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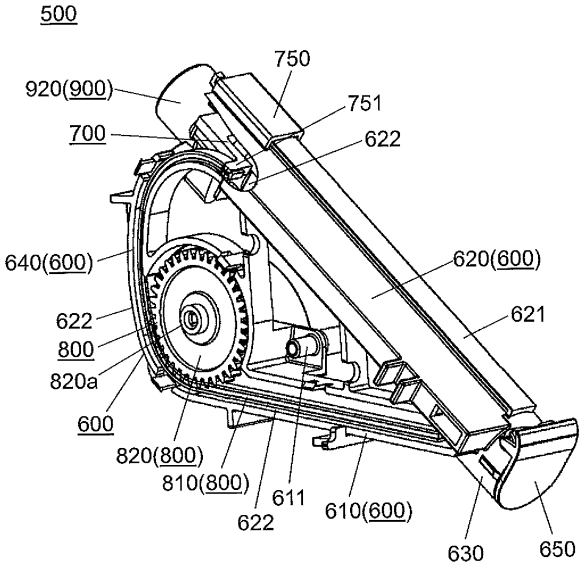
(54) NOZZLE DEVICE AND SANITARY WASHING DEVICE USING SAME

(57) Nozzle device (500) includes nozzle unit (700) including a jet port and a flow passage, support (600), and actuator (800) including flexible rack (810). Support (600) includes holding part (630), guide rail (621), rack guide (622) that guides flexible rack (810), sliding unit (750) engaged with guide rail (621). Flexible rack (810) is coupled to sliding unit (750), and a driving force applied to nozzle unit (700) acts on a middle part of a front end of holding part (630) and a rear end of sliding unit (750). Consequently, it is possible to attain smooth sliding and a stable moving locus of nozzle unit (700), and it is possible to move each jet port of nozzle unit (700) to a proper washing position.

FIG. 6



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Description

TECHNICAL FIELD

[0001] The present invention relates to a nozzle device for washing a private part of a human body, and a sanitary washing device using the same.

BACKGROUND ART

[0002] Conventionally, a nozzle device including a discharge port, a nozzle head, three cylinders, and an actuator is proposed as this type of a nozzle device (e.g., see PTL 1). The discharge port is provided on a front end of the nozzle device, and jets washing water for washing a private part. The nozzle head is provided at a rear end of the nozzle, and is connected to a water supply tube for supplying washing water. The cylinders store the nozzle head, and configure a guide of forward and backward motion of the nozzle head. Specifically, the cylinders are configured by slidable first and second cylinders, and a third cylinder fixed to a base of the nozzle device. The actuator moves the nozzle head forwards and backwards. Specifically, the actuator includes a flexible rack coupled to the rear end of the nozzle head and passing through inside of the cylinder, and a drive unit that drives the flexible rack. The drive unit of the actuator retractably drives the flexible rack. Consequently, the nozzle head and the first and second cylinders are moved forwards and backwards.

[0003] However, in a configuration of the conventional nozzle device, the cylinder serving as the guide of the forward and backward motion of the nozzle head is only the third cylinder fixed to the base of the nozzle device. The second cylinder is slidably supported by the third cylinder, and the first cylinder is slidably supported by the second cylinder. In this case, dispersion and variation of clearances in a junction between the nozzle head and the first cylinder and junctions between the respective cylinders cause dispersion of a moving locus of the nozzle head. Therefore, a position of the discharge port of the nozzle head cannot be sufficiently stabilized. As a result, washing water cannot be accurately jetted to an object to be washed, and therefore there is still room for improvement in view of positioning precision of a washing position.

Citation List

Patent Literature

[0004]

PTL 1: Japanese Patent No. 4793992

SUMMARY OF THE INVENTION

[0005] The present invention provides a nozzle device, in which a moving locus of a nozzle unit is stabilized, and positioning precision of a washing position is improved.

[0006] The nozzle device of the present invention includes a nozzle unit including a jet port and a flow passage communicated with the jet port, a support that retractably supports the nozzle unit, and an actuator that moves the nozzle unit forwards and backwards. The actuator includes a flexible rack coupled to the nozzle unit, a gear that moves the flexible rack forwards and backwards, and a motor that drives the gear. The support includes a holding part that embraces and supports the nozzle unit at a front end, a guide rail that is disposed behind the holding part and guides forward and backward motion of the nozzle unit, and a rack guide that guides forward and backward motion of the flexible rack. Furthermore, the nozzle unit includes a sliding unit that is engaged with the guide rail to slide. The flexible rack is coupled to a front part of the sliding unit, and driving force applied to the nozzle unit through the flexible rack acts on a middle part of a front end of the holding part and a rear end of the sliding unit.

[0007] Consequently, the sliding unit slides along the guide rail. In this case, while a front part of the nozzle unit is supported by the holding part, and a rear part of the nozzle unit is supported by the sliding unit, the driving force by the flexible rack is applied to the middle part of these two supporting points. Therefore, it is possible to attain smooth sliding and a stable moving locus of the nozzle unit. As a result, it is possible to move the jet port of the nozzle unit to a proper washing position, and to implement a nozzle device improving positioning precision of a washing position of the jet port.

BRIEF DESCRIPTION OF DRAWINGS

[0008]

FIG. 1 is a perspective view illustrating an outer shape in a state where a sanitary washing device according to an exemplary embodiment of the present invention is mounted on a toilet bowl.

FIG. 2 is a perspective view illustrating an inside of a main body of the sanitary washing device.

FIG. 3 is a schematic diagram illustrating a configuration of a water circuit of the sanitary washing device.

FIG. 4 is a perspective view illustrating a storage state of the nozzle device according to this exemplary embodiment.

FIG. 5 is a sectional view taken along line 5-5 illustrated in FIG. 4.

FIG. 6 is a perspective view illustrating an inside of an actuator of the nozzle device.

FIG. 7 is a longitudinal sectional view illustrating the storage state of the nozzle device.

FIG. 8 is a detailed sectional view of Part B illustrated in FIG. 7.

FIG. 9 is a sectional view of the nozzle unit in an

axial direction, illustrating the storage state of the nozzle device.

FIG. 10 is a detailed sectional view of Part C illustrated in FIG. 9.

FIG. 11 is a perspective view illustrating a buttock washing state of the nozzle device according to a first exemplary embodiment.

FIG. 12 is a longitudinal sectional view illustrating the buttock washing state of the nozzle device.

