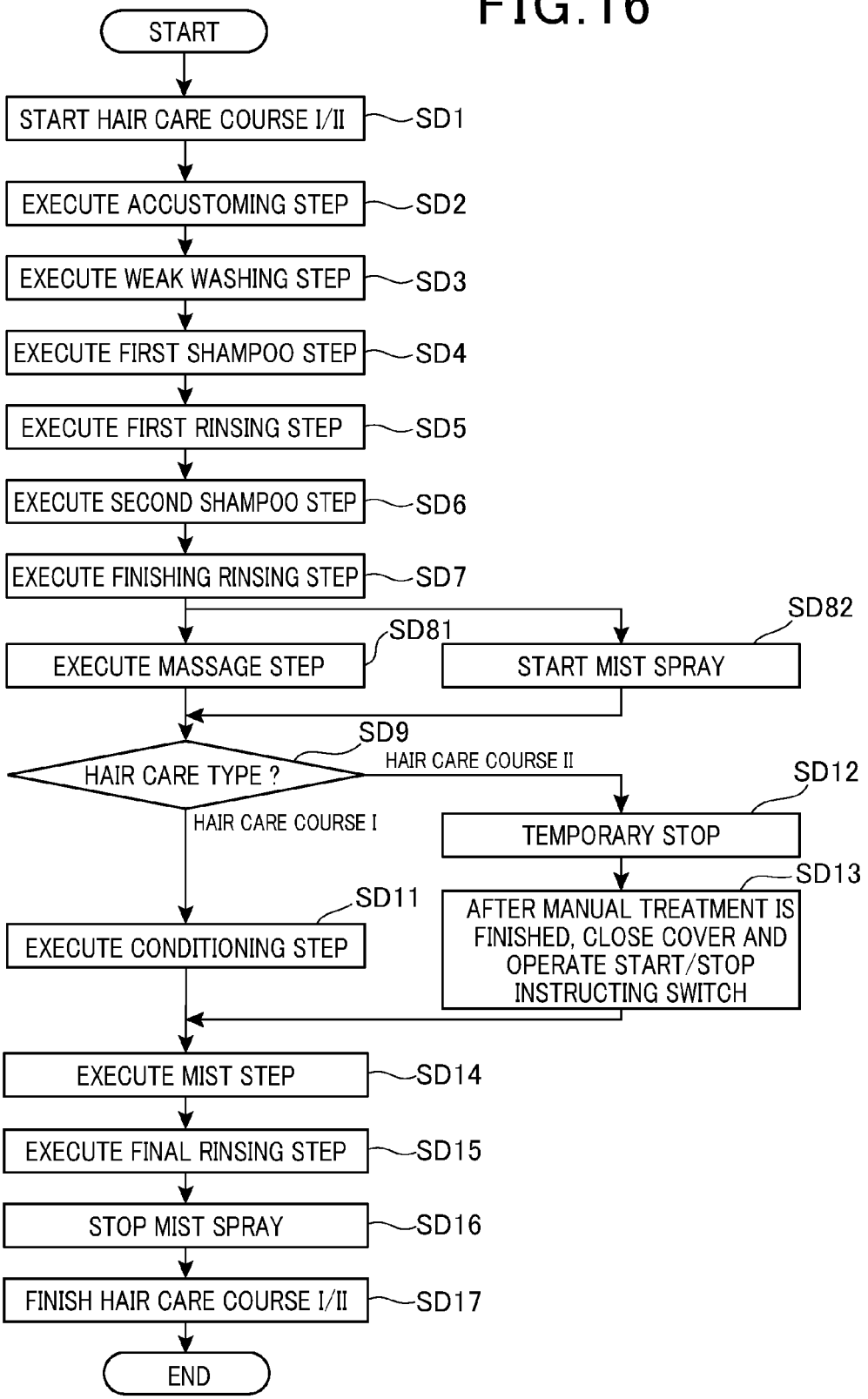
