HEAD CARE SYSTEM AND HAIR WASHING APPARATUS USING THE SYSTEM

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Abstract:
A head care system (hair washing apparatus 100) according to the present invention includes a base (bowl 101) having a head support 11 for supporting a head 10 of a human. The system includes a pair of arm units (washing unit 12) for taking care of the head 10. Each of the arm units has a support shaft mounted to the base. The arm units are arranged such that the head support 11 is located between the pair of arm units. The system includes a pair of shaft driving members for driving the arm units in such a manner that each of the arm units rotates about the corresponding support shaft. The system includes a controller 400 for controlling driving operations of the shaft driving members. Each of the arm units includes a contact arm (third arm 107L, 108L, 107R, 108R) having a plurality of contacts equipped on tips of the contact arm, a secondary arm (second arm 106L, 106R) for rotatably supporting the contact arm, and a main arm (first arm 105L, 105R) which rotatably supports the secondary arm and is rotatably supported by the base. The main arm has a four-link mechanism.
Fig. 5
HEAD CARE SYSTEM AND HAIR WASHING APPARATUS USING THE SYSTEM

TECHNICAL FIELD

[0001] The present invention relates to a head care system for automatically taking care of the head of a human and a hair washing apparatus using the system, both of which may be utilized in the medical field, the beauty field and so on.

[0002] BACKGROUND ART

[0003] A washing treatment for the head of a human is exemplary one of cares for the head of the human. In regard to the beauty field in which hair dressing, haircut or the like is performed, the washing treatment for the head having hair which requires manual labor, has been expected to be automated. Meanwhile, in regard to the medical field also, the washing treatment for the head having hair of a patient or the like accommodated in a hospital which requires manual labor, has been expected to be automated.

[0004] There has been conventionally known an automatic head washing apparatus as disclosed in JP 2001-149113 A or the like, which automatically washes the head of a human. FIG. 8 is a view showing a schematic structure of a main portion of a conventional automatic head washing apparatus. As shown in FIG. 8, the conventional automatic head washing apparatus is equipped with a washing unit 1 of nozzle type having a plurality of comb-shaped projections 2 arranged at regular intervals on an arc-like inner periphery of the washing unit 1. Each of the comb-shaped projections 2 is equipped with a nozzle 2a for washing the scalp of the human, the nozzle 2a being disposed on the tip of the projection 2. On the other hand, a nozzle 1a for washing the hair of the head is equipped between respective two adjacent comb-shaped projections 2. The nozzles 1a and the nozzles 2a are connected to a liquid switching member 3 through some liquid supply channels (not shown), the liquid switching member 3 being adapted to switch the liquid to be ejected. The liquid supply channels are equipped in the washing unit 1 in such a manner that they separately supply the nozzles 1a and to the nozzles 2a with the liquid. Thus, a washing agent or a washing liquid is ejected through the nozzles 1a and nozzles 2a toward the scalp and hair of the head of the human so as to wash the head.

[0005] The washing unit 1 is adapted to be driven by a reciprocating drive unit 4 through a rack 4a and a pinion 4b, and to be moved in the direction indicated by an arrow 4c. By virtue of this structure, the washing unit 1 can wash the scalp and hair of the head over an increased area of the head. The washing unit 1, the liquid switching member 3 and the reciprocating drive unit 4 are supported by a washing unit support 5. In order to wash the scalp and hair of the whole head of the human, the washing unit support 5 is adapted to be driven by a rotary drive unit 6 through some gears 8 and so on and to be rotated about the central axis of a shaft 7. In regard to the automatic head washing apparatus having the above-mentioned structure, the liquid switching member 3, the reciprocating drive unit 4 and the rotary drive unit 6 are controlled in conjunction with one another so that the operation for washing the head is performed. In consequence, the scalp and hair of the whole head of the human can be automatically washed so that manual labor may be omitted.

[0006] On the other hand, JP 2011-72631 A discloses an apparatus for taking care of the scalp of a human (although it does not wash the head of the human), which applies a stimulus to the scalp of the human by rotating some protrusions, and stops the rotation of the protrusions when information indicating an overload for the scalp is detected.

SUMMARY OF INVENTION

Problems to be Solved by the Invention

[0007] In regard to the conventional automatic head washing apparatus described above, the whole head of the human may be washed by the nozzles (Nozzles 1a and 2a) fixed to the single washing unit (washing unit 1). However, if the shape of the washing unit does not fit with the shape of the head of the human, the contacting situation between the washing unit and the head of the human becomes non-uniform. As a result, in regard to the conventional automatic head washing apparatus, there is such a problem that it is impossible to sufficiently wash the scalp or hair of the head of the human so that a sufficient washing effect cannot be achieved.