FIG. 13 is a detailed sectional view of Part D illustrated in FIG. 12.

FIG. 14 is a sectional view of the nozzle unit in the axial direction, illustrating the buttock washing state of the nozzle device.

FIG. 15 is a detailed sectional view of Part E illustrated in FIG. 14.

FIG. 16 is a perspective view illustrating a bidet washing state of the nozzle device according to the first exemplary embodiment.

FIG. 17 is a longitudinal sectional view illustrating the bidet washing state of the nozzle device.

FIG. 18 is a detailed sectional view of Part F illustrated in FIG. 17.

FIG. 19 is a sectional view of the nozzle unit in the axial direction, illustrating the bidet washing state of the nozzle device.

FIG. 20 is a detailed sectional view of Part G illustrated in FIG. 19.

DESCRIPTION OF EMBODIMENT

[0009] Hereinafter, an exemplary embodiment of the present invention is described with reference to the drawings. The present invention is not limited by this exemplary embodiment.

FIRST EXEMPLARY EMBODIMENT

<1> Configuration of Sanitary Washing Device

[0010] Hereinafter, a configuration of a sanitary washing device according to an exemplary embodiment of the present invention is described with reference to FIG. 1 to FIG. 3.

[0011] FIG. 1 is a perspective view illustrating an outer shape in a state where the sanitary washing device according to this exemplary embodiment of the present invention is mounted on a toilet bowl. FIG. 2 is a perspective view illustrating an inside of a main body of the sanitary washing device. FIG. 3 is a schematic diagram illustrating a configuration of a water circuit of the sanitary washing device.

[0012] As illustrated in FIG. 1, sanitary washing device 100 of this exemplary embodiment includes at least main body 200, sleeve part 210, toilet seat 300, toilet lid 400, and the like, and is installed on upper surface 110a of toilet bowl 110.

[0013] In the following, an installation side of main body 200 of sanitary washing device 100 is defined as rear, an installation side of toilet seat 300 is defined as front, and a right side and a left side as viewed from the rear toward the front are defined as right and left respectively, and location of respective components is described.

[0014] As illustrated in FIG. 1, toilet seat 300 and toilet lid 400 are openably mounted on main body 200 through a rotation mechanism. In a state where toilet lid 400 is opened, toilet lid 400 erects so as to be located at a last part of sanitary washing device 100. On the other hand, in a state where toilet lid 400 is closed, toilet lid 400 conceals upper surface 300a being a seating surface of toilet seat 300, and a part of main body 200. Furthermore, toilet seat 300 rotates from a state of being placed on upper surface 110a of toilet bowl 110 illustrated in FIG. 1 to a state of erecting on a front surface of main body 200, similarly to toilet lid 400.

[0015] Sleeve part 210 is provided so as to protrude from rear to front of a right side of main body 200, and operation unit 211, a plurality of operation switches 212, indication lamp 213, and the like are provided on an upper surface of sleeve part 210. Operation switches 212 operate respective functions of sanitary washing device 100.

[0016] A toilet seat heater (not illustrated) is installed inside toilet seat 300, heats the seating surface of toilet seat 300 to a proper temperature and retains heat. A sitting sensor (not illustrated) is provided in a bearing portion inside main body 200 supporting a rotating shaft of toilet seat 300, and detects that a user sits on toilet seat 300. The sitting sensor is configured by, for example, a weight type sitting sensor, and opens or closes the switch depending on change in weight caused by sitting on toilet seat 300 by the user. Consequently, the sitting sensor detects that the user sits on toilet seat 300.

[0017] As illustrated in FIG. 2, at least nozzle device 500, deodorizer 220, controller 230, and the like are installed inside main body 200. Nozzle device 500 is installed at a center of main body 200. Deodorizer 220 is disposed on a left side of nozzle device 500, and sucks and deodorizes odor in toilet bowl 110. Controller 230 controls respective functions of sanitary washing device 100 based on control signals of operation switches 212.

[0018] Furthermore, on a right side of nozzle device 500, hot water tank 245 that is a main component of washing water supply unit 240 is installed. Hot water tank 245 is configured from, for example, a tank main body molded by a resin material such as PP (polypropylene). A sheathed heater (not illustrated) that heats washing water is provided at a lower part in the tank main body, and a thermistor (not illustrated) is installed near the sheathed heater, as a temperature detector that detects a hot water temperature. A vacuum breaker is provided on the upper surface of the tank main body. The vacuum breaker introduces air from outside to adjust pressure in a case where pressure inside hot water tank 245 becomes negative pressure.

[0019] Hydrant 241 illustrated in FIG. 3 is provided at

a lower part of a right side of main body 200, and is connected to external water service piping. Inside hydrant 241, a strainer that removes garbage and impurities contained in washing water of tap water or the like is incorporated.

[0020] As illustrated in FIG. 3, constant flow valve 242, cut-off solenoid valve 243, relief valve 244 that are components of washing water supply unit 240 are successively connected by flowing water passage 270 between hydrant 241 and hot water tank 245, and are installed in front of hot water tank 245 illustrated in FIG. 2.

[0021] Hot water tank 245 is connected to flow regulating valve 900 of nozzle device 500 through connection tube 612 configuring a part of flowing water passage 270. Then, washing water supplied from the water service piping through hydrant 241 is heated by hot water tank 245, and the heated water is supplied to nozzle device 500. Furthermore, the heated water supplied to nozzle device 500 is jetted from nozzle unit 700 of nozzle device 500 toward a private part of a user, thereby washing the private part of the user.

[0022] Thus, the sanitary washing device of this exemplary embodiment is configured.

[0023] A detail configuration and action of nozzle device 500 are described later.

<2> Configuration of Water Circuit of Sanitary Washing Device

[0024] Hereinafter, a configuration of the water circuit in the sanitary washing device of this exemplary embodiment is described in detail with reference to FIG. 3 while referring to FIG. 1 and FIG. 2.

[0025] FIG. 3 is a schematic diagram illustrating the water circuit configuring a flow passage through which washing water of the sanitary washing device is fed.

[0026] As illustrated in FIG. 3, inside main body 200, flowing water passage 270 that allows washing water to be supplied to nozzle device 500 is formed. Then, hydrant 241, constant flow valve 242, cut-off solenoid valve 243, relief valve 244, hot water tank 245, flow regulating valve 900, nozzle device 500, and the like are successively installed along flowing water passage 270.

