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### Hair care device

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#### Abstract

A hair care device according to the present disclosure includes a tank that stores a liquid, a pump that outputs the liquid stored in the tank, and a controller that controls an output of the pump. The hair care device according to the present disclosure further includes a detector that detects swing of the hair care device. The controller adjusts the output of the pump based on a detection value of the detector. Thus, the hair care device that suitably sprays a cosmetic component is provided.

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## Background/Summary

### CROSS-REFERENCE OF RELATED APPLICATIONS

(1) This application is the U.S. National Phase under 35 U.S.C. § 371 of International Patent Application No. PCT/JP2021/003193, filed on Jan. 29, 2021, which in turn claims the benefit of Japanese Patent Application No. 2020-028769, filed on Feb. 21, 2020, the entire disclosures of which Applications are incorporated by reference herein.

### TECHNICAL FIELD

(2) The present disclosure relates to a hair care device.

### BACKGROUND ART

(3) A hair care device is required to appropriately spray a cosmetic component. A hair care device described in PTL 1 detects an inclination in a vertical direction of the hair care device and controls a pump that sends out a cosmetic component based on the inclination to appropriately spray the cosmetic component.

### CITATION LIST

#### Patent Literature

(4) PTL 1: Unexamined Japanese Patent Publication No. 2018-196862

### SUMMARY OF THE INVENTION

(5) At the time of using a hair care device, a user sprays the cosmetic component from the root to the tip of the hair, and thus there is a case where the user swings the hair care device in a short cycle. In this case, because a centrifugal force acts on the cosmetic component, assumed amount and range of spraying the cosmetic component possibly deviate from the actual amount and range of spraying the cosmetic component.

(6) The present disclosure addresses the foregoing problem, and an object thereof is to provide a hair care device that suitably sprays a cosmetic component.

(7) A hair care device according to the present disclosure is a hair care device including a tank that stores a liquid, a pump that outputs the liquid stored in the tank, and a controller that controls an output of the pump, the hair care device further including a detector that detects swing of the hair care device, in which the controller adjusts the output of the pump based on a detection value of the detector.

(8) According to the hair care device of the present disclosure, the cosmetic component can be suitably sprayed.

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## Description

### BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. 1 is a side view of a hair care device according to an exemplary embodiment.

(2) FIG. 2 is a cross-sectional view of the hair care device in FIG. 1.

(3) FIG. 3 is a block diagram illustrating an electrical connection of the hair care device in FIG. 1.

(4) FIG. 4 is a flowchart illustrating an example of first control executed by a controller in a first exemplary embodiment.

(5) FIG. 5 is a flowchart illustrating an example of second control executed by a controller in a second exemplary embodiment.

### DESCRIPTION OF EMBODIMENTS

#### One Example of Modes that a Hair Care Device can Take

(6) A hair care device according to the present disclosure is a hair care device including a tank that stores a liquid, a pump that outputs the liquid stored in the tank, and a controller that controls an output of the pump, the hair care device further including a detector that detects swing of the hair care device, in which the controller adjusts the output of the pump based on a detection value of the detector.

(7) According to the hair care device, because the output of the pump is controlled based on the detection value, the cosmetic component can be suitably sprayed.

(8) According to an example of the hair care device, the detector detects an angular velocity of the hair care device.

(9) According to the hair care device, the output of the pump can be controlled using the angular velocity.

(10) According to an example of the hair care device, the controller decreases the output of the pump as the angular velocity of the hair care device increases.

(11) According to the hair care device, because the output of the pump decreases as a value of the angular velocity increases, the liquid can be appropriately output.

(12) According to an example of the hair care device, the hair care device further includes an air blower that outputs gas and includes a motor and a fan, in which the controller adjusts an output of the motor based on the detection value of the detector.

(13) According to the hair care device, because the output of the motor is controlled based on the detection value, the control can be suitably executed.

(14) According to an example of the hair care device, the detector detects the angular velocity of the hair care device, and the controller increases the output of the motor as the angular velocity of the hair care device increases.

(15) According to the hair care device, an amount of air blow is increased when the angular velocity is large. Therefore, usability is improved.

