

FACE-WASHING APPARATUS HAVING FINE BRISTLE BRUSH FOR MAKE-UP MADE OF POLYBUTYLENE TEREPHTHALATE RESIN

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a face washing machine having a makeup brush with fine bristles made of polybutylene terephthalate resin, and more particularly, to a face washing machine having a makeup brush of polybutylene terephthalate resin in which a bristle base is divided into two sides such that polybutylene terephthalate resin bristles are inserted into an inner side and an outer side respectively, wherein the bristles have rounded ends, the bristles inserted into the inner side rotate, and the lower sides of the bristles are tapered, resulting in soft and stable face washing.

2. Description of the Related Art

In general, regardless of age or gender, people have a desire for the beauty of body. Since it is required a systemic and clean skin care for this beauty of body, particularly, for the beauty of skin, various skin care machines for the skin beauty have been developed. These skin care machines have widely been developed in various types suitable for nature of body parts to which the skin care machines are applied.

Especially, skin care is carried out using fundamental cosmetics as a method of caring face skin above all body parts

and functional cosmetics are used for the skin care nowadays.

Up to now, various devices are proposed to wash face such as device simply rotating a washing brush, a device making vibration, and a face washing machine rotating forward and
5 reversely to wash face using a brushless electric motor.

The face washing machine using a brushless electric motor is disclosed in Korean Patent No 10-1257256 and includes a case 100; an operating unit 200 installed out of the case to command forward and reversely switching by a preset angle; a power supply
10 300 installed at an inner end of the case; a brushless motor 400 installed in the case to rotate forward and reversely by a preset angle when an electric power is supplied from the power supply; a controller 500 outputting an electric signal to control the forward and reverse rotation of the brushless motor
15 400 according to the switching signal from the operating unit; and a face-washing brush 600 fitted around a shaft of the brushless DC (BLDC) motor 400 to rotate forward and reversely when the BLDC motor is driven; wherein the controller 500 includes: a rectifying unit 510 having a rectifier 511 and a
20 smoothing capacitor 512 to rectify and smoothen an AC power into a DC power; an inverter 530 converting the DC power supplied from the rectifying unit 510 into a three-phase (U, V, and W) AC power in the form of pulses with any variable frequency and having six switching devices Q1 to Q6 and six diodes; a terminal
25 voltage detector 560 detecting terminal voltages of the

respective phases U, V, and W from the three-phase AC power supplied to the BLDC motor 400; a control circuit 570 detecting a zero crossing point (ZCP) of a counter electromotive force based on the terminal voltages of the respective phases U, V, and W that are detected by the terminal voltage detector 560 to acquire position information of a rotor and controlling patterns of a PWM signal fed to the inverter 530 to rotate the rotor of the motor forward and reversely by a preset angle; and a PWM signal generator 580 generating the patterns of the PWM signal based on the output from the control circuit 570 to feed the patterns to the inverter 530.

The outer appearance thereof, as illustrated in FIGS. 1 and 2, is configured such that the face-washing brush is coupled to the shaft of the BLDC motor so that the face-washing brush rotates forward and reversely when the BLDC motor rotates forward and reversely and then the face washing is enabled.

However, in the configurations, foreign matters are spattered out when the foreign matters remaining on face are washed out during the rotation of the face-washing brush.

In other words, the face-washing brush rotates and rubs the face and at this time. In this case, liquid content flows and is spattered in all directions due to the rotation of the face-washing brush when liquid content remains resulting in sanitary matter.

Moreover, according to the existing face-washing machine

using a BLDC motor, since the BLDC motor rotates forward and reversely simply, a high torque cannot be applied to face.

SUMMARY OF THE INVENTION

5 Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an object of the present invention is to provide a face washing machine having makeup brush made of polybutylene terephthalate resin designed such that a separated supporting brush is
10 installed in an not-rotated area when a face-washing brush is installed, that the face-washing brush is installed therein and is connected to an electric motor so that liquid content is filtered by supporting brush during rotation of the face-washing brush, and made of polybutylene terephthalate resin such that
15 tips of the face-washing brush are rounded to touch face of a user softly.