[0027] Hydrant 241 is connected to a water supply pipe branched by a branch faucet from the water service piping. Then, constant flow valve 242, cut-off solenoid valve 243, and relief valve 244 are successively connected in this order by flowing water passage 270 between hydrant 241 and hot water tank 245. Furthermore, to flowing water passage 270 between hot water tank 245 and nozzle unit 700 of nozzle device 500, flow regulating valve 900 that switches flowing water passage 270 and regulates a flow rate is connected. Buttock washing flow passage 714, bidet washing flow passage 715, nozzle cleaning flow passage 716 that configure nozzle unit 700 are connected to the respective ports of flow regulating valve 900. Consequently, washing water from hydrant 241 is supplied to each flow passage of nozzle unit 700.

[0028] Hereinafter, flow of washing water in main body 200, and control of each component of main body 200 by controller 230 are described in detail.

[0029] First, tap water flowing in the water service piping is supplied to hydrant 241 as washing water. At this time, the supplied washing water is regulated such that a flow rate of washing water flowing in flowing water passage 270 is maintained constant by constant flow valve 242.

[0030] Cut-off solenoid valve 243 switches a state where the washing water is supplied to hot water tank 245. Controller 230 controls operation of cut-off solenoid valve 243 based on manipulation of operation unit 211.

[0031] Hot water tank 245 heats the washing water supplied through flowing water passage 270 to a predetermined temperature. Controller 230 controls operation of hot water tank 245 based on the manipulation of operation unit 211 and detection data of the thermistor.

[0032] Then, the washing water heated by hot water tank 245 is supplied to flow regulating valve 900 through connection tube 612 that is a part of flowing water passage 270. For example, stepping motor 920 is operated, so that flow regulating valve 900 supplies, with the washing water, any flow passage of buttock washing flow passage 714, bidet washing flow passage 715, and nozzle cleaning flow passage 716. Consequently, the washing water is jetted from any jet port of buttock washing jet port 711, bidet washing jet port 712, and nozzle cleaning jet port 713 described later. Controller 230 controls washing and stopping operation of flow regulating valve 900 based on the manipulation of operation unit 211 by a user. Additionally, controller 230 controls regulating operation of a flow rate of washing water to be jetted, based on a flow rate set through operation unit 211 by the user.

[0033] Thus, the water circuit of the sanitary washing device of this exemplary embodiment is configured.

<3> Configuration of Nozzle Device

[0034] Hereinafter, a configuration of the nozzle device in the sanitary washing device of this exemplary embodiment is described with reference to FIG. 4 to FIG. 20.

[0035] FIG. 4 is a perspective view illustrating a storage state of the nozzle device according to this exemplary embodiment. FIG. 5 is a sectional view taken along line 5-5 illustrated in FIG. 4. FIG. 6 is a perspective view illustrating an inside of an actuator of the nozzle device. FIG. 7 is a longitudinal sectional view illustrating the storage state of the nozzle device. FIG. 8 is a detailed sectional view of Part B illustrated in FIG. 7. FIG. 9 is a sectional view of the nozzle unit in an axial direction, illustrating the storage state of the nozzle device. FIG. 10 is a detailed sectional view of Part C illustrated in FIG. 9. FIG. 11 is a perspective view illustrating a buttock washing state of the nozzle device. FIG. 12 is a longitudinal sectional view illustrating the buttock washing state of the nozzle device. FIG. 13 is a detailed sectional view of Part D illustrated in FIG. 12. FIG. 14 is a sectional view

of the axial direction of the nozzle unit, illustrating the buttock washing state of the nozzle device. FIG. 15 is a detailed sectional view of Part E illustrated in FIG. 14. FIG. 16 is a perspective view illustrating a bidet washing state of the nozzle device. FIG. 17 is a longitudinal sectional view illustrating the bidet washing state of the nozzle device. FIG. 18 is a detailed sectional view of Part F illustrated in FIG. 17. FIG. 19 is a sectional view of the nozzle unit in the axial direction, illustrating the bidet washing state of the nozzle device. FIG. 20 is a detailed sectional view of Part G illustrated in FIG. 19.

[0036] As illustrated in FIG. 4, nozzle device 500 includes at least support 600, nozzle unit 700, actuator 800, flow regulating valve 900, and the like. Support 600 is molded by a resin material such as POM (polyoxymethylene: generally, polyacetal, acetal resin), and is formed in a substantially triangular (including a triangle) frame shape (see FIG. 6). Nozzle unit 700 moves forwards and backwards along support 600. Actuator 800 drives so as to move nozzle unit 700 in a forward and backward direction. Flow regulating valve 900 switches supply of washing water to the respective flow passages of nozzle unit 700.

[0037] In the following, a storage direction of nozzle unit 700 is defined as rear, an advance direction of nozzle unit 700 is defined as front, and a right side and a left side as viewed from the rear toward the front are defined as right and left respectively, and location of respective components of nozzle device 500 is described.

[0038] Hereinafter, the respective components of nozzle device 500 are described in detail.

[0039] As illustrated in FIG. 6, support 600 is formed in a substantially triangular (including a triangle) frame shape in side view, and includes bottom part 610, inclination part 620, vertical part 640, and the like. Bottom part 610 is substantially horizontally (including horizontality) provided, inclination part 620 descends from the rear to the front with respect to bottom part 610 (inclined forward), and is provided above bottom part 610. Vertical part 640 is provided so as to join bottom part 610 with a rear end of inclination part 620. In inclination part 620 of support 600, guide rail 621 that guides forward and backward motion of nozzle unit 700, rack guide 622 that guides flexible rack 810 of actuator 800 are formed over a substantially whole length (including a whole length) of inclination part 620. Furthermore, substantially cylindrical (including a cylindrical shape) holding part 630 that supports so as to hold nozzle unit 700 is integrally formed at a lower part of a front end of inclination part 620.

[0040] As illustrated in FIG. 5, guide rail 621 that is disposed in inclination part 620 of support 600 and guides nozzle unit 700 is formed to have a substantially T-shaped (including a T-shape) cross section. Furthermore, rack guide 622 that is disposed in inclination part 620 of support 600 and guides flexible rack 810 is formed in a substantially U-shaped (including a U-shape) cross section in which one of side surfaces is open. Consequently, rack guide 622 regulates upper and lower surfaces and the other side surface of flexible rack 810 to guide flexible rack 810.