#### First Exemplary Embodiment

(16) Hereinafter, hair care device **10** of a first exemplary embodiment is described with reference to

FIGS. 1 to 3. Hair care device **10** supplies at least one of a cosmetic component and air to the hair or the like of a user. Hair care device **10** is, for example, a dryer. Hair care device **10** includes housing **11** that constitutes the appearance of hair care device **10** and houses at least one of the other elements that constitute hair care device **10**, and grip **12** that is gripped by the user in use. Housing **11** and grip **12** are preferably connected to each other by a connector configured to be able to change a position of housing **11** with respect to grip **12**. Housing **11** and grip **12** are made of any material having excellent heat resistance. In one example, the material constituting housing **11** and grip **12** is polycarbonate. Housing **11** includes suction port **11A** through which the external air flows in and discharge port **11B** through which the cosmetic component or the air is discharged to the outside. Suction port **11A** preferably includes a filter that prevents dust or the like in the outside air from entering housing **11**. Suction port **11A** and discharge port **11B** each have, for example, an elliptical shape.

(17) Housing **11** includes flow path **13** in which a fluid flow is formed. Flow path **13** connects suction port **11A** and discharge port **11B**. Flow path **13** includes first flow path **13A** through which mainly gas passes and second flow path **13B** through which mainly cosmetic components pass. In one example, the length of each of first flow path **13A** and second flow path **13B** is half the length of the entire length of flow path **13**.

(18) Hair care device **10** further includes controller **20**, storage **30**, operation unit **40**, detector **50**, power supply unit **60**, air blower **70**, heating unit **80**, and mist generator **90**. At least one of controller **20**, storage **30**, operation unit **40**, detector **50**, power supply unit **60**, air blower **70**, heating unit **80**, and mist generator **90** is held inside housing **11**.

(19) Controller **20** is constituted of an arithmetic processing unit that executes a control program. The arithmetic processing unit is constituted of, for example, at least one or both of a central processing unit (CPU) and a micro processing unit (MPU). Controller **20** is configured to be able to communicate with storage **30**, operation unit **40**, detector **50**, air blower **70**, heating unit **80**, and mist generator **90** in a wireless or wired manner. Controller **20** starts control when, for example, power is supplied from power supply unit **60** and an operation signal is input from operation unit **40**. Preferably, controller **20** is provided at a position away from heating unit **80** as a heat generation source. In one example, controller **20** is provided at a location corresponding to grip **12**.

(20) Storage **30** stores program information and table information for executing various controls executed by controller **20**. The table information is information in which a detection value detected by detector **50** is associated with appropriate amounts of output of air blower **70** and mist generator **90**. Storage **30** includes, for example, a non-volatile memory and a volatile memory. Storage **30** is provided in the same control circuit as, for example, controller **20**.

(21) Operation unit **40** outputs an operation signal by, for example, an operation from the user to controller **20**. The operation signal includes a signal for switching on and off of controller **20** or a signal for changing the output of at least one of air blower **70**, heating unit **80**, and mist generator **90** by controller **20**. A part of operation unit **40** is configured to protrude toward the outside of housing **11** to allow the user to operate easily. Operation unit **40** is constituted of, for example, a button, a switch, and a dial. Operation unit **40** may be constituted of a touch panel. Operation unit **40** is mounted on, for example, grip **12**.

(22) Detector **50** detects various pieces of information on hair care device **10**. The detection value detected by detector **50** is output to controller **20**. In a first example, detector **50** is constituted of an acceleration sensor or a gyro sensor, and detects movement of hair care device **10** in three axial directions. Specifically, detector **50** detects acceleration or angular velocity. In the case of the first example, detector **50** is preferably disposed in second flow path **13B**. In a second example, detector **50** detects torque of motors provided in air blower **70** and mist generator **90**. Specifically, detector **50** is constituted of a torque sensor. Specifically, detector **50** may be configured to detect counter electromotive force. In one example, detector **50** is a microcomputer that controls a motor. Controller **20** calculates the rotation speed and the load torque of the motor from the counter

electromotive force. In a third example, detector 50 detects the number of times used and a usage time period of hair care device 10. Detector 50 includes a configuration of at least one of the first example and the second example. More preferably, detector 50 includes all the configurations of detector 50 from the first to third examples.

(23) Power supply unit 60 supplies power to controller 20, storage 30, operation unit 40, detector 50, air blower 70, heating unit 80, and mist generator 90. In the illustrated example, power supply unit 60 is an external power supply such as a commercial power supply. Power supply unit 60 may have a configuration of a secondary battery provided inside housing 11. When power supply unit 60 is the external power supply, hair care device 10 and power supply unit 60 are connected by power line 61.

(24) Air blower 70 forms a flow that sucks the air from suction port 11A and discharges the air from discharge port 11B. Air blower 70 includes motor 71 and fan 72. When motor 71 is driven to rotate fan 72, an air flow is generated in flow path 13. Motor 71 is controlled by controller 20. Air blower 70 is located upstream of first flow path 13A and second flow path 13B in flow path 13, and supplies the air to both first flow path 13A and second flow path 13B.

