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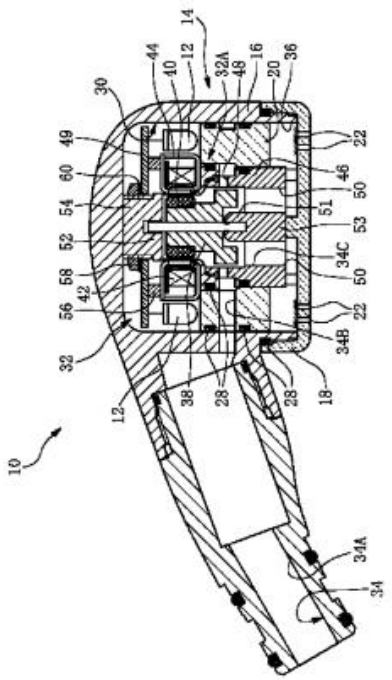
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(54) [Title of Invention] FAUCET WITH LED ILLUMINATION LAMP

(57) [Abstract]

[Problem] To prevent excessive power from being supplied to an LED illumination lamp or the like by increasing feed-water pressure in a spout head with the LED illumination lamp provided with a plurality of LED illumination lamps and a hydroelectric generator.

[Resolution Means] A plurality of LED illumination lamps 12 and a hydroelectric generator 32A having a water turbine 38 that rotates by the force of water flow flowing through an inner water passage 34 are provided, and power from the hydroelectric generator 32A is voltage stabilized by a three-terminal regulator, and then supplied to the LED illumination lamps 12 to light up such, and a top part 54 of a water turbine case 46 cooled by water flow and the three-terminal regulator are connected in a contacting state by a metal heat transfer part 60 to promote heat dissipation of the three-terminal regulator.



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[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention] The present invention relates to a faucet with an LED illumination lamp and more particularly relates to a faucet provided with a hydroelectric generator.

[0002]

[Conventional Art and Problem to be Solved by the Invention] Conventionally, various types of faucet have been installed in water-running hygiene equipment rooms such as kitchens and washrooms. When using a faucet in these water-running hygiene equipment rooms, the main illumination device of the room is lit up to illuminate the entire room, but when performing predetermined work while discharging water from the spout of the faucet while the entire room is illuminated by such a main illumination device, a problem arises wherein a hand portion and the like is not always sufficiently bright and work is difficult depending on the content of the work. For example, when performing work of washing a container or tableware such as a pot or washing a sink while discharging water from the spout, a problem arises wherein washing work is difficult because the bottom portion of the container or tableware such as a pot is dark or a corner portion of the sink is dark.

[0003] In this situation, it is conceivable that an illumination lamp is attached to the faucet, for example, to the spout thereof, to achieve illumination below the spout by the illumination lamp. By doing so, illumination can be performed from a position near the hand, and when washing a container or tableware such as a pot, or a sink or the like while discharging water from a spout, cleaning work and the like can be performed favorably in a state where these are brightly illuminated.

[0004] Conventionally, attaching this type of illumination lamp to a faucet has been proposed, but conventional arts extend electrical wiring to connect an external power source to the illumination lamp and supply power to light up the lamp, or alternatively, mount a battery in the faucet, for example, in the spout thereof, and use this as a power source to light up the illumination lamp, and therefore both have problems as follows.

[0005] That is, the former requires electrical wiring work for supplying power from an external power source, so there is a problem of taking time and effort in the construction, and an illumination function

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cannot be easily provided to the faucet. Furthermore, in the latter, there is a problem that, in association with mounting the battery, a battery mounting portion in the faucet, for example, a periphery of the spout thereof when mounting the battery in the spout, becomes large, as well as a problem of a high running cost and maintenance taking effort because the battery must be periodically replaced.

[0006] Therefore, the present inventors have devised a faucet provided with an LED illumination lamp and equipped with a hydroelectric generator that generates power using a water current in an inner water passage. In this faucet, because power can be supplied to the LED illumination lamp by power generated by force of the faucet itself, there is no need to perform electrical wiring work for connecting the LED illumination lamp of the faucet to an external power source to supply power, and therefore, the problem of effort and time taken for construction can be solved. Furthermore, the problem of a battery mounting portion becoming large when mounting a battery as well as the problem of a high running cost and maintenance taking effort because the battery must be periodically replaced can be solved.