[0041] As illustrated in FIG. 6, rack guide 622 is continuously formed from inclination part 620 of support 600 to vertical part 640 located at rear of support 600 and bottom part 610. A corner connecting inclination part 620 and vertical part 640 of support 600, and a corner connecting vertical part 640 and bottom part 610 are each formed in a substantially circular arc shape (including a circular arc shape). A sectional shape of rack guide 622 formed in vertical part 640 and bottom part 610 of support 600 is formed in a substantially U-shape (including a U-shape), similarly to rack guide 622 formed in inclination part 620. However, while an opened side surface of rack guide 622 in inclination part 620 is a left side surface, but the opened side surface of rack guide 622 in each of vertical part 640 and bottom part 610 is an opposite right side surface. The open surfaces of rack guide 622 in vertical part 640 and bottom part 610 of support 600 are closed by support lid 660 configured by a separate member illustrated in FIG. 5.

[0042] As illustrated in FIG. 6, a size in a height direction of rack guide 622 that regulates vertical movement of flexible rack 810 is slightly larger than a thickness of flexible rack 810 in inclination part 620 and vertical part 640 of support 600. On the other hand, a size in the height direction of rack guide 622 of bottom part 610 of support 600 is sufficiently larger than the thickness of flexible rack 810. Consequently, in bottom part 610 of support 600, resistance caused by sliding of rack guide 622 and flexible rack 810 is reduced.

[0043] The actuator 800 includes flexible rack 810 coupled to nozzle unit 700, pinion gear 820 that meshes with flexible rack 810, and a drive motor 830 that rotates pinion gear 820. Consequently, actuator 800 moves forwards and backwards nozzle unit 700 along guide rail 621.

[0044] Flexible rack 810 is integrally molded by, for example, TPE (thermoplastic elastomer) of TPEE (polyester-based elastomer) or TPU (thermoplastic polyurethane). Flexible rack 810 is formed in a belt shape slightly curved as a whole. A tooth profile that meshes with pinion gear 820 of actuator 800 is formed on a curved inner peripheral surface, and a curved outer peripheral surface is formed in a flat surface. The curved outer peripheral surface of flexible rack 810 is coated with fluororesin such as PTFE (polytetrafluoroethylene resin). Consequently, friction resistance of flexible rack 810 to rack guide 622 is reduced.

[0045] As illustrated in FIG. 6, in the corner of vertical part 640 and bottom part 610 of support 600, pinion gear 820 that meshes with flexible rack 810 to drive flexible rack 810, and drive motor 830 that drives pinion gear 820 are installed. Drive motor 830 is configured by, for example, a stepping motor, and a rotation angle is controlled by a pulse signal. Pinion gear 820 is installed at such a position so as to be concentric with a corner of rack guide 622, a rotating shaft of drive motor 830 is coupled to bearing 820a formed at a center of pinion gear 820. Con-

sequently, rotation of drive motor 830 is transmitted to the tooth profile of meshing flexible rack 810 through pinion gear 820, to drive flexible rack 810.

[0046] As illustrated in FIG. 9, in a vicinity of a front end (holding part 630 side) and a rear end (vertical part side) of inclination part 620 of support 600, front stopper receiving part 623 and rear stopper receiving part 624 are formed. Consequently, a sliding range of nozzle cover 720 is regulated in a predetermined range.

[0047] As illustrated in FIG. 7 and FIG. 8, clearance 740 is provided between an inner peripheral surface of holding part 630 of support 600 and an outer peripheral surface of nozzle cover 720 of nozzle unit 700. Then, washing water jetted from nozzle unit 700 flows into clearance 740 formed between the inner peripheral surface of holding part 630 and the outer peripheral surface of nozzle cover 720 of nozzle unit 700. Consequently, the washing water washes the outer peripheral surface of nozzle cover 720 of nozzle unit 700 and then is exhausted from exhaust port 725.

[0048] In front of holding part 630, nozzle lid 650 that opens and closes by the forward and backward motion of nozzle unit 700 is openably provided. Then, nozzle lid 650b closes in a state where nozzle unit 700 is stored, so that nozzle unit 700 is prevented from being contaminated with feces or the like.

[0049] As illustrated in FIG. 4, in bottom part 610 of support 600, water supply joint 611 is provided. Water supply joint 611 mutually connects the water supply tube (not illustrated) connected to the washing water supply unit, and connection tube 612 that supplies washing water from support 600 to flow regulating valve 900. Furthermore, water supply joint 611 is disposed at a vertically lower position than a middle position of guide rail 621 corresponding to a substantially center (including a center) of a sliding range of slider 750 configuring a sliding unit described later, and at a position sufficiently separated from guide rail 621. With this configuration, a length of connection tube 612 can be shortened. Additionally, it is possible to reduce deformation of connection tube 612 when nozzle unit 700 moves forwards and backwards along guide rail 621. Furthermore, it is possible suppress resistance by connection tube 612. As a result, it is possible to smoothly slide nozzle unit 700 along guide rail 621.

[0050] As illustrated in FIG. 8 and FIG. 9, nozzle unit 700 is molded by a resin material such as ABS (acrylonitrile, butadiene, styrene copolymerized resin), and includes nozzle main body 710, nozzle cover 720, and coupling part 730. Nozzle main body 710 is formed into, for example, a bar shape, and includes buttock washing jet port 711, bidet washing jet port 712, and nozzle cleaning jet port 713 on a front end side. Furthermore, nozzle main body 710 includes buttock washing flow passage 714, bidet washing flow passage 715, and nozzle cleaning flow passage 716 communicated with buttock washing jet port 711, bidet washing jet port 712, and nozzle cleaning jet port 713, respectively. Nozzle cover 720 is formed into, for example, a cylindrical shape, and covers substantially whole (including whole) nozzle main body 710. Coupling part 730 engages nozzle main body 710 and nozzle cover 720, so that nozzle cover 720 is towed by nozzle main body 710, as described later.

[0051] In nozzle unit 700, a front side of nozzle unit 700 is supported in a state of being inserted into holding part 630 of support 600, and a rear side is slidably installed in a state of being suspended from guide rail 621. Nozzle unit 700 retractably moves among a storage position where nozzle unit 700 is stored behind holding part 630, illustrated in FIG. 4, FIG. 7 and

[0052] FIG. 9, a buttock washing position where nozzle unit 700 protrudes from holding part 630, illustrated in FIG. 11, FIG. 12 and FIG. 14, and a bidet washing position illustrated in FIG. 16, FIG. 17 and FIG. 19.