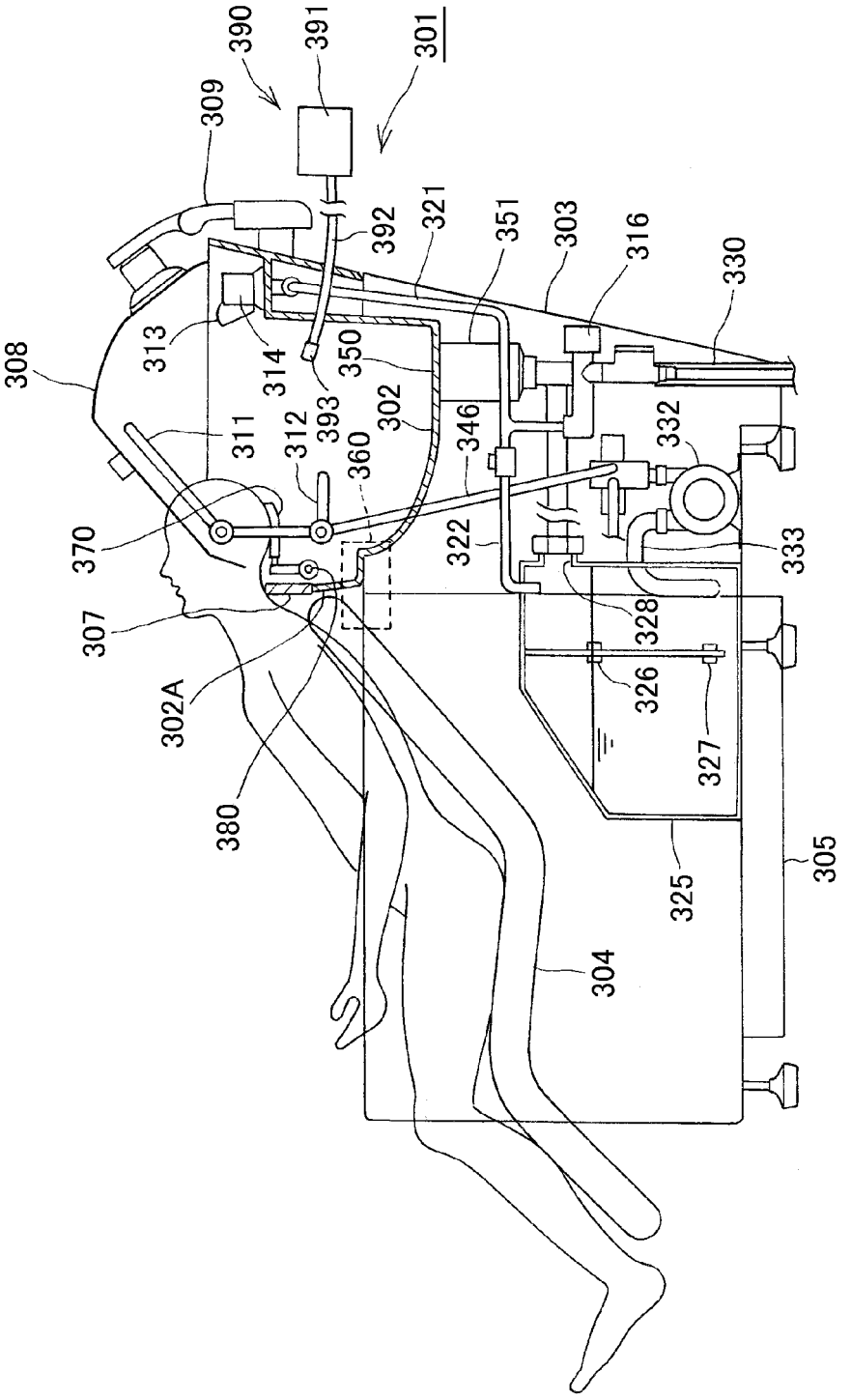