[0008] The present invention which has been made to solve the above-mentioned problem, has an object to provide a head care system which can effectively and surely take care of the head of a human in dependence upon the shape of the head of the human regardless of differences among the shapes of the heads of humans, and further to provide a hair washing apparatus using the head care system.

Means for solving the Problems

[0009] A head care system according to the present invention which has been made to achieve the above-mentioned object, is characterized as follows. The system includes a base having a head support for supporting the head of a human, a pair of arm units for taking care of the head, a pair of shaft driving members for driving the arm units, and a controller for controlling driving operations of the shaft driving members. Each of the arm units has a support shaft mounted to the base. The pair of arm units are arranged in such a manner that the head support is located between the pair of arm units. The shaft driving members drive the arm units in such a manner that each of the arm units rotates about the central axis of the corresponding support shaft. Each of the arm units includes a contact arm having a plurality of contacts equipped on tips of the contact arm, a secondary arm for rotatably supporting the contact arm, and a main arm which rotatably supports the secondary arm and is rotatably supported by the base. The main arm has a four-link mechanism.

[0010] Meanwhile, a hair washing apparatus according to the present invention which has been made to achieve the above-mentioned object, is characterized in that it includes a head care system according to the present invention, wherein the arm unit for taking care of the head of the human is a washing unit for washing the head.

Advantages of the Invention

[0011] In each of a head care system and a hair washing apparatus including the system according to the present invention, it is achieved such an advantage that it is possible to efficiently and surely take care of the head of a human in dependence upon the shape of the head regardless of differences among the shapes of the heads.

BRIEF DESCRIPTION OF DRAWINGS

[0012] FIG. 1 is a perspective view schematically showing the structure of a hair washing apparatus according to an embodiment of the present invention.
FIG. 2 is a schematic view showing the structure of a first main portion of a driving mechanism of the hair washing apparatus according to the embodiment.

FIG. 3 is a perspective view showing a second main portion of the driving mechanism of the hair washing apparatus according to the embodiment.

FIG. 4 is a side view showing the second main portion of the driving mechanism of the hair washing apparatus according to the embodiment.

FIG. 5 is a perspective view showing a third main portion of the driving mechanism of the hair washing apparatus according to the embodiment.

FIG. 6 is a side view showing the action of the second main portion of the driving mechanism of the hair washing apparatus according to the embodiment.

FIG. 7 is a side view showing the action of a hair washing apparatus which is equipped with a first arm having a single-link mechanism instead of a first arm having a four-link mechanism.

FIG. 8 is a schematic view showing the structure of a main portion of a conventional automatic head washing apparatus.

BEST MODE FOR CARRYING OUT THE INVENTION

An embodiment according to the present invention will be described hereinafter with reference to the accompanying drawings. In regard to the drawings, like structural elements are denoted by like reference numerals in order to avoid duplicate descriptions. Meanwhile, some of the drawings schematically illustrate the structural elements relevant thereto in order to facilitate understanding of the drawing.

As an embodiment of the present invention, it will be described a hair washing apparatus for automatically washing the head of a human, which is an example of a head care system for automatically taking care of the head of the human. In regard to the present invention, the term “take care of the head of a human” means to perform at least one of “washing of the scalp of the human”, “washing of the hair of the head of the human”, and “head massage for the human”.

FIG. 1 is a perspective view which schematically shows the structure of a hair washing apparatus according to an embodiment of the present invention as a perspective view. FIG. 2 is a schematic view which shows the structure of a first main portion of a driving mechanism of the hair washing apparatus according to the embodiment. FIG. 3 is a perspective view which shows a second main portion of the driving mechanism of the hair washing apparatus according to the embodiment. FIG. 4 is a side view which shows the second main portion of the driving mechanism of the hair washing apparatus according to the embodiment. An X-axis, a Y-axis and a Z-axis are described in each of FIGS. 2-4, where the Z-axis indicates the vertical direction while each of the X-axis and the Y-axis (perpendicular to the X-axis) indicates a direction perpendicular to the Z-axis.

As shown in FIG. 1, a hair washing apparatus 100 according to the embodiment of the present invention has a bowl 101. The bowl 101 which is an example of the base, has a head support 11 for supporting the head 10 of a human, and is adapted to surround approximately half of the outer surface of the head 10 at the back side of the head 10. Two support columns 102L and 102R are equipped in a housing 101a which is one structural element of the bowl 101. The support columns 102L and 102R are disposed so as to stand at the left and right sides of the head support 11 in the bowl 101, respectively.