[0053] As illustrated in FIG. 9, nozzle cover 720 includes nozzle cover main body 721 and coupling member 722. Nozzle cover main body 721 is formed by molding, for example, a stainless thin plate into a cylindrical shape, and has a front end surface which is a closed surface, and a rear end surface which is an open surface. Coupling member 722 is molded by a resin material such as POM into a substantially cylindrical shape (including a cylindrical shape), and is formed with a pair of coupling pieces 723 (see FIG. 10) engaged with nozzle main body 710 at a position facing an end surface. Furthermore, nozzle cover stopper 726 that regulates a sliding range of nozzle cover 720 is integrally formed on a right side of a rear end of coupling member 722. Nozzle cover stopper 726 comes into contact with front stopper receiving part 623 and rear stopper receiving part 624 which are formed in support 600, thereby regulating the sliding range of nozzle cover 720.

[0054] A part of coupling member 722 of nozzle cover 720 is fixed to be integrated while being inserted into nozzle cover main body 721 from an opening of the open surface provided at a rear end of nozzle cover main body 721.

[0055] As illustrated in FIG. 7 and FIG. 8, in a front upper surface of nozzle cover main body 721, single jet opening 724 is provided at a position where buttock washing jet port 711 and bidet washing jet port 712 of nozzle main body 710 can face. In a front lower surface of nozzle cover main body 721, exhaust port 725 that exhausts washing water flowing out into nozzle cover main body 721 to outside is provided.

[0056] Nozzle main body 710 is molded by a resin material such as ABS. Nozzle main body 710 is formed to have an outer diameter slightly smaller than an inner diameter of nozzle cover 720. Consequently, it is possible to attain mutual smooth sliding of nozzle main body 710 and nozzle cover 720 in a state where nozzle main body 710 is inserted in nozzle cover 720.

[0057] As illustrated in FIG. 8, buttock washing jet port 711, and bidet washing jet port 712 located at an interval behind buttock washing jet port 711 are disposed on an upper surface on a front end side of nozzle main body

710. Furthermore, as illustrated in FIG. 9, nozzle cleaning jet port 713 is installed on a left side of rear of bidet washing jet port 712.

[0058] As illustrated in FIG. 7 and FIG. 9, the three flow passages, namely buttock washing flow passage 714, bidet washing flow passage 715, nozzle cleaning flow passage 716, which are substantially linearly (including "linearly") disposed from the rear end to the front end are formed inside nozzle main body 710 in a manner illustrated in FIG. 5. Specifically, buttock washing flow passage 714 is disposed on a right side of a lower part of nozzle main body 710. As illustrated in FIG. 13, buttock washing flow passage 714 is bent in a direction of an upper surface of nozzle main body 710 in a vicinity of a front end, to be communicated with buttock washing jet port 711. Consequently, washing water jetted from buttock washing jet port 711 passes through jet opening 724 of nozzle cover 720 disposed in a facing manner, to be jetted upward.

[0059] On the other hand, bidet washing flow passage 715 illustrated in FIG. 5 is disposed on a right side of an upper part of nozzle main body 710. As illustrated in FIG. 18, bidet washing flow passage 715 is bent in the direction of the upper surface of nozzle main body 710 in a vicinity of a front end, to be communicated with bidet washing jet port 712. Consequently, washing water jetted from bidet washing jet port 712 passes through jet opening 724 of nozzle cover 720 disposed in a facing manner, to be jetted upward.

[0060] Furthermore, nozzle cleaning flow passage 716 illustrated in FIG. 5 is disposed on a left side of nozzle main body 710. As illustrated in FIG. 9 and FIG. 19, nozzle cleaning flow passage 716 is bent to the left side of nozzle main body 710 in a vicinity of a front end, to be communicated with nozzle cleaning jet port 713. Consequently, washing water jetted from nozzle cleaning jet port 713 is jetted into nozzle cover 720 to be discharged from exhaust port 725 of nozzle cover 720 to outside of nozzle cover 720. That is, washing water jetted from nozzle cleaning jet port 713 is used for cleaning of nozzle unit 700 and periphery of nozzle unit 700.

[0061] As illustrated in FIG. 4 and FIG. 7, flow regulating valve 900 is installed on a rear end surface of nozzle main body 710. Flow regulating valve 900 includes, for example, disc type valve main body 910 and stepping motor 920 that drives switching operation. Flow regulating valve 900 selectively switches buttock washing flow passage 714, bidet washing flow passage 715, and nozzle cleaning flow passage 716 and supplies with washing water.

[0062] Furthermore, an outline of valve main body 910 of flow regulating valve 900 is molded by a resin material such as POM. Then, slider 750 and engaging piece 751 are disposed at an upper part of valve main body 910 of flow regulating valve 900. Slider 750 includes a sliding unit by suspending integrally molded nozzle unit 700 from guide rail 621. Engaging piece 751 engages nozzle unit 700 with flexible rack 810.

[0063] As illustrated in FIG. 5, a cross section of slider 750 is formed in a substantially C-shape (including a C-shape) such that slider 750 holds a substantially T-shaped (including a T-shape) guide rail 621. Then, slider 750 is formed to have such a size that only a vicinity of both side ends 750a of an inner peripheral surface of slider 750 are in contact with upper and lower surfaces of guide rail 621. Furthermore, recess 750b having a depressed cross section so as to generate a gap between guide rail 621 and slider 750 is formed at a center of slider 750. Consequently, a contact area between slider 750 and guide rail 621 is reduced, and sliding resistance is reduced.

[0064] As described above, engaging piece 751 is integrally formed with a front end of slider 750. As illustrated in FIG. 6, flexible rack 810 is disposed behind engaging piece 751. Consequently, the driving force applied from flexible rack 810 to slider 750 is always applied to the front end of slider 750 through engaging piece 751. That is, slider 750 inserted in guide rail 621 is slidable along guide rail 621.

[0065] Furthermore, engaging piece 751 of slider 750 engaged with flexible rack 810 is disposed inside rack guide 622. Then, flexible rack 810 is driven by drive motor 830 through pinion gear 820. Consequently, engaging piece 751 slides forward and rearward inside rack guide 622, and nozzle unit 700 slides forward and rearward along guide rail 621.