(25) Heating unit 80 heats the air in housing 11 to produce hot air. The hot air is, for example, the air within a range of 100° C. to 120° C. inclusive. Heating unit 80 includes heater 81. An example of heater 81 includes a positive temperature coefficient (PTC) heater or an infrared heater. Heating unit 80 is provided, for example, in first flow path 13A. Controller 20 controls the output of heater 81.

(26) Mist generator 90 forms the cosmetic component in a mist form. The cosmetic component is a liquid or a component contained in a liquid. Mist generator 90 includes pump 91, tank 92, and nozzle 93. Pump 91 is a liquid pump that supplies the cosmetic component stored in tank 92 to nozzle 93 by driving a motor (not shown). The liquid pump is, for example, a gear pump. Tank 92 stores the liquid containing the cosmetic component in the inside of hair care device 10. Tank 92 is made of any material suitable for holding the liquid containing the cosmetic component. Examples include at least one of polyethylene, polypropylene, polyvinylidene chloride, nylon, polyethylene terephthalate, an ethylene vinyl alcohol copolymer, polyvinyl alcohol, and aluminum. Nozzle 93 forms the cosmetic component, which is a liquid, in a mist form. Nozzle 93 is made of resin or metal. Nozzle 93 includes a plurality of minute holes. When the cosmetic component of the liquid supplied by pump 91 passes through the minute holes, the cosmetic component is generated in a mist form. Alternatively, the cosmetic component and the gas are mixed inside nozzle 93 to generate the cosmetic component in a mist form by shearing force. In this case, pump 91 further includes a gas pump. The gas pump is, for example, a diaphragm pump.

(27) The cosmetic component contains at least one of amino acids such as glycine, alanine, valine, leucine, isoleucine, phenylalanine, proline, hydroxyproline, threonine, serine, tyrosine, methionine, tryptophan, cystine, cysteic acid, arginine, histidine, lysine, hydroxylysine, and glutamic acid; higher fatty acids such as capric acid, lauric acid, myristic acid, palmitic acid, stearic acid, behenic acid, oleic acid, coconut oil fatty acid, isostearic acid, isopalmitic acid, and  $\alpha$ -linolenic acid; hydrocarbon oils such as liquid paraffin, liquid isoparaffin, vaseline, squalene, and squalane; natural oils such as camellia oil, macadamia oil, corn oil, olive oil, avocado oil, castor oil, safflower oil, jojoba oil, sunflower oil, rapeseed oil, sesame oil, soybean oil, and meadow foam oil; organic acids such as malic acid, tannic acid, citric acid; lipids such as cholesterol, ceramide 1, ceramide 2, ceramide 3, ceramide 1A, ceramide 6II, 18-methyleicosanoic acid, cholesterol sulfate, triglyceride, and lysolecithin; higher alcohols such as stearyl alcohol and cetyl alcohol; esters such as beeswax, candelilla wax, carnauba wax, isopropyl palmitate, myristyl lactate, 2-ethylhexyl stearate, wax esters, isopropyl myristate, myristyl myristate, octyl palmitate, stearyl stearate, isocetyl stearate, isononyl isononanoate, isotridecyl isononanoate, hydrogenated castor oil stearate, hydroxystearate hydrogenated castor oil, glyceryl tri(2-ethylhexanoate), pentaerythritol tetra(2-ethylhexanoate), neopentyl glycol dicaprate, diglyceryl diisostearate, dipentaerythritol, and esters with mixed fatty

acids such as hydroxystearic acid/stearic acid/rosin acid; silicones such as dimethylpolysiloxane, amino-modified silicone, polyether modified, and cationized silicone; antioxidants such as polyphenols, vitamins and fullerenes; polysaccharides such as D-galactose, D-glucuronic acid, L-fucose, D-mannose, chitosan, and cationized polysaccharides; humectants such as glycerin, water, xanthan gum, panthenol, sucrose, glucose, fructose, sorbitol, mannitol, xylitol, maltitol, diglycerin, triglycerin, propylene glycol, dipropylene glycol, polypropylene glycol, triethylene glycol, tetraethylene glycol, polyethylene glycol, 1,2-butylene glycol, 1,3-butylene glycol, 1,2-pentanediol, hexylene glycol, erythritol, polyoxyethylene methyl glucoside, and polyvinyl alcohol; sphingosines such as dihydrosphingosine, phytosphingosine, and hydroxy caproyl phytosphingosine; peptides such as collagen PPT, keratin PPT, silk PPT, pearl PPT, milk PPT, soybean PPT, cationized PPT derivatives of the above PPT, acylated PPT derivatives, silylated PPT derivatives, and ethyl esterified PPT derivatives; proteins such as sesame protein, protein obtained from seeds of leguminous plants, rice protein, protein obtained from shells having pearl layers or pearls, and protein obtained from silk; extracts such as ginseng extract, rice germ extract, fuc ales extract, camellia extract, aloe extract; shell ginger extract, and chlorella extract; metals such as zinc, magnesium, and calcium; polymer compounds such as cationized cellulose, hydroxylated cellulose, highly polymerized polyethylene oxide, and cationized synthetic polymer; anti-dandruff agents such as zinc pyrithione and benzalkonium chloride; and antibacterial agents such as dipotassium glycyrrhizinate.