The hair washing apparatus 100 has a pair of (two) washing units 12 for washing the head 10 supported by the bowl 101. The two washing units 12 are composed of a left washing unit 12L and a right washing unit 12R, both of which are arranged in such a manner that the head support 11 is located between the two washing units 12L and 12R in the bowl 101. The left washing unit 12L is an example of the first washing unit while the right washing unit 12R is an example of the second washing unit. Because the present embodiment refers to the hair washing apparatus 100, the apparatus 100 is equipped with the washing units 12 which are configured as arc-like units. However, each of the washing units 12 is merely an example of the arm unit for taking care of the head of the human in the head care system.

The left washing unit 12L which has a support shaft 104L coupled to the support column 102L, is adapted to rotate about the central axis of the support shaft 104L. Similarly, the right washing unit 12R which has a support shaft 104R coupled to the support column 102R, is adapted to rotate about the central axis of the support shaft 104R. The hair washing apparatus 100 has two motors 101L and 101R as examples of the shaft driving members which drive the washing units 12L and 12R respectively so that the washing units 12L and 12R are rotated about the central axes of the support shafts 104L and 104R, respectively (see FIG. 2).

As shown in FIG. 2, the left washing unit 12L includes several arms 105L, 106L, 107L and 108L each of which has a predetermined shape such as approximately circular arc, and a pipe 111L which has a predetermined shape such as approximately circular arc. The arms 105L, 106L, 107L and 108L and the pipe 111L are arranged so as to face the head support 11.

The pipe 111L of the left washing unit 12L has a plurality of nozzles 110 for ejecting at least one of water, hot water, a washing liquid or a washing agent and a conditioner. The nozzles 110 are equipped on the surface of the pipe 111L, the surface facing the head support 11. The pipe 111L is mounted to an arm base 103L, fixed to the support shaft 104L. The pipe 111L is adapted to rotate together with the arm base 103L, about the central axis of the support shaft 104L.

The hair washing apparatus 100 is equipped with a water valve 216, a washing liquid valve 217 and a conditioner valve 218 as shown in FIG. 2. The respective outlet ports of the water valve 216, the washing liquid valve 217 and the conditioner valve 218, which are arranged in parallel to one another, are connected to the pipes 111L and 111R through pipe lines 219.

The inlet port of the water valve 216 is connected to a water supply (not shown), and is adapted to be supplied with water or hot water from the water supply. The inlet port of the washing liquid valve 217 is connected to a mixer 220 for mixing compressed air with the washing liquid, and is adapted to be supplied with the washing liquid in the form of mousse from the mixer 220. The mixer 220 produces the washing liquid in the form of mousse by mixing compressed air with the washing liquid such as shampoo supplied from a washing liquid supply 222. The inlet port of the conditioner valve 218 is connected to a conditioner supply 221, and is adapted to be supplied with conditioner (for example, rinse) from the conditioner supply 221.
[0030] In regard to the hair washing apparatus 100, it is possible to eject water, hot water, the washing liquid in the form of mousse or the conditioner through the nozzles 110 equipped on the pipes 111L and 111R by suitably controlling the water valve 216, the washing liquid valve 217 and the conditioner valve 218.

[0031] Thus, the water supply and the water valve 216 compose a water supply device for supplying the washing units 12L and 12R with water or hot water. The washing liquid supply 222, the mixer 220 and the washing liquid valve 217 compose a washing liquid supply device for supplying the washing units 12L and 12R with the washing liquid. The conditioner supply 221 and the conditioner valve 218 compose a conditioner supply device for supplying the washing units 12L and 12R with the conditioner.

[0032] The first arm 105L as an example of the main arm is rotatably mounted to the arm base 103L through an arm rotation shaft 209L, and is adapted to rotate together with the arm base 103L about the central axis of the support shaft 104L. That is, the first arm 105L is rotatably supported by the bowl 101 through the support column 102L.

[0033] The second arm 106L as an example of the secondary arm is rotatably supported by the first arm 105L through a support shaft 212L. As shown in FIG. 3, the second arm 106L is supported by the support shaft 212L of the first arm 105L. An elastic member 212L.a such as a spring as an example of the first elastic member is equipped between the first arm 105L and the second arm 106L in such a manner that the second arm 106L is held at a predetermined position with respect to the first arm 105L. That is, the elastic member 212L.a as the first elastic member which is disposed between the first arm 105L and the second arm 106L, regulates the positional relation between the first arm 105L and the second arm 106L. The elastic member 212L such a spring is coupled to the second arm 106L as well as the support shaft 212L of the first arm 105L. Alternatively, instead of the first elastic member 212L.a, it is possible to use another means for making the first arm 105L support the second arm 106L in such a manner to enable their self-aligning.