[0066] During sliding of nozzle unit 700, a front part of nozzle unit 700 is supported by holding part 630, and a rear part of nozzle unit 700 is supported by guide rail 621 through slider 750. Consequently, the driving force applied from flexible rack 810 to nozzle unit 700 is applied to a middle part between a front end and a rear end of support 600 (specifically, a most forward position of water supply port 911 being a hose connection part of nozzle main body 710 in a movement range of nozzle unit 700, and a most rearward storage position of water supply port 911). Therefore, it is possible to suppress friction resistance (sliding resistance) of guide rail 621 and slider 750, which is generated by the driving force applied to nozzle unit 700. This is because in a case where water supply joint 611 and water supply port 911 being the hose connection parts are disposed closely each other, when the hose connection parts come close with movement of nozzle unit 700, twisting force of connection tube 612 increases, and therefore torsional force becomes sliding resistance. That is, in a case where nozzle unit 700 moves forward and backward, uniformly keeping of a distance between the hose connection parts enables reduction in sliding resistance. Ideally, the hose connection parts are preferably provided at a center of a semicircle that is a locus where connection tube 612 moves. However, location of the hose connection parts is generally restricted. In this exemplary embodiment, any one of the hose connection parts is provided at the center of a moving section where nozzle unit 700 slides, so that it is possible to most uniformly keep the distance between the

hose connection parts. As a result, nozzle unit 700 can smoothly slide.

[0067] As illustrated in FIG. 4, water supply port 911 that supplies flow regulating valve 900 with washing water is installed on an outer surface of valve main body 910 of flow regulating valve 900. Water supply port 911 is connected to connection tube 612 communicated with water supply joint 611 of support 600. Consequently, flow regulating valve 900 selectively supplies each flow passage of nozzle unit 700 with washing water.

[0068] A configuration and operation of the coupling part of the nozzle unit according to this exemplary embodiment is described with reference to FIG. 10, FIG. 15, and FIG. 20. As described above, coupling part 730 includes coupling member 722 of nozzle cover 720 and coupling receiving part 717 of nozzle main body 710.

[0069] As illustrated in FIG. 10, FIG. 15, and FIG. 20, coupling receiving part 717 is formed on an outer peripheral right side of a rear end of nozzle main body 710. In coupling receiving part 717, front depressed parts 717a and rear depressed parts 717b each including, for example, a substantially V-shaped (including a V-shape) groove are opened at front and rear at a predetermined interval. The interval between front depressed parts 717a and rear depressed parts 717b is provided to have the same interval between buttock washing jet port 711 and bidet washing jet port 712.

[0070] On the other hand, coupling member 722 of nozzle cover 720 is molded by a substantially cylindrical (including a cylindrical shape) resin material such as POM, and includes coupling pieces 723 and coupling protrusions 723a. Coupling pieces 723 protrude rearward on rear both sides of nozzle cover 720. Coupling protrusions 723a each are formed in a substantially V-shaped (including a V-shape) protruding inward, at rear ends of coupling pieces 723.

[0071] In a state where nozzle main body 710 is inserted in nozzle cover 720, elasticity of coupling member 722 of nozzle cover 720 causes coupling protrusions 723a to be always pressed against coupling receiving part 717 of nozzle main body 710. That is, in a state where coupling protrusions 723a are engaged with front depressed parts 717a or rear depressed parts 717b, nozzle main body 710 and nozzle cover 720 are coupled. Consequently, nozzle cover 720 can be towed by nozzle main body 710 to move.

[0072] As illustrated in FIG. 10 and FIG. 15, in a case where coupling protrusions 723a enter front depressed parts 717a, bidet washing jet port 712 of nozzle main body 710 and jet opening 724 of nozzle cover 720 face each other as illustrated in FIG. 18. On the other hand, as illustrated in FIG. 20, in a case where coupling protrusions 723a enter rear depressed parts 717b, buttock washing jet port 711 and jet opening 724 face each other as illustrated in FIG. 8 and FIG. 13.

[0073] Thus, nozzle device 500 of this exemplary embodiment is configured.

<4> Operation and Action of Nozzle Device

[0074] Hereinafter, operation and action of the nozzle device of the sanitary washing device of this exemplary embodiment is described with reference to FIG. 4 to FIG. 20.

[0075] As illustrated in FIG. 7, in a storage state where nozzle device 500 is not used, nozzle main body 710 is located at a rearmost part of guide rail 621, and nozzle cover 720 is also located at a rearmost part of the sliding range. As illustrated in FIG. 10, nozzle cover stopper 726 of nozzle cover 720 comes into contact with rear stopper receiving part 624 provided at a rear part of support 600. That is, nozzle main body 710 and nozzle cover 720 are disposed at a most retreat position. In the following description, this position is referred to as a "storage position", and this state is referred as a "storage state". As illustrated in FIG. 10, in a state where coupling protrusions 723a of coupling pieces 723 are fitted in front depressed parts 717a of coupling receiving part 717, nozzle main body 710 and nozzle cover 720 are coupled.

[0076] Now, a case where washing by nozzle device 500 from the storage state is started is described with reference to FIG. 7 and FIG. 8.

[0077] First, a user manipulates operation switch 212 for instructing to wash. Consequently, controller 230 starts control of each unit.

[0078] Specifically, controller 230 drives cut-off solenoid valve 243 and flow regulating valve 900 to supply buttock washing flow passage 714 with washing water. Then, controller 230 causes buttock washing jet port 711 to jet the washing water toward the inner peripheral surface of holding part 630.

[0079] The jetted washing water is reflected by the inner peripheral surface of holding part 630, to flow through clearance 740 between an outer peripheral surface of nozzle cover main body 721 and the inner peripheral surface of holding part 630. Consequently, a stain on the outer peripheral surface of nozzle cover main body 721 is mainly removed.

[0080] Controller 230 controls flow regulating valve 900 to stop supplying washing water after a predetermined time elapses. This operation is referred to as "nozzle pre-washing". This "nozzle pre-washing" aims at washing of the outer peripheral surface of nozzle cover main body 721, and exhaust of cool water or the like staying in flow passages after hot water tank 245. Consequently, "nozzle pre-washing" is terminated.

[0081] Next, controller 230 normally rotates drive motor 830 to move nozzle main body 710 forward. Coupling protrusions 723a of coupling pieces 723 of nozzle cover 720 are kept in a state of being fitted in front depressed parts 717a of coupling receiving part 717. Consequently, nozzle cover 720 is towed by nozzle main body 710 to move forward while being integrated.