[0007] However, when a hydroelectric generator is provided in the faucet to generate power and the power is supplied to the LED illumination lamp, another new problem such as below arises. The feed-water pressure of the water supplied to the faucet varies depending on the installation site of the faucet or depending on a time period in which the faucet is used, and furthermore, depending on the use of another faucet connected by the same piping, and when the feed-water pressure to the faucet provided with the LED illumination lamp and the hydroelectric generator is too high, excessive power is supplied to the LED illumination lamp causing various inconveniences such as malfunctions.

[0008] When supplying power generated by the hydroelectric generator to the LED illumination lamp, it is conceivable to provide a voltage-stabilizing element on a supply path thereof to stabilize the voltage of the power generated by the hydroelectric generator before supplying the power to the LED illumination lamp. However, even then, when excessive power is generated in the hydroelectric generator, a large amount of heat is generated by the voltage-stabilizing element, and there is a risk that the voltage-stabilizing element may fall into inoperability due to the heat.

[0009]

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[Means for Solving the Problem] The faucet with an LED illumination lamp of the present invention is devised to solve such problems. Thus, the device of claim 1 is characterized by being provided with: (a) a plurality of LED illumination lamps; and (b) a hydroelectric generator having a water turbine that rotates by the force of water flow flowing through an inner water passage, wherein power from the hydroelectric generator is voltage stabilized by a voltage-stabilizing element, and then supplied to the LED illumination lamps to light up such, and a metal component cooled by water flow and the voltage-stabilizing element are connected in a contacting state by a metal heat transfer part to promote heat dissipation of the voltage-stabilizing element.

[0010] The device of claim 2 is characterized by being provided with: (a) a plurality of LED illumination lamps; and (b) a hydroelectric generator having a water turbine that rotates by the force of water flow flowing through an inner water passage, wherein power from the hydroelectric generator is supplied to the LED illumination lamps to light up such, and a number of LED illumination lamps that light up is increased in response to an increase of power generated by the hydroelectric generator.

[0011] The device of claim 3 is characterized by being provided with: (a) a plurality of LED illumination lamps; and (b) a hydroelectric generator having a water turbine that rotates by the force of water flow flowing through an inner water passage, wherein power from the hydroelectric generator is supplied to the LED illumination lamps to light up such, and a relief valve that relieves increased pressure when feed-water pressure increases beyond a set pressure is provided on the inner water passage.

[0012] The device of claim 4 is characterized by the device of claim 3, wherein the relief valve relieves water from the inner water passage to a branched water passage branched from the inner water passage.

[0013] The device of claim 5 is characterized by being provided with: (a) a plurality of LED illumination lamps; and (b) a hydroelectric generator having a water turbine that rotates by the force of water flow flowing through an inner water passage, wherein power from the hydroelectric generator is supplied to the LED illumination lamps to light up such, and a pressure-reducing valve that stabilizes the force of water flow acting on the hydroelectric generator is provided on the inner water

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passage and on an upstream portion of the hydroelectric generator.

[0014]

[Effect and Effect of the Invention] As described above, the device of claim 1 has a metal component cooled by water flow and a voltage-stabilizing element connected in a contacting state by a metal heat transfer part to promote heat dissipation of the voltage-stabilizing element, and therefore, according to the faucet with an LED illumination lamp of claim 1, overheating of the voltage-stabilizing element can be prevented, allowing stable operation of such even when excessive power is generated in a hydroelectric generator due to high feed-water pressure.

[0015] Next, the device of claim 2 increases a number of LED illumination lamps that light up in response to an increase of power generated by the hydroelectric generator, and therefore, with the faucet with an LED illumination lamp of claim 2, respectively necessary luminance can be secured by reducing the number of LED illumination lamps that light up when the power generated by the hydroelectric generator is small, and when the power generated by the hydroelectric generator increases due to a high feed-water pressure, the increased power can be consumed by increasing the number of LED illumination lamps that light up accordingly, and inconvenience due to excessive power generation can be avoided.