[0034] The first arm 105L includes two four-link mechanisms 231L and the support shaft 212L. The two four-link mechanisms 231L, each of which has the same shape, are disposed in parallel to each other. In other words, it may be considered that the first arm 105L has one parallel four-link mechanism. The support shaft 212L acts as a link member for coupling the two four-link mechanisms 231L with each other. Each of the four-link mechanisms 231L includes a drive link member 105L.a, a driven link member 105L.b and an intermediate link member 105L.c. The drive link member 105L.a which is fixedly mounted to the arm rotation shaft 209L, has an approximately circular arc shape. The driven link member 105L.b which has a shape identical to that of the drive link member 105L.a, is rotatably mounted to a support shaft 215L equipped in the arm base 103L. The intermediate link member 105L.c to which the support shaft 212L is fixedly mounted, is rotatably coupled to the drive link member 105L.a through the support shaft 212L, and further is rotatably coupled to the driven link member 105L.b through a support shaft 216L.

[0035] In each of the four-link mechanisms 231L, each of the drive link member 105L.a and the driven link member 105L.b has the same shape while the drive link member 105L.a and the driven link member 105L.b are coupled in parallel with each other through the intermediate link member 105L.c and the arm base 103L. In other words, each of the four-link mechanisms 231L according to the present embodiment falls under a parallel four-link device. The second arm 106L is supported by the support shaft 212L at a position between the two four-link mechanisms 231L of the first arm 105L. The hair washing apparatus 100 according to the present embodiment is characterized in that it includes the first arms having the parallel four-link devices as described above. It will be described later an advantage of such a structure that the first arms are partly composed of the four-link devices.

[0036] Two third arms 107L and 108L as examples of the contact arms are rotatably supported by the second arm 106L. The third arm 107L is formed of approximately V-shaped fashion. Thus, one end portion of the second arm 106L, rotatably supports the third arm 107L through a support shaft 213L while the other end portion of the second arm 106L rotatably supports the third arm 108L through a support shaft 214L. The two third arms 107L and 108L are supported in such a manner that they are located at approximately symmetrical positions to each other with respect to the support arm 212L.

[0037] Two elastic members (not shown) such as springs as examples of the second elastic members are equipped between the second arm 106L and each of the two third arms 107L and 108L, respectively. As is the case in the first elastic member 212L.a which is coupled to the first arm 105L and the second arm 106L, one of the two second elastic members is coupled to the second arm 106L and the third arm 107L while the other is coupled to the second arm 106L and the third arm 108L. That is, the two second elastic members regulate the positional relations between the second arm 106L and each of the third arms 107L and 108L. By virtue of the second elastic members such as springs, the third arms 107L and 108L can be held at predetermined positions with respect to the second arm 106L, respectively. Alternatively, instead of using the second elastic members, it is possible to use another means for making the second arm 106L support the third arms 107L and 108L in such a manner to enable their self-aligning.

[0038] Each of the third arms 107L and 108L is equipped with a plurality of contacts 109 mounted thereto, the contacts 109 being able to come into contact with the head 10 supported by the head support 11. In concrete terms, some of the contacts 109 are mounted to the third arm 107L in such a manner that the third arm 107L supports two bifurcated arms 310L each of which is formed of V-shaped fashion and is equipped with two contacts 109 at two tips thereof, respectively. On the other hand, the other contacts 109 are mounted to the third arm 108L in such a manner that the third arm 108L supports two bifurcated arms 310L each of which is formed of V-shaped fashion and is equipped with two contacts 109 at two tip ends thereof, respectively.

[0039] FIG. 5 shows the bifurcated arm 310L as the third main portion of the driving mechanism of the hair washing apparatus 100 according to the present embodiment. As shown in FIG. 5, the bifurcated arm 310L has a pair of branches 310L.a and a connector 310L.b. The two branches 310L.a each of which is equipped with a contact 109 at the tip thereof, are arranged in a symmetrical fashion with respect to a central axis C1. The connector 310L.b connects the two branches 310L.a to each other at the apex of the two branches 310L.a configured in the form of V-shaped fashion. In regard to the
bifurcated arm 310L shown in FIG. 5, each of the branches 310La is formed as a leaf spring. By virtue of this structure, if the bifurcated arm 310L is moved toward the head 10 and moved away from the head 10 in such a condition that the two contacts 109 are contacting with the head 10, the two contacts 109 are moved as indicated by two arrows 310L.e.

[0041] Because the contacts 109 are pressed to the head 10 in the direction toward the center of the head 10 due to the elastic force of the branches 310La formed as leaf springs, the contacts 109 are accurately located at desired positions in dependence upon the shape of the surface of the head 10. In consequence, by means of the contacts 109 of the hair washing apparatus 100 according to the present embodiment, it is possible to uniformly and efficiently take care of the whole head 10 regardless of differences among the shapes or sizes of the heads of humans. The contacts 109 are made of a flexible rubber or gum material.