START
START HAIR CARE COURSE I/II
SD1
EXECUTE ACCUSTOMING STEP
SD2
EXECUTE WEAK WASHING STEP
SD3
EXECUTE FIRST SHAMPOO STEP
SD4
EXECUTE FIRST RINSING STEP
SD5
EXECUTE SECOND SHAMPOO STEP
SD6
EXECUTE FINISHING RINSING STEP
SD7
SD82
SD81
EXECUTE MASSAGE STEP
START MIST SPRAY
SD9
HAIR CARE TYPE ?
HAIR CARE COURSE II
SD12
HAIR CARE COURSE I
TEMPORARY STOP
SD13
SD11
AFTER MANUAL TREATMENT IS FINISHED, CLOSE COVER AND OPERATE START/STOP INSTRUCTING SWITCH
EXECUTE CONDITIONING STEP
EXECUTE MIST STEP
SD14
EXECUTE FINAL RINSING STEP
SD15
STOP MIST SPRAY
SD16
FINISH HAIR CARE COURSE I/II
SD17
END

FIG.17


390
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301
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308
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312
360
370
322
333
307
328
326
302A
327
380
325
305
304

FIG.18A

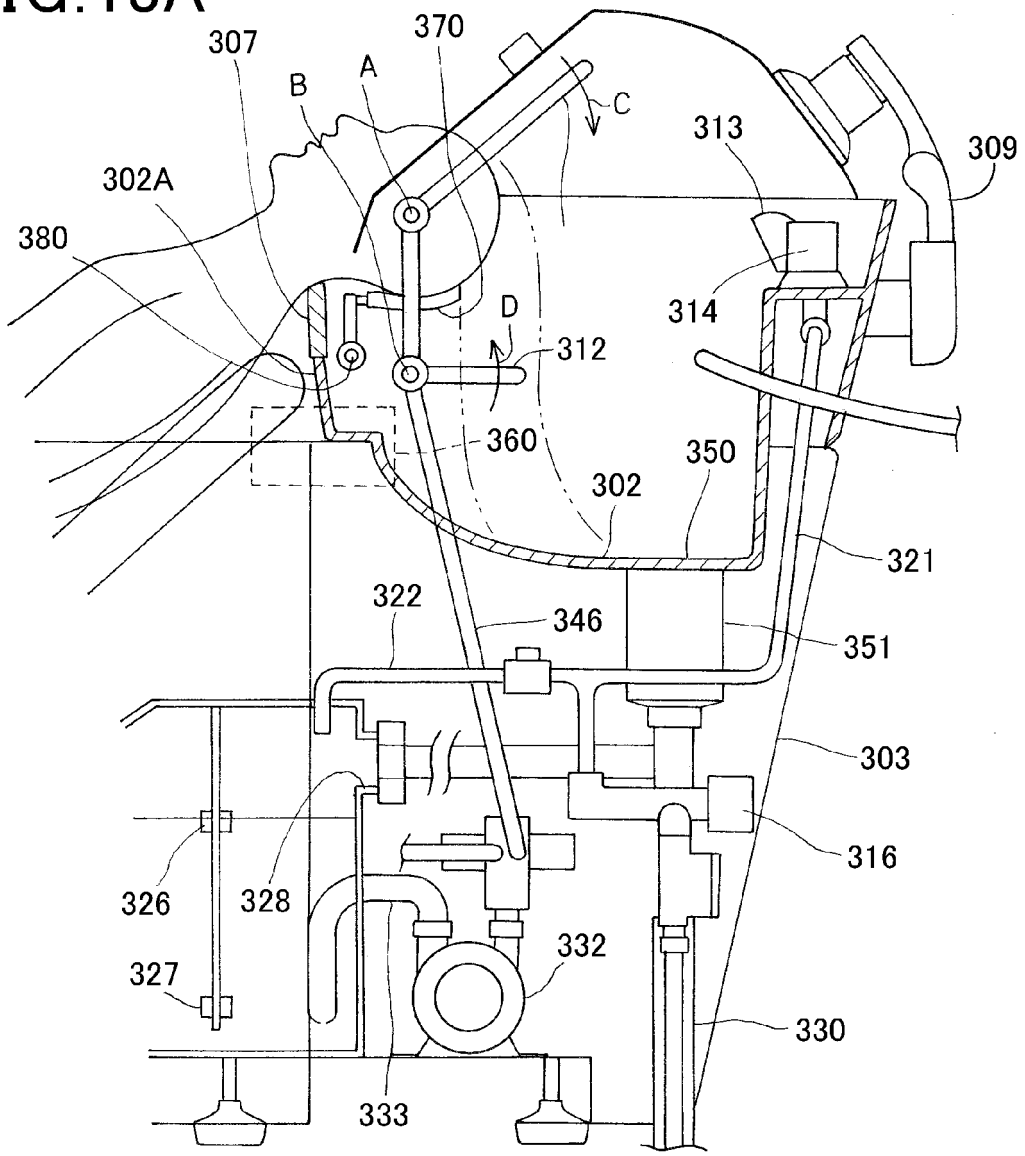


FIG.18B

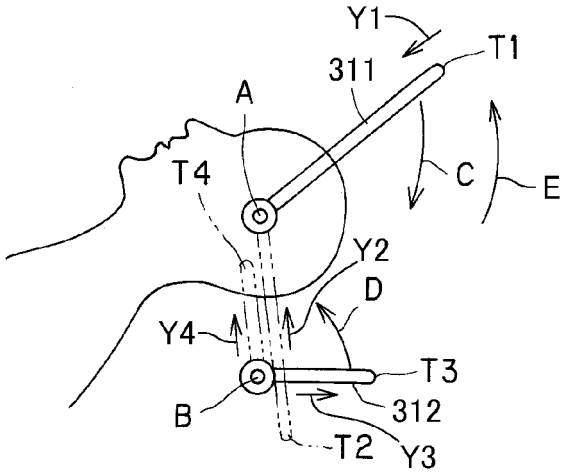
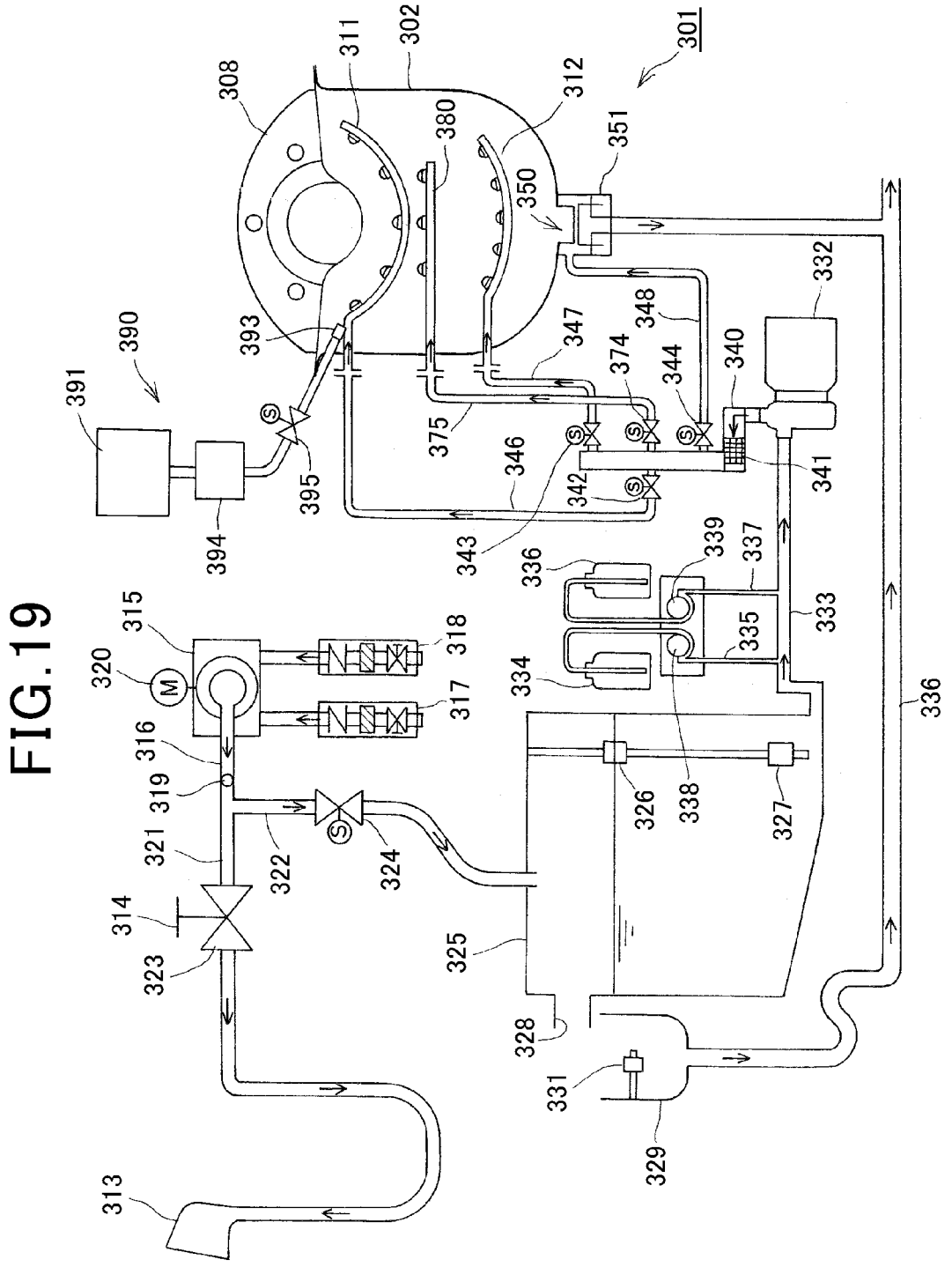


FIG.19


301
302
308
311
312
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318
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327
328
329
331
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FIG.20B