Moreover, the present invention provides a face washing machine in which a high torque is applied to a face-washing brush using a spring so that easy face washing can be achieved.

20 In order to achieve the above object, the present invention provides a face washing apparatus including a face washing apparatus case (100) having a rotating unit rotating by receiving externally provided electricity or battery electricity or a power from a secondary battery; and a face
25 washing brush (600) coupled to the face washing apparatus case

so as to rotate, wherein the face washing brush (600) includes:
a plurality of first brush bristle sets (610) formed of
polybutylene terephthalate resin, which are mounted on an output
panel of an electric motor to reversibly rotate according to
5 reversible rotation of the electric motor; and a plurality of
second brush bristle sets (620) formed of polybutylene
terephthalate resin, which are mounted on an outer side of a
front surface of the face washing apparatus case, arranged in
parallel to the first brush bristle sets at a height equal to
10 a height of the first brush bristle sets, simultaneously spaced
apart from the first brush bristle sets by a predetermined
distance, and fixedly surrounding a periphery of the first brush
bristle sets to prevent foreign substances from being dispersed
when the first brush bristle sets are rotated, wherein first
15 brush bristles (611) constituting the first brush bristle set
(610) and second brush bristles (621) constituting the second
brush bristle set (620) are formed at end portions thereof with
taper surfaces (611a and 621a), respectively; each of the first
brush bristles (611) constituting the first brush bristle set
20 (610) has a distal end polished to be rounded in an arc shape;
and wherein the rotating unit includes: an operating unit (200)
mounted on an outer side of the case to instruct power on/off
and reversible rotation switching in a unit of a predetermined
angle; a power supply unit (300) mounted on an inner one end
25 of the case; a brushless electric motor (400) mounted in the

case to operate by receiving power from the power supply unit according to a switching signal of the operating unit and to reversibly rotate in the unit of the predetermine angle; a control unit (500) to output an electric signal to control the reversible rotation of the brushless electric motor at the predetermined angle according to the switching signal of the operating unit; a holder (700) coupled to a shaft (410) of the brushless electric motor (400) and including vertical and horizontal panels bent in an L shape to reversibly rotate according to the reversible rotation of the brushless electric motor; a spring (800) coupled to one side of the horizontal panel of the holder and having an opposite side coupled to a support unit to move about the support unit while being supported by the support unit as the holder moves up and down in a vertical direction, the spring providing elasticity in order to generate torque to return the holder to an original position; the support unit (900) to support the opposite side of the spring to induce the torque; and a ballast (1000) mounted at an upper portion of the holder to maintain a balance of the holder such that reversible rotation of the holder is stably induced.

In addition, the taper surfaces (611a and 621a, LT) are formed in a range of 2 mm to 4 mm from an end of the brush bristle; and a thickness of an end point (DT) of the brush bristle is 10 μm or less.

Further, each brush bristle (621) constituting the second brush bristle set (610) has a distal end polished to be rounded in an arc shape or is formed in a straight line.

In addition, the brush bristles (611 and 621) constituting
5 the first brush bristle set (610) and the second brush bristle set (620) have thicknesses of $63 \pm 10 \mu\text{m}$.

Further, the brush bristles (611 and 621) constituting the first brush bristle set (610) and the second brush bristle set (620) have lengths of $11.0 \pm 1.0 \text{ mm}$.

10 In addition, 90,000 to 120,000 brush bristles (611 and 621) are implanted to constitute the first brush bristle set (610) and the second brush bristle set (620).

Further, the first brush bristle set (610) is formed in a first color and the second brush bristle set (620) is formed
15 in a second color different from the first color.

As described above, the face washing machine according to the present invention is designed such that a separated supporting brush is installed in an not-rotated area when a face-washing brush is installed, that the face-washing brush
20 is installed therein and is connected to an electric motor so that liquid content is filtered by supporting brush during rotation of the face-washing brush, and is made of polybutylene terephthalate resin such that tips of the face-washing brush are rounded to touch face of a user softly.