[0042] In regard to the bifurcated arm 310L configured as described above, the connector 310Lb supported by the third arm 107L is rotatable about the central axis C1 as indicated by an arrow 310L.e so that the contacts 109 mounted to the bifurcated arm 310L can swing. In regard to the hair washing apparatus 100 according to the present embodiment, when each of the bifurcated arms 310L is rotatable about the central axis C1 in such a condition that the contacts 109 are contacting with the head 10, the contacts 109 pinch or pull the scalp and hair of the head 10. Thus, in regard to the hair washing apparatus 100 according to the present embodiment, it is possible to take care of the head 10 by pinching or pulling the scalp and hair of the head 10 by means of the contacts 109. The hair washing apparatus 100 has a contact driver 401 such as a motor for driving the bifurcated arm 310L. Thus, the bifurcated arm 310L is rotatable about the central axis C1 by the contact driver 401 so that the contacts 109 are swung.

[0043] In addition, the bifurcated arm 310L can be rotated about a central axis C2 as indicated by an arrow 310L.e by means of the connector 310Lb supported by the third arm 107L. The central axis C2 is an axis of the inner angle formed by the two branches 310La configured in the form of V-shaped fashion, which passes through the apex of the inner angle. In regard to the hair washing apparatus 100 according to the present embodiment, the central axis C2 intersects with a central axis C3 of the support shaft 213L at an approximately right angle. The central axis C3 of the support shaft 213L is a rotation axis of the third arm 107L which is rotatably supported by the second arm 106L while the central axis C2 is a rotation axis of the bifurcated arms 310L which are rotatably supported by the third arm 107L.

[0044] The third arm 108L is configured in the same manner as that of the third arm 107L. The contacts 109 equipped on the bifurcated arms 310L each of which is supported by the third arm 107L or 108L, are arranged in a form of approximately circular arc in dependence upon the shape of the head 10, as shown in FIG. 4.

[0045] As shown in FIG. 1, in regard to the hair washing apparatus 100 according to the present embodiment, the first arm 105L, the second arm 106L and the third arms 107L and 108L are housed within an arm housing 115L. Meanwhile, the contacts 109 equipped on the third arms 107L and 108L are disposed at the outer side of the arm housing 115L.

[0046] As shown in FIG. 2, the motor 201L is disposed in the support column 102L of the hair washing apparatus 100. The torque outputted from the motor 201L is transferred to the support shaft 104L through a gear 203L mounted to an output rotation shaft 202L of the motor 201L and a gear 204L mounted to the support shaft 104L. The arm base 103L mounted to the support shaft 104L is driven by the torque transferred from the motor 201L so that the arm base 103L is rotated in the direction indicated by an arrow 205L. The driving operation of the motor 201L is controlled by a controller 400.

[0047] A motor 206L is equipped in the arm base 103L. The torque outputted from the motor 206L is transferred to the first arm 105L through a gear 207L mounted to an output rotation shaft 202L of the motor 206L, and another gear (not shown) which engages with the gear 207L is mounted to the arm rotation shaft 209L of the arm base 103L of the arm rotation shaft 209L in the direction indicated by an arrow 210L. The motor 206L acts as a shaft driving member for driving the first arm 105L about the axis of the arm rotation shaft 209L in such a manner that the first arm 105L is moved toward or away from the head support 11. The driving operation of the motor 206L is controlled by the controller 400.

[0048] As previously described, the hair washing apparatus 100 is equipped with the contact driver 401 such as a motor for driving the bifurcated arms 310L in such a manner that each of the bifurcated arms 310L is rotated about the central axis C1. The driving operation of the contact driver 401 is controlled by the controller 400.

[0049] The right washing unit 12R is configured in the same manner as that of the left washing unit 12L. The right washing unit 12R has several arms 105R, 106R, 107R and 108R and a pipe 111R. The arms 105R, 106R, 107R and 108R and the pipe 111R are disposed so as to face the head support 11.

[0050] The pipe 111R is configured in the same manner as that of the pipe 111L. The pipe 111R has a plurality of nozzles 110 for ejecting at least one of water, hot water, a washing liquid or washing agent and a conditioner, through the pipe lines 219. The pipe 111R is mounted to an arm base 103R fixed to the support shaft 104R. The pipe 111R is adapted to rotate together with the arm base 103R about the central axis of the support shaft 104R.

[0051] The arms 105R, 106R, 107R and 108R of the washing unit 12R are directly or indirectly mounted to the arm base 103R fixed to the support shaft 104R. The first arm 105R is rotatably mounted to the arm base 103R through an arm rotation shaft 209R, and is adapted to rotate together with the arm base 103R about the central axis of the support shaft 104R.

[0052] A second arm 106R is rotatably supported by the first arm 105R through a support shaft 212R. An elastic member (not shown) such as a spring as an example of the first elastic member is equipped between the first arm 105R and the second arm 106R. The elastic member such as a spring is coupled to the second arm 106R and the support shaft 212R of the first arm 105R in such a manner that the second arm 106R is held at a predetermined position with respect to the first arm 105R.