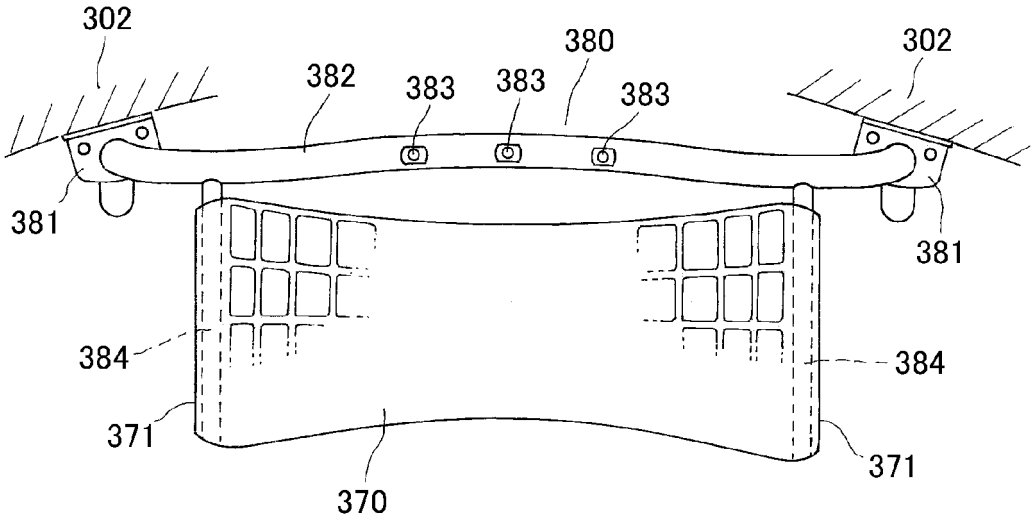


FIG.20A

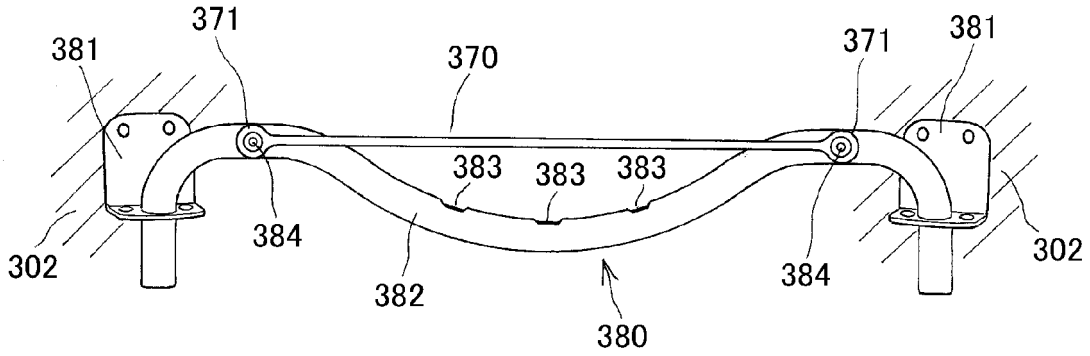


FIG.21A

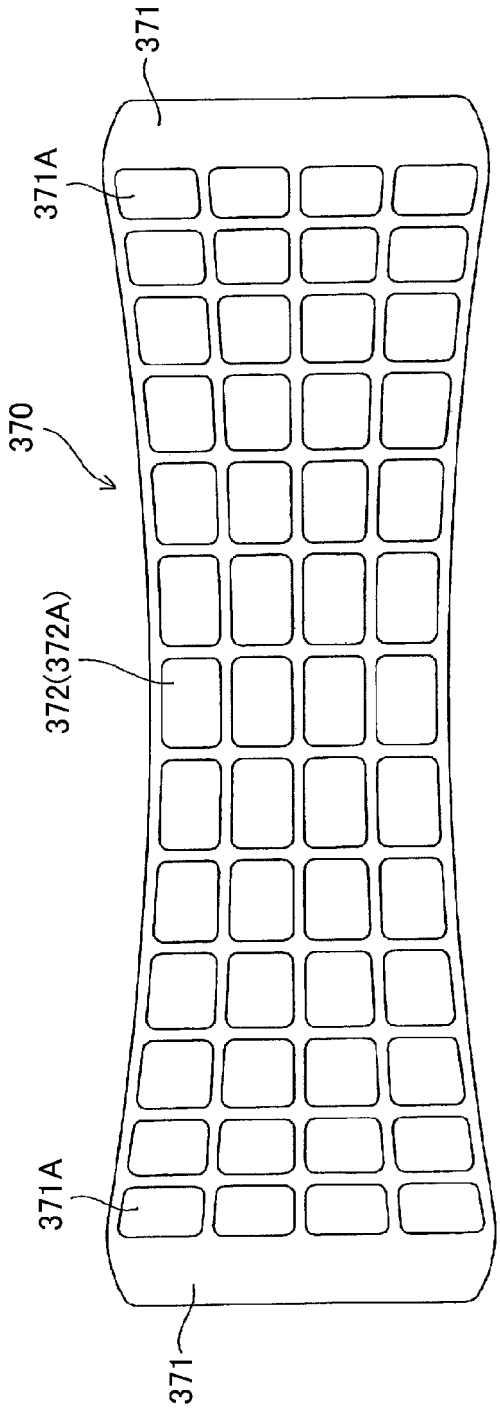


FIG.21B

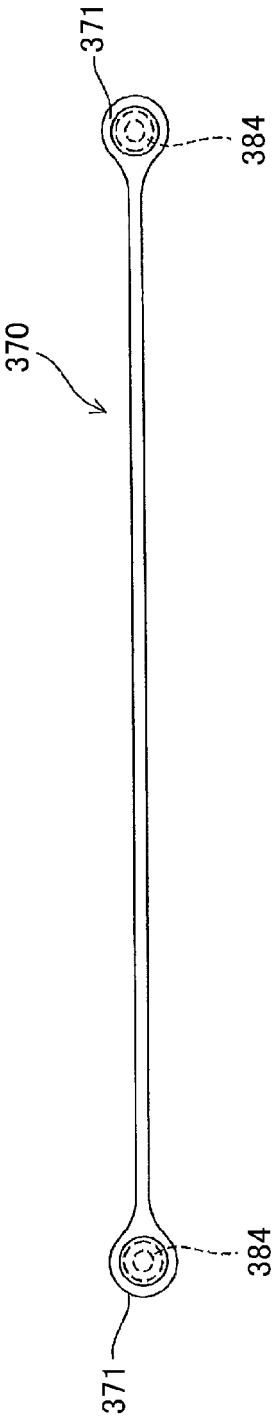


FIG.22

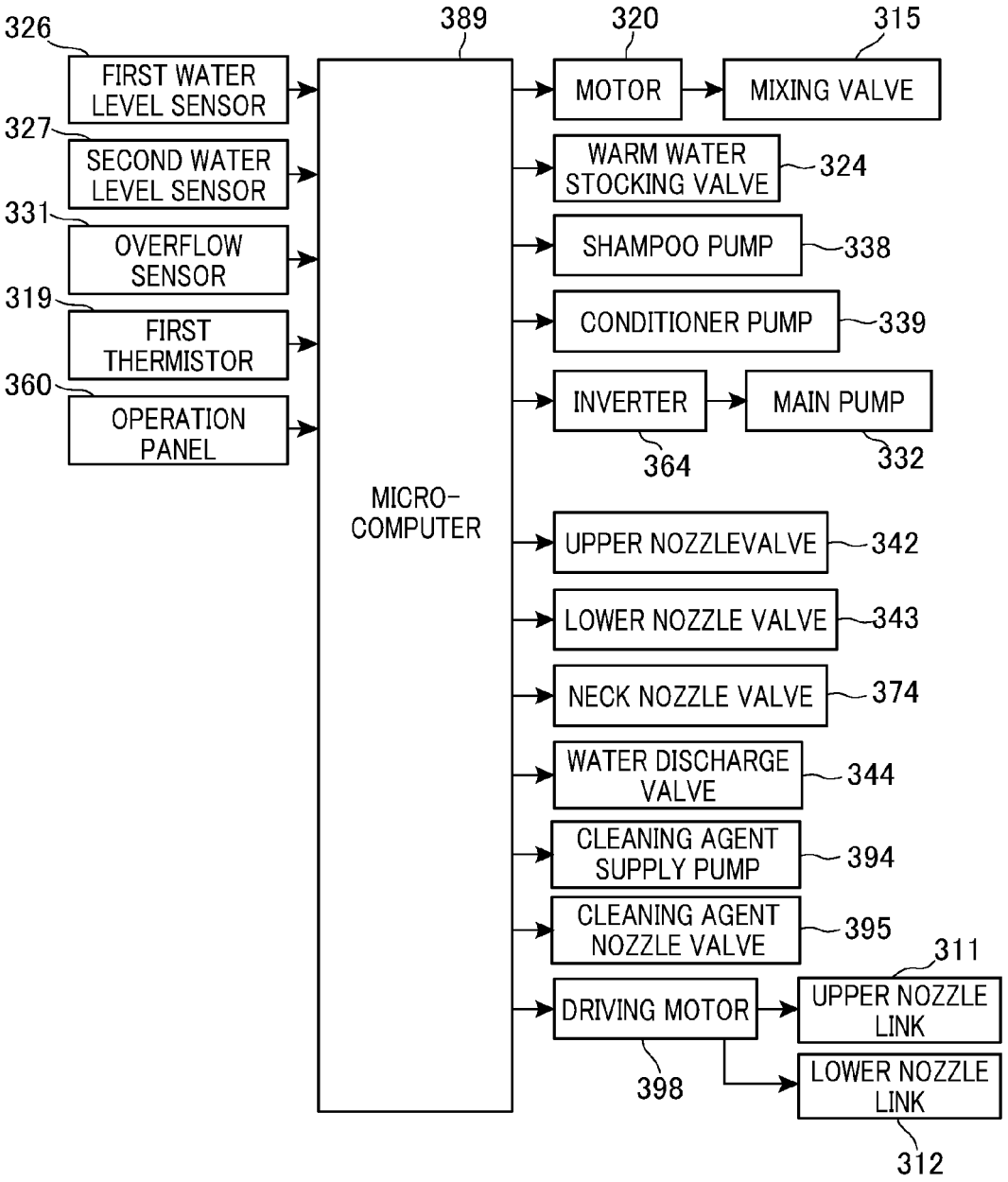

326
FIRST WATER LEVEL SENSOR
327
SECOND WATER LEVEL SENSOR
331
OVERFLOW SENSOR
319
FIRST THERMISTOR
360
OPERATION PANEL
389
MICRO-COMPUTER
320
MOTOR
315
MIXING VALVE
WARM WATER STOCKING VALVE
324
SHAMPOO PUMP
338
CONDITIONER PUMP
339
INVERTER
364
MAIN PUMP
332
UPPER NOZZLEVALVE
342
LOWER NOZZLE VALVE
343
NECK NOZZLE VALVE
374
WATER DISCHARGE VALVE
344
CLEANING AGENT SUPPLY PUMP
394
CLEANING AGENT NOZZLE VALVE
395
DRIVING MOTOR
398
311
UPPER NOZZLE LINK
LOWER NOZZLE LINK
312