25 Moreover, a high torque is applied to a face-washing brush

using a spring so that easy face washing can be achieved.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view illustrating an entire
5 appearance of a face washing machine according to an embodiment
of the present invention;

FIG. 2 is a vertical sectional view taken along the line
A-A of FIG. 1;

FIG. 3 is a perspective view illustrating main parts such
10 as an electric motor, a spring, and a support of a face washing
machine according to an embodiment of the present invention;

FIG. 4 is an exploded perspective view of FIG. 3;

FIG. 5 is a view illustrating operation of a spring
employed in a face washing machine according to an embodiment
15 of the present invention; and

FIG. 6 is a sectional view illustrating an example of
bristle employed in a face washing machine according to an
embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, exemplary embodiments of the present
invention will be described with reference to the accompanying
drawings. However, the drawings and a description thereof
correspond to the exemplary embodiments among various methods
25 for effectively explaining the features of the present invention,

and the present invention is not limited by the drawings and the description thereof.

Further, in the following description of the present invention, a detailed description of known functions and configurations incorporated herein will be omitted when it may make the subject matter of the present invention rather unclear. The following terms are those defined, considering the functions of the present invention, and may be changed according to the intentions of the user or the manager or the customs. Therefore, 10 the definitions of the terms should be made based on the contents of the specification.

Functional elements already provided in a system or generally provided in the art to which the present invention pertains can be omitted from the exemplary embodiments of the present invention to effectively explain the technical elements 15 of the present invention. Thus, functional elements that should be additionally provided for the present invention will be mainly described.

Among functions of elements that are not illustrated but omitted, the functions of conventional elements can be easily 20 understood by those skilled in the art to which the present invention pertains, and relationships between the omitted elements and the elements added for the present invention will be clearly understood.

25 In the description of the embodiment of the present

invention, terms will be properly modified to effectively explain the technical features of the present invention so that those skilled in the art to which the present invention pertains can clearly understand the present invention, but the present
5 invention is not limited thereto.

As a result, the technical spirit of the present invention is determined by the claims, and the embodiments of the present invention are provided to merely effectively explain the technical spirit of the present invention to those skilled in
10 the art to which the present invention pertains.

FIG. 1 is a perspective view illustrating an entire appearance of a face washing machine according to an embodiment of the present invention.

FIG. 2 is a vertical sectional view taken along the line
15 A-A of FIG. 1.

FIG. 3 is a perspective view illustrating main parts such as an electric motor, a spring, and a support of a face washing machine according to an embodiment of the present invention.

FIG. 4 is an exploded perspective view of FIG. 3.

20 FIG. 5 is a view illustrating operation of a spring employed in a face washing machine according to an embodiment of the present invention.

FIG. 6 is a sectional view illustrating an example of bristle employed in a face washing machine according to an
25 embodiment of the present invention.

A face washing machine according to an embodiment of the present invention includes a face-washing case 100, an operating unit 200, a power supply 300, a brushless DC (BLDC) motor 400, a controller 500, a face-washing brush 600, a holder 700, a plate
5 spring 800, and a support 900.

First, the face-washing brush 600 as an essential element of the face washing machine according to an embodiment of the present invention includes first bristle sets 610 having a first feature and second bristle sets 620 of a second feature.

10 The first bristle sets 610 and the second bristle sets 620 are made by combining a plurality of bristles 611 and 621 respectively and a front side of the case 100 is divided into an electric motor-connecting panel 110 and a fixed panel 120, while the first bristle set 610 is inserted into the electric
15 motor-connecting panel 110 of the case by an interval and the second bristle set 620 is inserted into the fixed panel 120 of the case by an interval.

The electric motor-connecting panel 110 is preferably formed with five lanes of holes such as six holes, twelve holes,
20 twenty-one holes, twenty-seven holes, and thirty-three holes from the innermost side. The fixed panel 120 is formed with two lanes of holes having 39 holes respectively.

Each of the holes is preferably 1.8 mm to 20.mm wide and 3.6 mm deep such as 450 to 850 bristles are coupled in one hole.

25 The respective bristles of the first bristle sets and the

second bristle sets are preferably 63 ± 10 micrometers thick and 11.0 ± 1.0 mm long and total of the bristles is preferably 90,000 to 120,000. As occasion demands, the first bristle sets 610 have a first color and the second bristle sets 620 have a second color different from the first color so that a rotating portion and a fixed portion can be recognized easily.