[0016] Next, the device of claim 3 is provided with a relief valve that relieves increased pressure when feed-water pressure increases beyond a set pressure on the inner water passage, and therefore, in such a situation, generation of excessive power in the hydroelectric generator due to excessive feed-water pressure can be prevented. In this situation, the relief valve relieves water from the inner water passage to a branched water passage branched therefrom (claim 4).

[0017] Next, the device of claim 5 is provided with a pressure-reducing valve that stabilizes the force of water flow acting on the hydroelectric generator on the inner water passage and on an upstream portion of the hydroelectric generator, and therefore, even in such a situation, power generated in the hydroelectric generator can be prevented from becoming excessive regardless of an increase in feed-water pressure.

[0018]

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[Embodiments] Next, embodiments of the present invention will be described in detail based on the drawings. In FIG. 1, 10 is a spout head in a faucet, and a plurality of LED illumination lamps 12 (12 in this example) are built-in.

[0019] An internal structure of the spout head 10 is illustrated in detail in FIG. 2 and FIG. 3. In these figures, 14 is a body of the spout head 10, and the body 14 has an upper part 16, a lower part 18 that also serves as a water-sprinkling member, and an annular part 20 of the interior composed entirely of a translucent material (acrylic resin in this example), these parts respectively forming separate bodies.

[0020] A multitude of water-sprinkling holes (shower holes) 22 having small hole diameters are formed on a lower surface of the lower part 18 also serving as a water-sprinkling member. In the present example, the entirety of the lower part 18 is configured by a translucent material (acrylic resin in this example).

[0021] A female thread 24 is formed on an inner peripheral surface of the lower part 18. Meanwhile, a male thread 26 is formed on an outer peripheral surface of the upper part 16, and the lower part 18 and the upper part 16 are threaded together by the female thread 24 and the male thread 26. Note that the gap therebetween is sealed so as to be watertight by an O ring 28.

[0022] A fitting recess 30 is formed inside the body 14, and a generator unit 32 is fitted therein. Furthermore, an inner water passage 34 is formed in the spout head 10. The inner water passage 34 has a water passage 34A formed in the upper part 16 of the body 14; a water passage 34B formed in the annular part 20 of the body 14; a case inner water passage 34C formed inside a water turbine case 46—described later—in the generator unit 32; a water flow inlet 48 that causes water to flow into the case inner water passage 34C and a water flow outlet 50 that causes water to flow out from the case inner water passage 34C; and a water chamber 36 (see FIG. 2) formed further downstream thereof. The water chamber 36 is formed under the annular part 20 in communication with the water-sprinkling hole 22.

[0023] As illustrated in FIGS. 2 and 3, the generator unit 32 is configured as a unit provided with a generator (hydroelectric generator) 32A provided with a water turbine 38 that rotates by the force of the water flow flowing through the inner water passage 34, a magnet 40 that rotates integrally with

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the water turbine, a coil 42 arranged in a fixed position opposite to the magnet 40, and a yoke 44; a water turbine case 46 that rotatably houses the water turbine 38 inside; the LED illumination lamps 12; a control board 49 that supplies power generated by the generator 32A to the LED illumination lamps 12 and controls the operation thereof; and a lower part bearing 51 that supports the rotating shaft of the water turbine 38 so as to be rotatable, and an upper part bearing 52.

[0024] Here, the water turbine case 46 is divided into an upper part and a lower part, and these are integrally connected. At least the upper part of the water turbine case 46 is made of metal. In the present example, the bearings 51 and 52 are respectively provided on a bottom part 53 of the water turbine case 46 and a metal top part (metal component) 54.

[0025] The water flow inlet 48 is formed on a peripheral wall part of the water turbine case 46 to allow water flowing in from the water passages 34A and 34B to flow into the water turbine case 46; that is, into the case inner water passage 34C. Furthermore, the water flow outlet 50 is formed on the bottom part 53 to allow water from the case inner water passage 34C to flow out to the water chamber 36. In the present example, the water turbine 38 rotates by the force of water flowing into the water turbine case 46 from the water flow inlet 48, and generates power by rotating the magnet 40 integrally therewith.