FIG.23

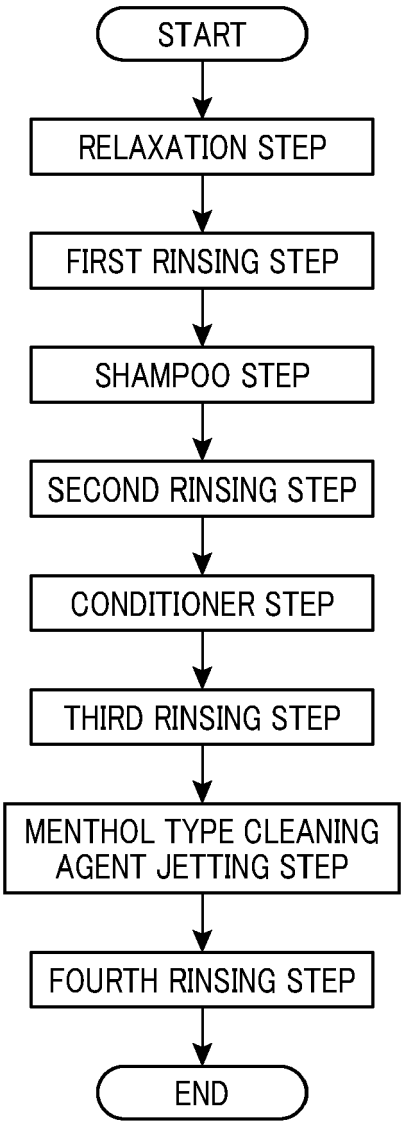

START
RELAXATION STEP
FIRST RINSING STEP
SHAMPOO STEP
SECOND RINSING STEP
CONDITIONER STEP
THIRD RINSING STEP
MENTHOL TYPE CLEANING AGENT JETTING STEP
FOURTH RINSING STEP
END

FIG.24A

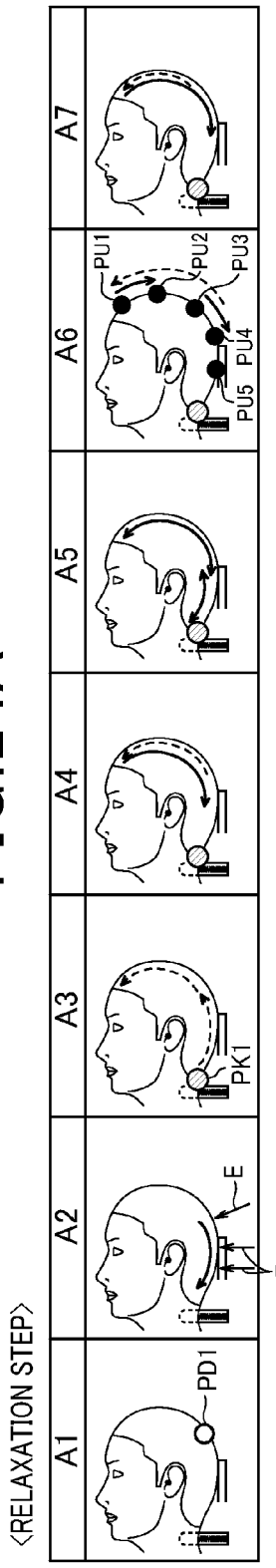


FIG.24B

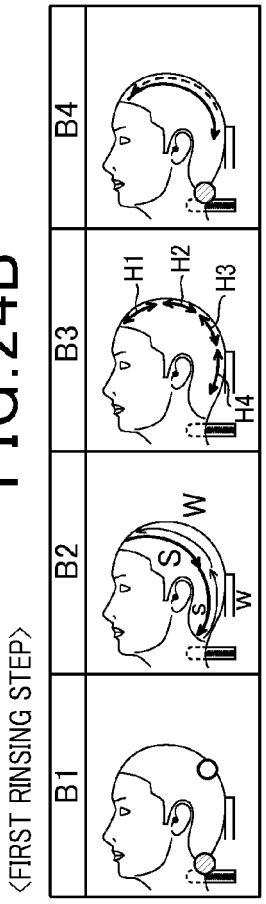


FIG.24C

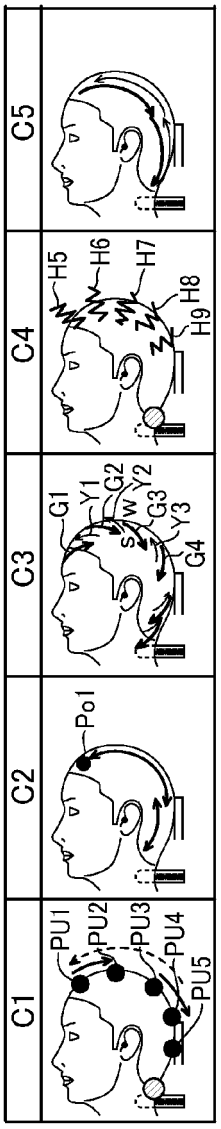
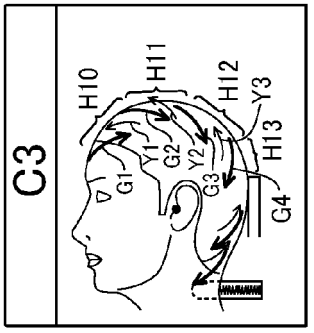