[0082] Hereinafter, operation of each of buttock washing, bidet washing, and nozzle cleaning washing, which is manipulation set by the user, is separately described.

[0083] First, a case where the manipulation set by the user is manipulation of the buttock washing is described.

[0084] As illustrated in FIG. 11, FIG. 12, and FIG. 14, nozzle main body 710 and nozzle cover 720 move forward until the number of rotation of drive motor 830 reaches a set value from an origin state in accordance with preset control sequence, and stop. Nozzle cover stopper 726 provided in nozzle cover 720 is in contact with front stopper receiving part 623 of support 600 and in a stop state. That is, as illustrated in FIG. 13, buttock washing jet port 711 faces jet opening 724 of nozzle cover main body 721. This position is a "buttock washing position".

[0085] In a state where nozzle main body 710 and nozzle cover 720 are disposed at the "buttock washing position", controller 230 controls cut-off solenoid valve 243 and flow regulating valve 900, to make washing water pass through buttock washing flow passage 714, thereby starting the buttock washing. The washing water jetted from buttock washing jet port 711 passes without contacting with jet opening 724 of nozzle cover main body 721, to jet upward.

[0086] As illustrated in FIG. 13, bidet washing jet port 712 is covered with nozzle cover main body 721. Therefore, dirty water generated due to the buttock washing can be prevented from directly splashing on bidet washing jet port 712. Consequently, it is possible to keep bidet washing jet port 712 clean.

[0087] When stop of buttock washing is manipulated, controller 230 controls cut-off solenoid valve 243 and flow regulating valve 900 to stop supplying the washing water. Then, controller 230 reversely rotates drive motor 830, to move nozzle main body 710 and nozzle cover 720 rearward, thereby returning nozzle main body 710 and nozzle cover 720 to the original "storage position" illustrated in FIG. 7 and FIG. 8.

[0088] In a state where nozzle main body 710 and nozzle cover 720 return to the "storage position", controller 230 controls cut-off solenoid valve 243 and flow regulating valve 900 to supply buttock washing flow passage 714 with washing water. Then, washing water is jetted from buttock washing jet port 711 through jet opening 724. The jetted washing water is reflected by the inner peripheral surface of holding part 630, to flow into clearance 740 between the outer peripheral surface of nozzle cover main body 721 and the inner peripheral surface of holding part 630. Consequently, a stain on the outer peripheral surface of nozzle cover main body 721 is mainly effectively removed.

[0089] Then, controller 230 controls cut-off solenoid valve 243 and flow regulating valve 900 to stop supplying washing water since a predetermined time elapses after the jetting of the washing water from buttock washing jet port 711. The above washing operation is referred to "nozzle post-washing".

[0090] Thus, the operation of the buttock washing is completed.

[0091] Hereinafter, a case where the user selects the bidet washing is described.

[0092] In the case where the bidet washing is selected, controller 230 first normally rotates drive motor 830 to move nozzle main body 710 forward similarly to the buttock washing. In a case of the bidet washing, controller 230 moves nozzle main body 710 further forward beyond the buttock washing position.

[0093] In a case of the buttock washing, nozzle cover stopper 726 provided in nozzle cover 720 comes into contact with front stopper receiving part 623 of support 600, so that further movement of nozzle cover 720 is regulated, as illustrated in FIG. 15 and FIG. 20. In the case of the bidet washing, controller 230 further normally rotates drive motor 830 to move nozzle main body 710 further forward. Consequently, coupling protrusions 723a of coupling pieces 723 are detached from front depressed parts 717a. A condition enabling the above operation is that driving torque of drive motor 830 for moving the nozzle forward and rearward is larger than a load value required for detaching coupling protrusions 723a.

[0094] When coupling protrusions 723a are detached from front depressed parts 717a, nozzle main body 710 and nozzle cover 720 are separated from each other. Front stopper receiving part 623 of support 600 regulates movement of nozzle cover 720. Therefore, only nozzle main body 710 moves further forward, and coupling protrusions 723a are fitted into rear depressed parts 717b. When coupling protrusions 723a are completely fitted into rear depressed parts 717b, bidet washing jet port 712 faces jet opening 724 of nozzle cover main body 721 as illustrated in FIG. 18. At this point, controller 230 stops driving of drive motor 830. Consequently, forward movement of nozzle main body 710 is terminated. This state is a "bidet washing position".

[0095] When nozzle main body 710 reaches the "bidet washing position", controller 230 controls cut-off solenoid valve 243 and flow regulating valve 900, to make washing water pass through bidet washing flow passage 715, thereby starting the bidet washing. Then, the washing water jetted from bidet washing jet port 712 passes without directly contacting with jet opening 724 of nozzle cover main body 721, to jet upward.

[0096] As illustrated in FIG. 18, an upper part of buttock washing jet port 711 is covered with nozzle cover main body 721 of nozzle cover 720. Therefore, dirty water generated due to the bidet washing can be prevented from directly splashing on buttock washing jet port 711. Consequently, it is possible to keep the buttock washing jet port clean.

[0097] When stop of the bidet washing is manipulated, controller 230 controls cut-off solenoid valve 243 and flow regulating valve 900 to stop supplying the washing water. Then, controller 230 reversely rotates drive motor 830, to start moving nozzle main body 710 and nozzle cover 720 rearward. In a middle process of rearward movement for storage, nozzle cover stopper 726 of nozzle cover 720 comes into contact with rear stopper receiving part 624 provided at the rear part of support 600.

[0098] At a position where nozzle cover stopper 726

comes into contact with rear stopper receiving part 624, controller 230 stops driving of drive motor 830. Then, controller 230 controls cut-off solenoid valve 243 and flow regulating valve 900 to supply bidet washing flow passage 715 with washing water, and to allow jetting of the washing water from bidet washing jet port 712. The washing water jetted from bidet washing jet port 712 is reflected by the inner peripheral surface of holding part 630 of support 600, to flow into clearance 740 between the outer peripheral surface of nozzle cover main body 721 and the inner peripheral surface of holding part 630. Consequently, a stain on the outer peripheral surface of nozzle cover main body 721 is mainly effectively removed.

[0099] Then, controller 230 controls cut-off solenoid valve 243 and flow regulating valve 900 to stop supplying washing water since a predetermined time elapses after the jetting of the washing water from bidet washing jet port 712.