[0053] The first arm 105R which is configured in the same manner as that of the first arm 105L, includes two parallel four-link mechanisms and the support shaft 212R as an example of the link member for coupling the two parallel four-link mechanisms with each other. The second arm 106R is supported by the support shaft 212R at a position between the two parallel four-link mechanisms.
The two third arms 107R and 108R are rotatably supported by the second arm 106R through respective support shafts 213R and 214R. Two elastic members (not shown) such as springs as examples of the second elastic members are equipped between the second arm 106R and each of the two third arms 107R and 108R, respectively. One of the two second elastic members is coupled to the second arm 106R and the third arm 107R while the other is coupled to the second arm 106R and the third arm 108R in such a manner that the third arms 107R and 108R are held at respective predetermined positions with respect to the second arm 106R. Each of the third arms 107R and 108R rotatably supports two bifurcated arms, each of which is formed of V-shaped fashion and is equipped with two contacts 109 at the tips thereof, respectively. Each of the bifurcated arms is configured in such a manner that the contacts 109 are swung by the contact driver 401.

As shown in FIG. 2, the motor 201R is disposed in the support column 102R of the right washing unit 12R. The torque outputted from the motor 201R is transferred to the support shaft 104R through a gear 203R mounted to an output rotation shaft 202R of the motor 201R and a gear 204R mounted to the support shaft 104R. The arm base 103R is mounted to the support shaft 104R and driven by the torque transferred from the motor 201R so that the arm base 103R is rotated in the direction indicated by an arrow 205R. The driving operation of the motor 201R is controlled by the controller 400.

A motor 206R is equipped in the arm base 103R. The torque outputted from the motor 206R is transferred to the first arm 105R through a gear 207R mounted to an output rotation shaft 207Ra of the motor 206R and another gear (not shown) which engages with the gear 207R and is mounted to the arm rotation shaft 209R of the first arm 105R. The first arm 105R is driven by the torque transferred from the motor 206R so that the first arm 105R is rotated about the central axis of the arm rotation shaft 209R in the direction indicated by an arrow 210R. The driving operation of the motor 206R is controlled by the controller 400.

Each of the bifurcated arms supported by the third arm 107R or 108R of the right washing unit 12R is configured in such a manner that the contacts 109 are swung by the driving operation of the contact driver 401. The driving operation of the contact driver 401 is controlled by the controller 400.

As shown in FIG. 1, in the right washing unit 12R, the first arm 105L, the second arm 106L and the third arms 107R and 108R are housed in an arm housing 115R. Meanwhile, the contacts 109 equipped on the third arms 107R and 108R are disposed at the outer side of the arm housing 115R.

When the hair washing apparatus 100 described above is operated, the motors 206L and 206R are driven in accordance with the instruction of the controller 400 so that the first arms 105L and 105R are moved toward the head support 11 so as to come near the head support 11 while the second arms 106L and 106R and the third arms 107L, 108L, 107R and 108R are moved toward the head support 11 so as to come near the head support 11. Thus, the contacts 109 come into contact with the head 10 supported by the head support 11. Then, the motors 201L and 201R and the contact driver 401 are driven in such a condition that the contacts 109 are contacting with the head 10 so as to take care of the head 10 of the human.

In regard to the hair washing apparatus 100 according to the present embodiment, when the motors 206L and 206R and the contact driver 401 are driven by the controller 400 so as to take care of the head 10, it is possible to wash the head 10 by controlling the operations of the water supply, the washing liquid supply 222 and the conditioner supply 221 by means of the controller 400.

The bowl 101 of the hair washing apparatus 100 has a cutout 101c for supporting the neck of the human whose head 10 is supported by the head support 11. In addition, the bowl 101 is equipped with a supporting member 112 for supporting the back of the head 10. The supporting member 112 is configured in such a manner that the position thereof is adjustable in the upward, downward, leftward and rightward directions. For example, the position of the supporting member 112 may be adjusted on the basis of the position of the head 10 detected by a position detecting means such as a camera.

It is preferable that the position of the supporting member 112 is adjusted in such a manner that the respective supporting shafts 104L and 104R of the washing units 12L and 12R are located at positions near the ears of the human whose head 10 is supported by the head support 11. If the washing units 12L and 12R are driven on the basis of the positions of the ears of the human, the load applied to the neck of the human may be reduced.

The support columns 102L and 102R disposed in the bowl 101 are adapted to move in the axial direction of the support shafts 104L and 104R mounted to the support columns 102L and 102R, respectively. In consequence, the distance between the head 10 and each of the arm bases 103L and 103R can be adjusted in dependence upon the size of the head 10 supported by the supporting member 112.