The bristles 611 and 621 are made of polybutylene terephthalate resin. Polybutylene terephthalate (hereinafter, referred to as "PBT") resin employed in the present invention is a condensed product of diol basically consisting of butanediol and diacid basically consisting of terephthalic acid. The PBT resin is obtained by direct esterification of butanediol and terephthalate acid or by ester exchange of butane diol by terephthalate acid dimethyl ester and as a result contains resulting in esterified residue of butanediol and terephthalate acid. The PBT may be a polymer containing other component such as esterified residue of diol and dicarboxylic acid in addition to the esterified residue of butanediol and terephthalate acid, a small amount of multifunctional alcohol, or carboxylic acid. Typically, the PBT among composites employed in the present invention contains esterified residue of butanediol and terephthalate acid of 70 weight% more with reference to PBT weight. Proper diol contained in the PBT is for example ethylene glycol, diethylene glycol, propylene glycol, 2,3-pentanediol, neopentylglycol, hexamethylene glycol, and

cyclohexanedimethanol. Proper dicarboxylic acid is, for example, orthophthalic acid, isophthalic acid, naphthalene dicarboxylic acid, adipic acid, sebacic acid, and succinic acid.

The bristles of polybutylene terephthalate resin have the tapered lower sides to form the fine bristles. The bristles are 63 ± 10 micrometers thick and 11.0 ± 1.0 mm long. The bristles have the tapered ends 611a, 521a, and LT formed in the range from 2 to 4 mm from the ends and thickness DT less than 10 micrometers.

The ends of the bristles 611 of the first bristle sets 610 have a rounded shape 611b and the ends of the bristles (621) of the second bristle sets 620 have a rounded or flat shape 621b.

The case 100 of the face washing machine has an outer appearance held by a hand, accommodates the power supply and the BLDC motor therein, and is disposed with the operating unit at an outer side. The front side of the case 100 is divided into the electric motor-connecting panel 100 and the fixed panel 120, while the first bristle sets 610 are inserted into the electric motor-connecting panel 110 of the case by an interval and the second bristle sets 620 are inserted into the fixed panel 120 by an interval. The electric motor-connecting panel moves rightward and leftward when the BLDC motor rotates.

The operating unit 200 is installed on the outer side of the case in the form of a toggle switch or a pushbutton to command power ON/OFF and forward/reverse rotation by an angle and to

lead the BLDC motor to rotate forward and reversely by a desired angle range.

The power supply 300 is installed in the case to supply an electric power to the face washing machine. The power supply
5 may be a battery or a rechargeable battery or may be supplied with an electric power from an external power supply via a cable.

The BLDC motor 100 is installed in the case and is driven to rotate forward and reversely by an angle when the power supply supplies an electric power according to a switching signal from
10 the operating unit.

The controller 500 detects a counter electromotive force from the BLDC motor to acquire a position of the rotor and outputs an electric signal for controlling the forward and reverse rotation of the BLDC motor by an angle according to the switching
15 signal from the operating unit.

The face-washing brush 600 includes the first bristle sets 610 and the second bristle sets 620 such that the first bristle sets rotate forward and reversely by the rotation of the BLDC motor to wash face.

20 The holder 700 includes an L-shaped vertical panel 700a and a horizontal panel 700b which are connected to the shaft 410 of the BLDC motor 400, and rotates forward and reversely according to the forward and reverse rotation of the BLDC motor 400.

25 The spring 800 has an end coupled to a lower side of the

horizontal panel of the holder 700 and the end coupled to the support 900, moves the support 900 toward the shaft and provides an elastic force to generate a torque applied toward an original position when the holder 700 moves vertically. Preferably, the
5 spring 800 is a plate spring of a rectangular panel. That is, a coil spring may be employed as occasion demands but a plate spring is employed for powerful instant torque. When a plate spring is employed, the holder 700 is formed with a moving hole 710 such that the spring is coupled to slide so that horizontal
10 movement of the spring 800 can be easily achieved.