[0026] Annular grooves are formed in two upper and lower locations on the outer peripheral surface of the peripheral wall part of the water turbine case 46. O rings 28 are attached thereto, and the gap between the outer peripheral surface of the water turbine case 46 and the inner peripheral surface of the annular part 20 forming a portion of the body 14 is sealed so as to be watertight by the O rings 28.

[0027] The gap between the water passage 34B and the water chamber 36 is sealed so as to be watertight by a lower O ring 28, and the gap between the inner water passage 34 of the spout head 10 that includes the water passages 34A, 34B, and the like and a space above the annular part 20 is sealed so as to be watertight by an upper O ring 28. That is, the gap between the inner water passage 34 and the coil 42, the yoke 44, the control board 49 and the LED illumination lamps 12 is sealed so as to be watertight.

[0028] Furthermore, O rings 28 are mounted on two upper and lower locations on the outer peripheral

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surface of the annular part 20, and the annular part 20 is fitted to the inner peripheral surface of the upper part 16 via the O rings 28 so as to be watertight. Note that in the present example, each LED illumination lamp 12 is attached and held on the lower surface of the control board 49.

[0029] In the present example, a spacer member 56 is interposed between the control board 49 and the yoke 44 in the generator unit 32, and a fixing nut 58 is threaded to an upper surface of the control board 49. Furthermore, a metal heat transfer ring (heat transfer part) 60 is attached to the metal top part 54 of the water turbine case 46 by the fixing nut 58.

[0030] As illustrated in FIG. 4, a rectifier circuit 62 for rectifying power generated by the generator 32A to direct current and supplying such to the LED illumination lamps 12, and a three-terminal regulator 64 that serves as a voltage-stabilizing element are provided on the upper surface of the control board 49. A contact part 66 extending from the heat transfer ring 60 is connected to the three-terminal regulator 64 in a contacting state.

[0031] Here, the heat transfer ring 60 provided with the contact part 66 is for promoting heat dissipation of heat generated in the three-terminal regulator 64. The heat transfer ring 60 contacts the metal top part 54 that is cooled by directly contacting the water flow, and can be effectively cooled by the action of the water flow.

[0032] Therefore, according to the present example, overheating of the three-terminal regulator 64 can be prevented to allow stable operation of such even when excessive power is generated in the generator 32A due to high feed-water pressure. Note that the top part 54 may be configured as a direct heat transfer part, and the contact part 66 may be extended therefrom.

[0033] FIG. 5 illustrates another embodiment of the present invention. This example is one in which the number of LED illumination lamps 12 that light up is configured to increase in response to an increase in power generated by the generator 32A. Specifically, in this example, comparators 68-1 to 68-n are provided corresponding to each of the LED illumination lamps 12-1 to 12-n exceeding a fixed number, and a reference voltage generated in a stepwise magnitude is input by changing the resistance of variable resistances 70-1 to 70-n for each of the comparators 68-1 to 68-n, while voltage generated by the generator 32A is divided and input into each of the comparators 68-1 to 68-n

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corresponding to each of the LED illumination lamps 12-1 to 12-n. Each of the corresponding LED illumination lamps 12-1 to 12-n lights up when the voltage generated (specifically, the divided voltage) exceeds the reference voltage.

[0034] In this example, the number of LED illumination lamps 12 that light up increases along with an increase in the voltage generated by the generator 32A, and thereby, excessive power generated at the generator 32A is absorbed by the lighting up of the LED illumination lamps 12-1 to 12-n and the increase in the number of lights that light up. Note that in FIG. 5, 72-1 to 72-n are lighting control circuits for increasing the number of LED illumination lamps 12 that light up in response to an increase in power generated by the generator 32A, and 74-1 to 74-n are transistors that serve as switching elements for respectively lighting up or turning off the LED illumination lamps 12-1 to 12-n.

[0035] In the present example, a residual light circuit 72A is provided in addition to the lighting control circuits 72-1 to 72-n. The residual light circuit 72A is a circuit for using surplus power generated by the generator 32A to keep the LED illumination lamps 12A lit up for a predetermined period of time even after the water flow stops, and a basic circuit configuration thereof is similar to that of the lighting control circuits 72-1 to 72-n. However, a condenser 75 that stores surplus power and discharges such after the water flow stops is provided in the residual light circuit 72A.