(28) First control executed by controller **20** is described with reference to FIG. **4**.

(29) The first control is control executed by controller **20** at predetermined intervals when the user uses hair care device **10**. Detector **50** includes a configuration of detector **50** of at least the first example.

(30) In step **S11**, controller **20** acquires angular velocity information including the angular velocity of hair care device **10** from detector **50**. In step **S12**, controller **20** compares the angular velocity information with table information stored in storage **30**. The table information stores outputs of air blower **70** and mist generator **90** appropriate for the angular velocity of hair care device **10** in association with experimentally obtained results. Specifically, when the angular velocity is large, controller **20** reduces the output of the motor of mist generator **90** and supply capability of pump **91**, and controls an amount of mist output from second flow path **13B** to be small. When the angular velocity is large, controller **20** increases the output of motor **71** of air blower **70** to increase the air volume output from first flow path **13A**.

(31) In step **S13**, controller **20** determines a first output value of pump **91** of mist generator **90** and a second output value of motor **71** of air blower **70** from the table information. In step **S14**, controller **20** controls to make the output of pump **91** of mist generator **90** become the first output value and the output of motor **71** of air blower **70** become the second output value. After completion of step **S14**, controller **20** ends the control.

(32) An operation of hair care device **10** of the first exemplary embodiment is described.

(33) When the user operates operation unit **40**, power is supplied to hair care device **10**. The user performs hair care by directing discharge port **11B** of hair care device **10** toward the hair. Controller **20** controls the output of pump **91** of mist generator **90** and the output of motor **71** of air blower **70** in accordance with the operation of hair care device **10** by the user.

#### Second Exemplary Embodiment

(34) Hair care device **10** of a second exemplary embodiment is different from hair care device **10** of the first exemplary embodiment in that detector **50** includes the configuration of the second example, and controller **20** performs control based on a detection value of detector **50** of the second example. A part or all of the description of the configuration similar to that of hair care device **10** of the first exemplary embodiment may be omitted.

(35) Controller **20** executes control based on a value of a torque sensor configured as detector **50**. The torque sensor detects torque of a motor provided in hair care device **10**. In one example,

detector **50** detects the torque of a motor constituting pump **91** of mist generator **90**. Pump **91** includes liquid feed pump **910** that supplies the cosmetic component from tank **92** to nozzle **93** and air blower pump **920** that supplies gas to nozzle **93**. Liquid feed pump **910** is, for example, a gear pump. Air blower pump **920** is, for example, a diaphragm pump.

(36) Second control executed by controller **20** is described with reference to FIG. 5.

(37) The second control is control for determining a first output value of liquid feed pump **910** and a second output value of air blower pump **920** constituting pump **91** of mist generator **90** during a predetermined period from the start of use of hair care device **10**.

(38) Controller **20** executes the process of step **S21** when pump **91** operates.

(39) In step **S21**, controller **20** acquires torque value information from detector **50**. Specifically, the torque value information of the motor of liquid feed pump **910** is detected. In the case where the torque value information is acquired over time and the torque exceeds the first maximum value, controller **20** proceeds to the process of step **S22**.

(40) In step **S22**, controller **20** compares the torque value information with table information stored in storage **30**. The table information is information in which the torque value information experimentally obtained in advance is associated with the type of the cosmetic component. Specifically, the higher the viscosity of the cosmetic component, the higher the torque value, and the lower the viscosity of the cosmetic component, the lower the torque value. Controller **20** estimates the cosmetic component stored in tank **92** of hair care device **10** from the table information, and determines the type of the cosmetic component.

(41) In step **S23**, controller **20** determines the first output value and the second output value of pump **91** based on the determined type of the cosmetic component. Specifically, controller **20** determines the first output value that is the torque of the motor of liquid feed pump **910** and the second output value that is the torque of the motor of air blower pump **920**. In step **S24**, controller **20** controls to make the outputs of the motor of pump **91** of mist generator **90** become the first output value and the second output value. After completion of step **S24**, controller **20** ends the control.