The BLDC motor 400 employed in the face washing machine according to an embodiment of the present invention includes a stator generating a rotating magnetic field in which a permanent magnet rotate spatially, a rotor generating a magnetic
15 field with a permanent magnet is installed therein, synchronized with a rotation velocity of the rotation magnetic field to rotate relatively, and a separated controller controlling the rotation of the BLDC motor.

The purpose of detecting a position of the rotor of the
20 BLDC motor 400 is an ideal control without torque ripple and to this end both of voltage and current should be sine wave. In order to drive the BLDC motor 400, an early driving algorithm is needed because an initial position of the rotor cannot be known even in any control method and even in this case an early
25 driving algorithm is needed because an induced electromotive

force can be obtained only when the rotor rotates once. This early driving algorithm is already known in every control of the BLDC motor 400, a commonly known force arranging method is used even in this case and thus its detailed description will be omitted.

As such, if the initial position of the rotor is obtained, the rotor is synchronized with a preset order until rotational frequency reaches a preset velocity such that an induced electromotive force is generated. From this section, a sine wave control starts. In general, a PWM control identical to a sine wave control of an AC induction motor is applied as the driving method. However, various methods such as a triangle wave method, a sawtooth wave method and a circle approximation method may be applied to a carrier frequency.

The zero crossing points (ZCP) through which the respective phase induced electromotive forces obtained from rotation of the rotor pass through the zero cross are detected and phase inversion is carried out based on information of the ZCP to output PWM driving signals to corresponding phases. The BLDC motor is driven due to three-phase conduction from this and the current wave has a sine wave.

In this case, for the easy detection of ZCP, a winding of the BLDC motor 400 is preferably a distributed winding.

Hereinafter, overall operation of the face washing machine according to an embodiment of the present invention will

be described.

When a user turns a power switch on, the BLDC motor is driven.

In the present embodiment, the control circuit is
5 programmed to rotate the BLDC motor 400 forward and reversely while the first bristles 611 of the first bristle sets 610 of the face-washing brush 600 rotates forward and reversely.

That is, the rotor of the BLDC motor 400 rotates by an angle and the position of the rotor is checked using an induced
10 electromotive force to rotate the rotor forward and reversely, and the forward and reverse rotation of the rotor is repeated such that the forward and reverse rotation of the first bristles 611 of the first bristle sets 610 of the face-washing brush 600 is repeated.

15 The second bristle sets 620 of the face-washing brush 600 are fixed and then foreign matters on face are not spattered out during the forward and reverse rotation of the first bristle sets 610 but are blocked and filtered by the second bristles 621 of the second bristle sets 620.

20 That is, since the first bristle sets 610 rotates forward and reversely but the second bristle sets 620 keep stopping, the second bristles 621 of the second bristle sets 620 catch all the foreign matters even when the foreign matters are spattered out during the forward and reverse rotation of the
25 first bristle sets 610 so that the foreign matter are not

spattered out.

Since ends of the first bristles 611 have the rounded shape 611b, the first bristles 611 do not apply a great stimulus to face but scrub face softly so that more soft and easy face washing
5 of a user's face is enabled and massage effect can be also provided.

In this case, since the spring 800 is coupled with the holder 700 of the BLDC motor 400, the spring 800 is transformed due to the forward and reverse rotation of the holder 700.

10 That is, the spring 800 is bent clockwise when the holder 700 rotates clockwise, and is bent counterclockwise when the holder 700 rotates counterclockwise.

Since the spring 800 is made of material with an elastic restoring force, a strong torque is applied and the restoring
15 force becomes maximum at the end of the rotation of the BLDC motor 400 when the holder 700 rotates due to the rotation of the BLDC motor 400 and the spring 800 is bent.

Thus, the face-washing brush 600 rotates very fast forward and reversely.

20 The spring 800 is bent maximum after the BLDC motor 400 rotates by an angle. In this case, when a reverse rotational force of the BLDC motor 400 is applied, and a spring force is added and then a face reverse rotation is generated. Since the spring 800 is restored to the original position and is bent
25 maximum in other direction again at the time when the reverse

rotation reaches to an end, an instant maximum torque is applied the reverse rotation is fast converted into the forward rotation when the reverse rotation is converted into the forward rotation.