[0036] Note that depending on the situation, it is possible to omit the lighting control circuits 72-1 to 72-n and provide only one or a plurality of residual light circuits 72A so that excessive power is consumed by the generator 32A. Alternatively, conversely, it is also possible to configure the circuit so as to omit the residual light circuit 72A.

[0037] Note that while a description is given herein in which the number of LED illumination lamps 12 that light up is controlled so as to increase or decrease one by one only when the number thereof exceeds a fixed number, it is also possible to unitize (group) the entirety of the LED illumination lamps 12 every fixed number, for example, every three lamps, and to light up the plurality of units in increments of each unit as the power generated by the generator 32A increases. Alternatively, it is also possible to increase the number of LED illumination lamps 12 altogether one by one in response to an increase in surplus power.

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[0038] In the present example, when the power generated by the generator 32A is low, the respective necessary illuminance can be secured by reducing the number of LED illumination lamps 12 that light up, and when the power generated by the generator 32A becomes excessive due to high feed-water pressure, the excessive power can be consumed by increasing the number of LED illumination lamps 12 that light up in response to such, and inconvenience due to excessive power generation can be avoided.

[0039] FIG. 6 illustrates yet another embodiment of the present invention. The present example is one in which a straight spout 77 is provided together with the water-sprinkling hole 22 on the spout head 10, a branched water passage 76 for the straight spout is made to branch from the inner water passage 34, and a relief valve 78 is provided in the branched part. The relief valve 78 performs a valve opening operation when feed-water pressure in the inner water passage 34 rises above a certain level (when it increases to above a set pressure) to relieve an excessive pressure (increased pressure); that is, it performs an operation to relieve water from the inner water passage 34 to the branched water passage 76. In this example too, the LED illumination lamps 12 and other electrical components can be favorably prevented from breaking down or malfunctioning due to the generation of excessive power by the generator 32A.

[0040] FIG. 7 illustrates yet another embodiment of the present invention. The present example is one in which a pressure-reducing valve 80 is provided on the inner water passage 34 and on an upstream portion of the generator 32A, and the force of water flow acting on the generator 32A is stabilized by the action of the pressure-reducing valve 80. In this example too, the generator 32A generates excessive power due to an increase in feed-water pressure, and as a result, the LED illumination lamps 12 and other electrical components can be favorably prevented from breaking down or malfunctioning.

[0041] Embodiments of the present invention are described in detail above, but these are merely examples. For example, the present invention may be applied to a faucet provided with a shower head in a bathroom or other various types of faucet, and the present invention may be configured such that various changes are made within a scope that does not depart from the essence thereof.

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[Brief Description of the Drawings]

[FIG. 1] A diagram illustrating a spout head in a faucet with an LED illumination lamp, which is one embodiment of the present invention.

[FIG. 2] A diagram illustrating an internal structure of the spout head in FIG. 1.

[FIG. 3] An exploded view illustrating each member of FIG. 2.

[FIG. 4] A diagram illustrating the control board in FIGS. 2 and 3, and the three-terminal regulator provided thereupon, together with a peripheral portion.

[FIG. 5] A diagram illustrating the main parts of another embodiment of the present invention.

[FIG. 6] A diagram illustrating yet another embodiment of the present invention.

[FIG. 7] A diagram illustrating yet another embodiment of the present invention.

[Description of Reference Numerals]

10 Spout head

12, 12-1 to 12-n, 12A LED illumination lamp

32A Generator (hydroelectric generator)

34 Inner water passage

38 Water turbine

54 Top part (metal component)

60 Heat transfer ring (heat transfer part)

64 Three-terminal regulator (voltage-stabilizing element)

66 Contact part

76 Branched water passage

78 Relief valve

80 Pressure-reducing valve

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[Scope of Patent Claims]

[Claim 1] A faucet with an LED illumination lamp comprising: (a) a plurality of LED illumination lamps; and (b) a hydroelectric generator having a water turbine that rotates by the force of water flow flowing through an inner water passage, wherein power from the hydroelectric generator is voltage stabilized by a voltage-stabilizing element, and then supplied to the LED illumination lamps to light up such, and a metal component cooled by water flow and the voltage-stabilizing element are connected in a contacting state by a metal heat transfer part to promote heat dissipation of the voltage-stabilizing element.