A hood 113 which is configured to be openable and closable, is releasably mounted to the bowl 101 in order to prevent water or shampoo from scattering outward during the washing operation. It is preferable that the hood 113 is formed of a transparent material in order to possibly prevent the human from having oppressive feeling or anxious feeling during the washing operation.

The hair washing apparatus 100 according to the present embodiment, which is described as an apparatus for automatically washing the head 10 of the human here, may be used also as a head care system for automatically massaging the head 10 of the human by means of the contacts 109 in such a condition that water or shampoo is not ejected through the nozzles 110.

It will be further described hereinafter how the left washing unit 12L of the hair washing apparatus 100 performs such an operation that the first arm 105L is moved so as to come near or get away from the head support 11 around the arm rotation shaft 209L.

FIG. 6 shows an operation of the second main portion of the driving mechanism of the hair washing apparatus 100 according to the present embodiment. In FIG. 6, the solid lines show such a state that the contacts 109 of the left washing unit 12L are contacting with the head 10 while the two-dot chain lines show such a state that the contacts 109 of the left washing unit 12L are away from the head 10.

In regard to the present embodiment, the first arm 105L is adapted to have the parallel four-link mechanism 231L as previously described. In consequence, when the first arm 105L is rotated about the central axis of the arm rotation shaft 209L, the second arm 106L and the third arms 107L and 108L.
are moved in parallel with the movement of the first arm 105L while maintaining the original configuration thereof. As a result, the contacts 109 are also moved in parallel with the movement of the first arm 105L while maintaining the original configuration thereof.

[0070] Meanwhile, FIG. 7 shows an operation of a hair washing apparatus which includes a first arm having a single-link mechanism instead of the first arm having the four-link mechanism, contrary to the hair washing apparatus 100 including the second main portion of the driving mechanism according to the present embodiment. That is, FIG. 7 shows a hair washing apparatus equipped with no four-link mechanism which is one of the characteristic structural elements of the present invention. In FIG. 7 showing the hair washing apparatus having a first arm 105L composed of only the drive link member 105La contrary to the first arm 105L shown in FIG. 6, the solid lines show such a state that the contacts 109 of the left washing unit 12L are contacting with the head 10 while the two-dot chain lines show such a state that the contacts 109 of the left washing unit 12L are away from the head 10.

[0071] In regard to the left washing unit 12L shown in FIG. 7, an elastic member (not shown) which is coupled to the second arm 106L and the support shaft 212L of the first arm 105L, is disposed between the first arm 105L and the second arm 106L in such a manner that the second arm 106L is held at a predetermined position with respect to the first arm 105L.

[0072] As shown in FIG. 7, in regard to the hair washing apparatus in which the first arm 105L has the single-link mechanism composed of only the drive link member 105La, the first arm 105L can be driven so as to come into a state in which the contacts 109 are contacting with the head 10 as well as another state in which the contacts 109 are away from the head 10 when the first arm 105L is rotated about the central axis of the arm rotation shaft 209L. However, all of the first arm 105L, the second arm 106L and the third arms 107L and 108L are moved centering around the central axis of the arm rotation shaft 209L, because the first arm 105L has the single-link mechanism. That is, in regard to the driving mechanism in which the first arm 105L has the single-link mechanism, the contacts 109 are moved so as to rotate about the central axis of the arm rotation shaft 209L as shown in FIG. 7. In consequence, in regard to the hair washing apparatus using the single-link mechanism shown in FIG. 7, when the contacts 109 come into contact with the head 10, some contacts 109 come into contact with the head 10 at first, and then the other contacts 109 come into contact with the head 10. If the contacts 109 come into contact with the head 10 with time lags to one another as described above, it is probable that the contact positions between the head and the contacts 109 are changed during the operation. In consequence, it is probable that some hairs wind around the contacts 109 so that load is applied to the scalp of the human. Moreover, in of the hair washing apparatus using the single-link mechanism shown in FIG. 7, it is probable that it takes a long time to make all of the contacts 109 come into contact with the head 10.

[0073] In regard to the hair washing apparatus 100 according to the present embodiment, because it is configured in such a manner that the first arm 105L has the parallel four-link mechanism 231L as previously described, the contacts 109 can come into contact with the head 10 together approximately along the shape of the head 10 so that load applied to the scalp of the human may be reduced.

[0074] Moreover, in regard to the hair washing apparatus 100 according to the present embodiment, because it is configured in such a manner that the first arm 105L has the parallel four-link mechanism 231L, the range of movement of each of the first arm 105L, the second arm 106L and the third arms 107L and 108L may be reduced as compared with the case using the single-link mechanism, as apparent from FIG. 6 and FIG. 7. In consequence, in regard to the hair washing apparatus 100 according to the present embodiment, it is possible to move the first arm 105L, the second arm 106L and the third arms 107L and 108L in a compact space so that the space required to operate the left washing unit 12L may be reduced.