5 As such, since the BLDC motor 400 changes the rotation direction fast from the forward rotation to the reverser rotation and vice versa, a strong torque is applied to the face-washing brush 600 so that face can be washed with a stronger force.

10 Following table is obtained by comparing effects obtained by washing face with the face washing brush of fine bristles made of polybutylene terephthalate resin according to an embodiment of the present invention with effects obtained by washing face with hands.

15 [Table 1]

Pores on cheeks

	With hands	PBT fine bristles
Before use	45.26	49.02
After use	35.00	34.85
Reduced rate	22.70%	28.90%

In the above Table, the number of pores on cheeks having a diameter greater than a preset diameter is counted. The
 20 number of pores is reduced by 22.70% when face is washed with hands but by 28.90% when face is washed by rotating the fine

brush bristles of polybutylene terephthalate resin according to an embodiment of the present invention. Thus, it is understood that the number of pores on cheeks is remarkably reduced when the face washing brush with fine bristles of polybutylene terephthalate resin according to an embodiment of the present invention is used.

[Table 2]

Pores on nose

	With hands	PBT
Before use	12.33	11.30
Directly after use	10.82	9.80
After two weeks	10.92	9.21
After four weeks	9.96	8.90
Reduced rate (four weeks)	18.6%	21.3%

In the above Table, the number of pores on nose having a diameter greater than a preset diameter is counted. The number of pores is reduced by 18.6% at four weeks after face is washed with hands but by 21.3% at four weeks after face is washed by rotating the brush bristles with fine bristles of polybutylene terephthalate resin according to an embodiment of the present invention. Thus, it is understood that the number of pores on nose is remarkably reduced when the face washing brush with fine bristles of polybutylene terephthalate resin according to an embodiment of the present invention is used.

[Table 3]

Dead skin cells

	With hands	PBT
Before use	7.22	8.56
Directly after use	6.54	7.74
After two weeks	5.61	6.80
After four weeks	5.41	5.90
Reduced rate (four weeks)	25.1%	31.1%

In the above Table, as a result of comparing removal of dead skin cells, the dead skin cells are reduced by 25.1% at four weeks after face is washed with hands but by 31.1% at four weeks after face is washed by rotating the brush bristles of polybutylene terephthalate resin according to an embodiment of the present invention. Thus, it is understood that the dead skin cells are remarkably reduced when the face washing brush with fine bristles of polybutylene terephthalate resin according to an embodiment of the present invention is used.

[Table 4]

Changes on skin pigmentation

	With hands	PBT
Before use	146.00	131.88
After two weeks	145.65	124.86
After four weeks	145.57	121.82
Reduced rate (four weeks)	0.3%	7.6%

In the above Table, changes of skin tone is obtained by analyzing melanin index on pigmentation of skin, is reduced by 0.3% at four weeks after face is washed with hands but by 7.6% at four weeks after face is washed by rotating the brush bristles of polybutylene terephthalate resin according to an embodiment of the present invention. Thus, it is understood that the melanin index is remarkably reduced when the face washing brush with fine bristles of polybutylene terephthalate resin according to an embodiment of the present invention is used and thus skin is changed bright.

[Table 5]

Eye wrinkles (um, Rmax (maximum depth of wrinkle))

	With hands	PBT
Before use	223.11	230.15
After two weeks	218.50	225.30
After four weeks	219.19	217.65
Reduced rate (four weeks)	1.8%	5.4%

In the above Table, the depth of eye wrinkles is reduced by only 1.5% when face is washed with hands but is reduced by 5.4% when face is washed by rotating the brush bristles of polybutylene terephthalate resin according to an embodiment of the present invention. Thus, it is understood that the eye wrinkles are remarkably reduced when the face washing brush with fine bristles of polybutylene terephthalate resin according to an embodiment of the present invention is used.

It is to be understood that, if any prior art publication is referred to herein, such reference does not constitute an admission that the publication forms a part of the common general knowledge in the art, in Singapore or any other country.