FIG.24D



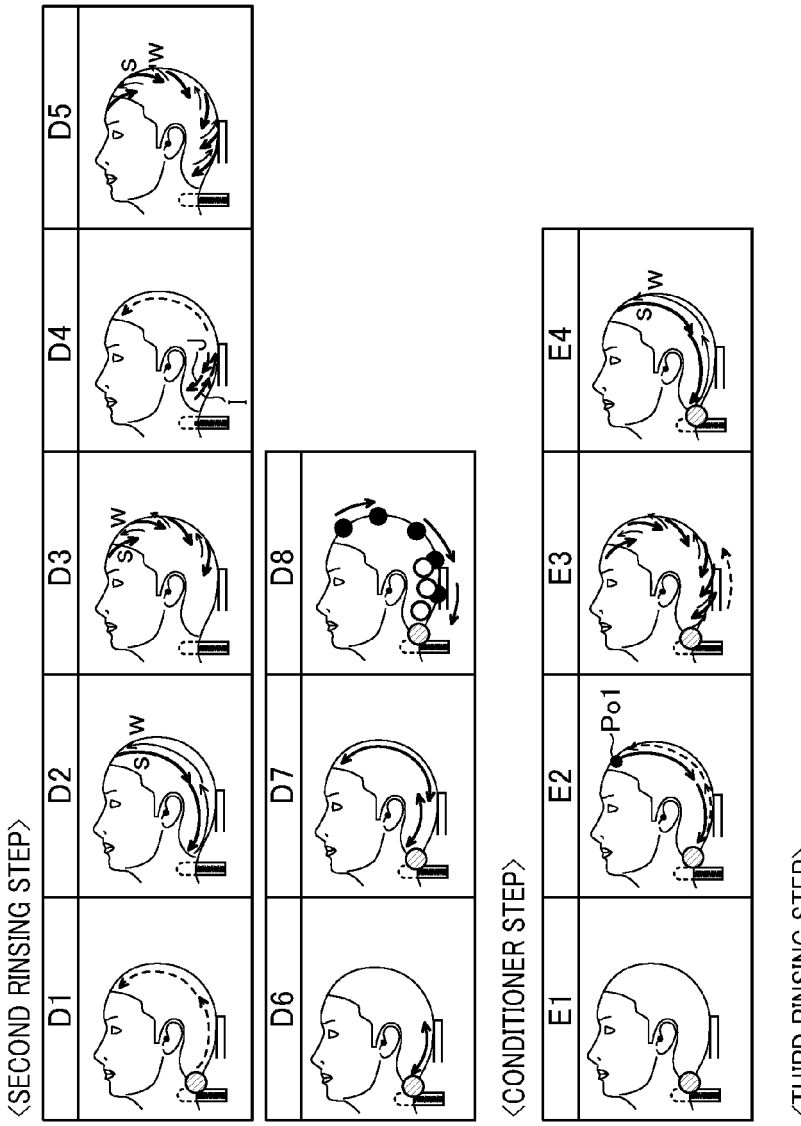


FIG.25A

FIG.25B

FIG.25C

FIG.26A

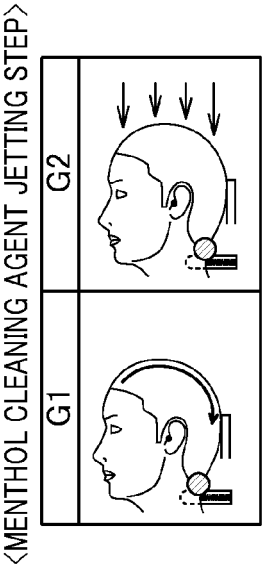
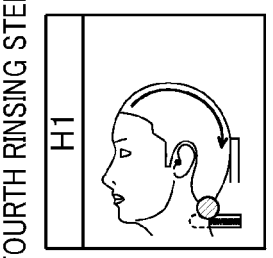


FIG.26B



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EUROPEAN SEARCH REPORT

Application Number
EP 11 15 9731

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X	WO 94/05179 A1 (TOTO LTD [JP]; IGARASHI JUN [JP]; AISO KAZUYA [JP]; AZUMA TSUTOMU [JP]) 17 March 1994 (1994-03-17)	1-12	INV. A45D19/06 A45D19/16
Y	* the whole document *	13-17	
Y	EP 0 856 266 A1 (SANYO ELECTRIC CO [JP]) 5 August 1998 (1998-08-05) * abstract * * column 6, line 12 - column 7, line 37 *	13-17	
A	WO 2005/029998 A1 (HYDROCO AUSTRALIA PTY LTD [AU]; GAY BRIAN [AU]) 7 April 2005 (2005-04-07) * line 11 - page 10, line 9 *	1	

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A45D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12 July 2011	Nicolás, Carlos

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1

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12-07-2011

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