[0075] In addition, in regard to the hair washing apparatus 100 according to the present embodiment, because it is configured in such a manner that the first arm 105L has the parallel four-link mechanism 231L, stiffness of the first arm 105L may be improved as compared with the case of using the single-link mechanism. In consequence, follow-up performance of the left washing unit 12L may be improved when the left washing unit 12L is moved in such a state that the contacts 109 of the left washing unit is contacting with the head 10, in consequence the head 10 may be surely washed in dependence upon the shape of the head 10.

[0076] In regard to the present embodiment, it is specified that each of the third arms 107L and 108L, rotatably supports two bifurcated arms 310L. However, the present invention is not limited to the embodiment described above, and therefore each of the third arms 107L and 108L may rotatorily support three or more bifurcated arms 310L.

[0077] The functions or effects of the left washing unit 12L of the hair washing apparatus 100 according to the present embodiment hold true for the right washing unit 12R which has a configuration similar to that of the left washing unit 12L.

INDUSTRIAL APPLICABILITY

[0078] The head care system and hair washing apparatus according to the present invention may be used and useful in the technical field such as beauty care or hair dressing, the medical technical field such as care or nursing, and so on.

EXPLANATION OF REFERENCE NUMERALS

[0079] 11 Head support
[0080] 12 Washing unit
[0081] 12L Left washing unit
[0082] 12R Right washing unit
[0083] 100 Hair washing apparatus
[0084] 101 Bowl
[0085] 103L, 103R Arm base
[0086] 104L, 104R Support shaft
[0087] 212L, 212R Support shaft
[0088] 213L, 213R Support shaft
[0089] 214L, 214R Support shaft
[0090] 215L Support shaft
[0091] 216L Support shaft
[0092] 105L, 105R First arm
[0093] 106L, 106R Second arm
[0094] 107L, 107R Third arm
[0095] 108L, 108R Third arm
[0096] 109 Contact
[0097] 110 Nozzle
[0098] 111L, 111R Pipe
[0099] 201L, 201R Motor
A head care system comprising:

1. A base having a head support for supporting a head of a human;
2. A pair of arm units for taking care of the head, each of said arm units having a support shaft mounted to said base, and said pair of arm units being arranged in such a manner that said head support is located between said pair of arm units;
3. A pair of shaft driving members for driving said arm units in such a manner that each of said arm units rotates about an axis of the corresponding support shaft; and
4. A controller for controlling driving operations of said shaft driving members, wherein each of said arm units comprises a contact arm having a plurality of contacts equipped on tips of said contact arm, a secondary arm for rotatably supporting said contact arm, and a main arm which rotatably supports said secondary arm and is rotatably supported by said base, said main arm having a four-link mechanism.

The head care system according to claim 1, wherein said contact arm has at least two bifurcated arms rotatably supported by said contact arm, each of said bifurcated arms being configured in a form of V-shape and equipped with said contacts on tips of said bifurcated arm.

The head care system according to claim 2, a central axis of a rotational shaft through which said contact arm is supported by said secondary arm intersects with central axes of respective rotational shafts through which said bifurcated arms are supported by said contact arm.

4. The head care system according to claim 1, wherein said main arm has a parallel four-link mechanism as said four-link mechanism.
5. The head care system according to claim 1, wherein said main arm comprises two four-link mechanisms which have the same shape to each other and are arranged in parallel to each other, and a link member which couples said two four-link mechanisms with each other, said link member supporting said secondary arm at a position between said two four-link mechanisms.
6. The head care system according to claim 1, further comprising a first elastic member for regulating a positional relation between said secondary arm and said main arm, said first elastic member coupling said secondary arm with said main arm.
7. The head care system according to claim 1, further comprising a second elastic member for regulating a positional relation between said contact arm and said secondary arm, said second elastic member coupling said contact arm with said secondary arm.
8. The head care system according to claim 1, further comprising a rotation shaft driving member for rotating said main arm so that said main arm moves toward or away from said head support, wherein said controller controls an driving operation of said rotation shaft driving member, and wherein said controller makes said secondary arm and said contact arm move toward said head support by making said main arm move toward said head support so that said contacts take care of the head of the human.
9. An hair washing apparatus comprising a head care system according to claim 1, wherein said main arm unit for taking care of the head of the human is a washing unit for washing the head.
10. The hair washing apparatus according to claim 9, further comprising:

- A water supply for supplying said washing unit with water or hot water;
- A washing liquid supply for supplying said washing unit with a washing liquid; and
- A conditioner supply for supplying said washing unit with a conditioner.