(42) An operation of hair care device **10** of the second exemplary embodiment is described

(43) When the user operates operation unit **40**, power is supplied to hair care device **10**. The user performs hair care by directing discharge port **11B** of hair care device **10** toward the hair. Controller **20** determines the type of the cosmetic component, and controls the output of pump **91** of mist generator **90** according to the type of the cosmetic component used by the user.

### Third Exemplary Embodiment

(44) Hair care device **10** according to a third exemplary embodiment is different from hair care device **10** according to the second exemplary embodiment in that table information stored in storage **30** does not include types of cosmetic components. A part or all of the description of the configuration similar to that of hair care device **10** of the first exemplary embodiment and the second exemplary embodiment may be omitted.

(45) Controller **20** detects torque of a motor of liquid feed pump **910** and torque of a motor of air blower pump **920** from detector **50** of the second example, and executes third control for determining a first output value and a second output value of pump **91** based on the detected torque value information.

(46) The third control is described. Controller **20** acquires the torque and the rotation speed of the motor of liquid feed pump **910** from detector **50** simultaneously with the start of liquid feed pump **910**. Controller **20** increases the output of liquid feed pump **910** until the rotation speed of liquid feeding pump **910** reaches a predetermined rotation speed. An optional rotation speed is set as the predetermined rotation speed. For example, the rotation speed is set to the rotation speed in the case of supplying pure water to nozzle **93** by liquid feed pump **910**.

(47) Controller **20** starts the motor of air blower pump **920** and estimates the load torque of the motor of air blower pump **920**. The load torque is estimated based on the counter electromotive



force detected by detector **50**. Controller **20** sets an input voltage of the motor of air blower pump **920** in which a fluctuation range of the load torque is less than or equal to a certain value. When the size of the mist of the cosmetic component is not appropriate, the fluctuation range of the load torque increases. Because the rotation speed of the motor of liquid feed pump **910** increases by the output of air blower pump **920**, controller **20** decreases the output of liquid feed pump **910** until the rotation speed of the motor of liquid feed pump **910** reaches a predetermined rotation speed. Controller **20** respectively drives the motor of liquid feed pump **910** and the motor of air blower pump **920** at suitable rotation speeds. Controller **20** repeatedly executes the third control while hair care device **10** is in operation.

(48) According to hair care device **10** of the third exemplary embodiment, the following effect can be obtained.

(49) Controller **20** can execute appropriate output based on the detection values of the motors of liquid feed pump **910** and air blower pump **920**. Therefore, even when the type of cosmetic component cannot be identified, the output of pump **91** can be suitably controlled.

#### Modifications

(50) The descriptions relating to the exemplary embodiments are merely examples of modes that the hair care device of the present invention can take, and do not intend to limit such modes. The present invention can include, in addition to the exemplary embodiments, for example, following modifications of the exemplary embodiments, and any configurations acquired by combining at least two modifications which do not contradict with each other. Hair care device **10** according to the first to third exemplary embodiments may further include a configuration of a notification unit that notifies of various kinds of information. The notification unit notifies of, for example, information detected by detector **50**. The notification unit is constituted of, for example, a display. In hair care device **10** according to the second exemplary embodiment, controller **20** may further control heater **81**. In one example, controller **20** changes the output of heater **81** according to the type of the cosmetic component. The table information further includes information for associating the type of cosmetic component with an appropriate blowing temperature.

(51) A hair care device according to the present disclosure can be used for commercial and home hair care devices that are used for hair care.

#### REFERENCE MARKS IN THE DRAWINGS

(52) **10** hair care device **20** controller **50** detector **70** air blower **71** motor **72** fan **90** mist generator **91** pump **910** liquid feed pump **920** air blower pump **92** tank

## Claims

1. A hair care device comprising: a tank that stores a liquid; a pump that outputs the liquid stored in the tank; a controller that controls an output of the pump; and a detector that detects swing of the hair care device, wherein the controller adjusts the output of the pump based on a detection value of the detector.
  2. The hair care device according to claim 1, wherein the detector detects an angular velocity of the hair care device.
  3. The hair care device according to claim 2, wherein the controller decreases the output of the pump as the angular velocity of the hair care device increases.
  4. The hair care device according to claim 1, further comprising an air blower that outputs gas and includes a motor and a fan, wherein the controller adjusts an output of the motor based on the detection value of the detector.
  5. The hair care device according to claim 4, wherein the detector detects an angular velocity of the hair care device, and the controller increases the output of the motor as the angular velocity of the hair care device increases.
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