5 In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word "comprise" or variations such as "comprises" or "comprising" is used in an inclusive sense, i.e. to specify
10 the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

CLAIMS

【Claim 1】

A face washing apparatus having a cosmetic brush including
5 nylon, the face washing apparatus comprising:

a face washing apparatus case (100) having a rotating unit
rotating by receiving externally provided electricity or
battery electricity or a power source from a secondary battery;
and a face washing brush (600) coupled to the face washing
10 apparatus case so as to rotate,

wherein the face washing brush (600) comprises: a plurality
of first brush bristle sets (610) including polybutylene
terephthalate resin and mounted at an output panel of an electric
motor to reversibly rotate according to reversible rotation of
15 the electric motor; and a plurality of second brush bristle sets
(620) including polybutylene terephthalate resin, mounted on
an outer side of a front surface of the case, arranged in parallel
to the first brush bristle set at a height equal to a height
of the first brush bristle set, simultaneously spaced apart from
20 the first brush bristle set by a uniform distance, and fixedly
surrounding a periphery of the first brush bristle set to prevent
foreign substances from being dispersed when the first brush
bristle set is rotated,

wherein a first brush bristle (611) constituting the first
25 brush bristle set (610) and a second brush bristle (621)

constituting the second brush bristle set (620) have tapered surfaces (611a and 621a) formed at distal ends thereof, respectively, and

wherein each of brush bristles (611) constituting the first
5 brush bristle set (610) has a distal end polished to be rounded in an arc shape, and the rotating unit comprises: an operating unit (200) mounted on an outer side of the case to instruct power on/off and reversible rotation switching in a unit of a predetermined angle; a power supply unit (300) mounted on an
10 inner one end of the case; a brushless electric motor (400) mounted in the case to operate by receiving power from the power supply unit according to a switching signal of the operating unit and to reversibly rotate in the unit of the predetermine angle; a control unit (500) to output an electric signal to
15 control the reversible rotation of the brushless electric motor at the predetermined angle according to the switching signal of the operating unit; a holder (700) coupled to a shaft (410) of the brushless electric motor (400) and including vertical and horizontal panels bent in an L shape to reversibly rotate
20 according to the reversible rotation of the brushless electric motor; a spring (800) coupled to one side of the horizontal panel of the holder and having an opposite side coupled to a support unit to flow about the support unit while being supported by the support unit as the holder move up and down in a vertical
25 direction; the support unit (900) to support the opposite side

of the spring to induce the torque; and a ballast (1000) mounted at an upper portion of the holder to maintain a balance of the holder such that reversible rotation of the holder is stably induced.

5

【Claim 2】

The face washing apparatus of claim 1, wherein the tapered surfaces (611a, 621a, and LT) are formed to points in a length range of 2 mm to 4 mm from ends of the brush bristles, and the
10 brush bristles have thin thicknesses of 10 μm or less at brush bristle end points (611b, 621b, and DT).

【Claim 3】

The face washing apparatus of claim 1 or 2, wherein each
15 brush bristle (621) constituting the second brush bristle set (610) has a distal end polished to be rounded in an arc shape or is formed in a straight line.

【Claim 4】

20 The face washing apparatus of any one of claims 1 to 3, wherein the brush bristles (611 and 621) constituting the first brush bristle set (610) and the second brush bristle set (620) have thicknesses of $63 \pm 10 \mu\text{m}$.

25

【Claim 5】

The face washing apparatus of any one of claims 1 to 4,
wherein the brush bristles (611 and 621) constituting the first
brush bristle set (610) and the second brush bristle set (620)
5 have lengths of 11.0 ± 1.0 mm.

【Claim 6】

The face washing apparatus of any one of claims 1 to 5,
wherein the first brush bristle set (610) and the second brush
10 bristle set (620) have 90,000 to 120,000 of brush bristles (611
and 621), respectively, that are implanted.

【Claim 7】

The face washing apparatus of any one of claims 1 to 6,
15 wherein the first brush bristle set (610) is formed in a first
color and the second brush bristle set (620) is formed in a second
color such that the first and second brush bristle sets (610
and 620) have mutually different colors.