[Claim 2] A faucet with an LED illumination lamp comprising: (a) a plurality of LED illumination lamps; and (b) a hydroelectric generator having a water turbine that rotates by the force of water flow flowing through an inner water passage, wherein power from the hydroelectric generator is supplied to the LED illumination lamps to light up such, and a number of LED illumination lamps that light up is increased in response to an increase of power generated by the hydroelectric generator.

[Claim 3] A faucet with an LED illumination lamp comprising: (a) a plurality of LED illumination lamps; and (b) a hydroelectric generator having a water turbine that rotates by the force of water flow flowing through an inner water passage, wherein power from the hydroelectric generator is supplied to the LED illumination lamps to light up such, and a relief valve that relieves increased pressure when feed-water pressure increases beyond a set pressure is provided on the inner water passage.

[Claim 4] The faucet with an LED illumination lamp according to claim 3, wherein the relief valve relieves water from the inner water passage to a branched water passage branched from the inner water passage.

[Claim 5] A faucet with an LED illumination lamp comprising: (a) a plurality of LED illumination lamps; and (b) a hydroelectric generator having a water turbine that rotates by the force of water flow flowing through an inner water passage, wherein power from the hydroelectric generator is supplied to the LED illumination lamps to light up such, and a pressure-reducing valve that stabilizes the force of water flow acting on the hydroelectric generator is provided on the inner water passage and on an upstream portion of the hydroelectric generator.

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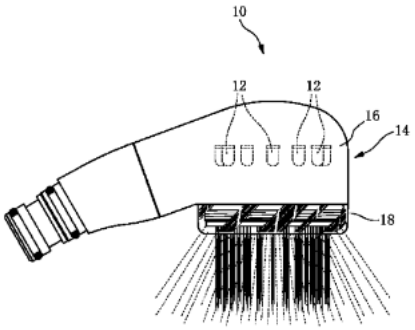
[Abstract]

[Problem] To prevent excessive power from being supplied to an LED illumination lamp or the like by increasing feed-water pressure in a spout head with the LED illumination lamp provided with a plurality of LED illumination lamps and a hydroelectric generator.

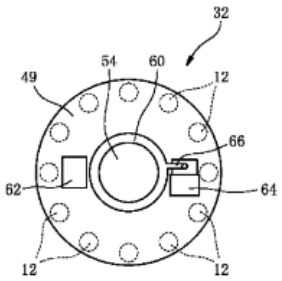
[Resolution Means] A plurality of LED illumination lamps 12 and a hydroelectric generator 32A having a water turbine 38 that rotates by the force of water flow flowing through an inner water passage 34 are provided, and power from the hydroelectric generator 32A is voltage stabilized by a three-terminal regulator, and then supplied to the LED illumination lamps 12 to light up such, and a top part 54 of a water turbine case 46 cooled by water flow and the three-terminal regulator are connected in a contacting state by a metal heat transfer part 60 to promote heat dissipation of the three-terminal regulator.

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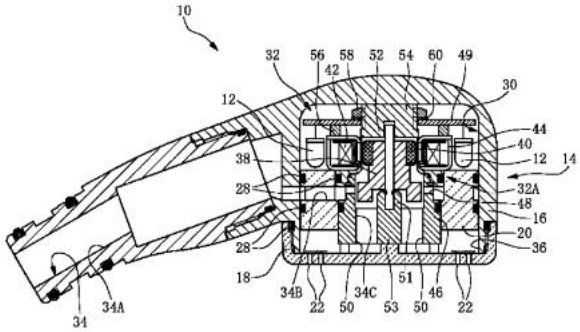
[FIG. 1]



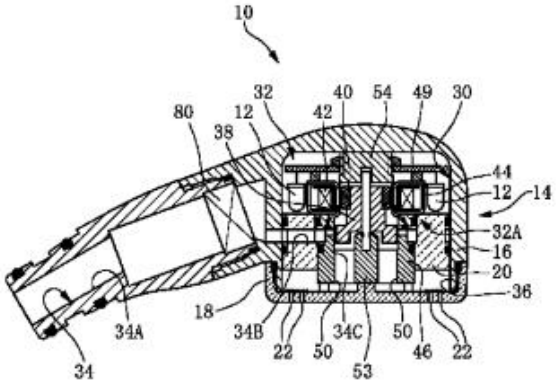
[FIG. 4]



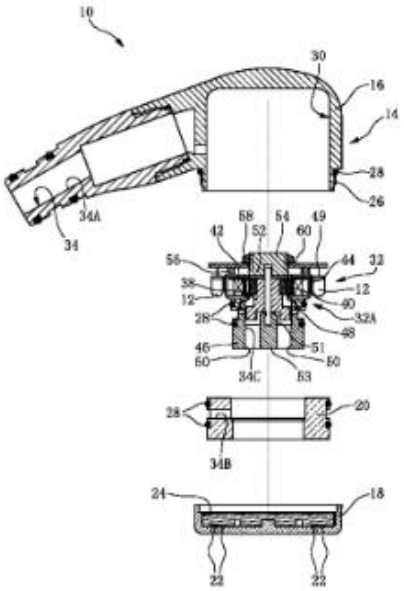
[FIG. 2]



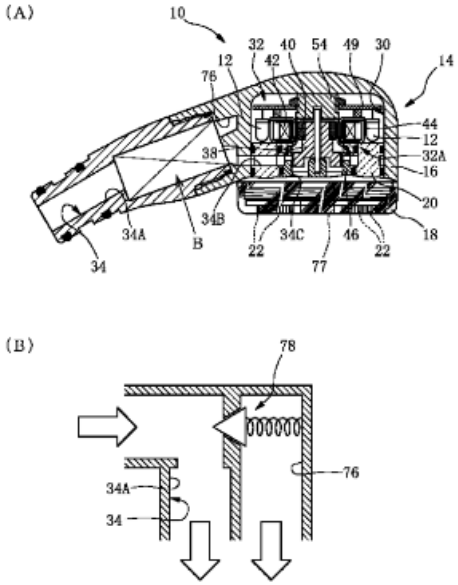
[FIG. 7]



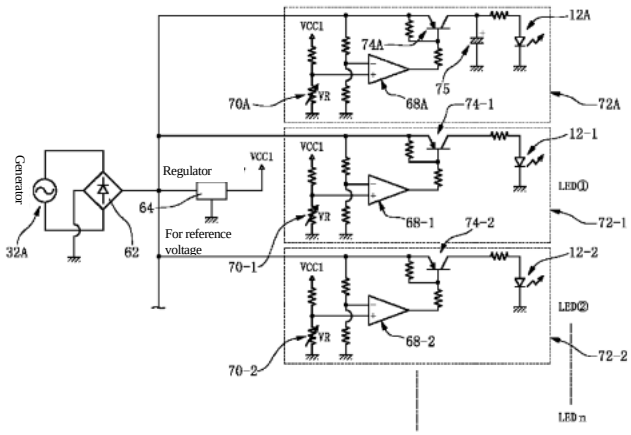
[FIG. 3]



[FIG. 6]



[FIG. 5]



Continued from front page

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F Terms (Reference) 2D060 BA03 BA05 BC30 BE01

February 12, 2024

Certification

Translators' Declaration

We, David Takata and Samantha Matsunaka hereby declare:

That we possess advanced knowledge of the Japanese and English languages,

Our qualifications are as follows:

- *3 years professional translation experience*
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- *Graduation from Japanese language school in Tokyo*

- *4 years professional translation experience*
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- *Double Master of Interpreting and Translation Studies (Japanese)*

The attached Japanese into English translation has been translated by us and to the best of our knowledge and belief, it is a true and accurate translation of:

JP2003027537A (Mizuno).pdf

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David Takata (Abstract, Claims, Specifications par. 1-19)

Samantha Matsunaka (Specifications par. 20-41, Bibliographic information, Drawings)

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