[0100] After the nozzle washing, controller 230 reversely rotates drive motor 830 to move nozzle main body 710 further rearward. Nozzle cover stopper 726 provided in nozzle cover 720 comes into contact with rear stopper receiving part 624 of support 600, so that further rearward movement of nozzle cover 720 is regulated. Therefore, when nozzle main body 710 is moved further rearward, coupling protrusions 723a of coupling pieces 723 are detached from rear depressed parts 717b. A condition enabling the above operation is that driving torque of drive motor 830 for moving nozzle cover 720 forward and rearward is larger than a load value required for releasing coupling protrusions 723a.

[0101] When coupling protrusions 723a are detached from rear depressed parts 717b, nozzle main body 710 and nozzle cover 720 are separated from each other. Rear stopper receiving part 624 of support 600 regulates movement of nozzle cover 720. Therefore, only nozzle main body 710 moves further rearward, and coupling protrusions 723a are fitted into front depressed parts 717a. Then, when coupling protrusions 723a are completely fitted into front depressed parts 717a, jet opening 724 of nozzle cover main body 721 faces buttock washing jet port 711 as illustrated in FIG. 13. At this point, controller 230 stops rotation of drive motor 830. Consequently, storage operation of nozzle main body 710 is terminated.

[0102] Thus, the operation of the bidet washing is completed.

[0103] Hereinafter, operation in a case where nozzle unit 700 is cleaned when the sanitary washing device is not used is described.

[0104] First, the user sets manipulation of nozzle cleaning by operation switch 212. Consequently, controller 230 normally rotates drive motor 830 to move nozzle main body 710 and nozzle cover 720 forward.

[0105] When nozzle main body 710 reaches the "buttock washing position", controller 230 stops drive motor 830. Furthermore, controller 230 controls cut-off solenoid valve 243 and flow regulating valve 900, to start making washing water pass through nozzle cleaning flow passage 716.

[0106] The jetted washing water from nozzle cleaning jet port 713 is jetted in nozzle cover 720, to be discharged from exhaust port 725 of nozzle cover 720 to outside of nozzle cover 720. Consequently, the user can clean nozzle unit 700 and the periphery of nozzle unit 700 with a brush or the like by using the washing water discharged from exhaust port 725.

[0107] After cleaning, the user stops manipulation, so that controller 230 controls cut-off solenoid valve 243 and flow regulating valve 900 to stop jetting washing water. Then, controller 230 drives drive motor 830 to move nozzle main body 710 to the storage position.

[0108] Thus, cleaning operation of nozzle unit 700 is completed.

[0109] Consequently, operation of the buttock washing, the bidet washing, and the nozzle cleaning washing is performed by manipulation set by the user.

[0110] As described above, according to this exemplary embodiment, the front part of nozzle unit 700 is supported by holding part 630, and the rear part is supported by guide rail 621 through slider 750. In this state, the driving force applied from flexible rack 810 is always applied to the middle part between the front end and the rear end of support 600. Therefore, friction resistance generated by the driving force applied to slider 750 from flexible rack 810 can be distributed forward and rearward, so that friction resistance can be reduced. Consequently, it is possible to suppress unstable sliding of slider 750 due to large friction resistance, to smoothly slide nozzle unit 700. As a result, it is possible to improve positioning precision of the washing position of nozzle unit 700.

[0111] According to this exemplary embodiment, guide rail 621 and rack guide 622 are disposed at the upper part of nozzle device 500, and nozzle unit 700 is suspended from guide rail 621 through slider 750. Slider 750 is disposed above nozzle unit 700. Therefore, one end of flexible rack 810 integrally coupled with slider 750 is also disposed on a substantially uppermost part (including an uppermost part) of nozzle device 500. Consequently, a locus formed at a curvature required for smooth driving of flexible rack 810 can be formed between the substantially uppermost part and a substantially lowermost part (including a lowermost part) of nozzle device 500. As a result, an entire height of nozzle device 500 can be functionally made to be a minimum necessary height.

[0112] According to this exemplary embodiment, nozzle unit 700 integrally includes the three jet ports, namely buttock washing jet port 711, bidet washing jet port 712, and nozzle cleaning jet port 713, the three flow passages, namely buttock washing flow passage 714, bidet washing flow passage 715, and nozzle cleaning flow passage 716 which are independently communicated with the respective jet ports, and flow regulating valve 900 that switches supply of washing water to the flow passages. Therefore, washing water can be supplied to nozzle unit 700 by single connection tube 612. Consequently, smooth forward

and backward motion is possible by minimum necessary single connection tube 612 that is resistance of forward and backward drive of nozzle device 500. As a result, it is possible to downsize drive motor 830, pinion gear 820, flexible rack 810, and the like related to a drive mechanism, to reduce a size and weight of a whole of nozzle device 500.

[0113] According to this exemplary embodiment, nozzle unit 700 includes nozzle main body 710 including the three jet port and the three flow passages independently communicated with the jet ports, cylindrical nozzle cover 720 covering the most part of nozzle main body 710, and coupling part 730 coupling nozzle main body 710 and nozzle cover 720. Furthermore, washing water jetted from each of buttock washing jet port 711 and bidet washing jet port 712 is jetted outside through jet opening 724 of nozzle cover 720. Consequently, nozzle main body 710 including the plurality of jet ports can jet washing water through single common jet opening 724. As a result, a number of parts to which stains are adhered are reduced, and cleanliness is improved. Furthermore, it is possible to improve a show of nozzle device 500, and to maintain nozzle device 500 sanitary and clean.

[0114] In this exemplary embodiment, the flexible rack is molded by TPE (thermoplastic elastomer) of TPEE (polyester-based elastomer) or TPU (thermoplastic polyurethane), and has an outer peripheral surface coated with PTFE (polytetrafluoroethylene resin) being fluororesin. However, the present invention is not limited to this. For example, the flexible rack may be molded by thermoplastic elastomer containing fluororesin. Consequently, it is possible to obtain an effect of reducing friction resistance of the flexible rack.

[0115] In this exemplary embodiment, in order to reduce sliding resistance, the slider is formed to have such a size that only the both side ends of the inner peripheral surface of the slider are in contact with the upper and lower surfaces of the guide rail, and has a cross section in which the center is depressed so as to generate the gap between the guide rail and the slider. However the present invention is not limited to this. For example, a plurality of ribs are formed along a sliding direction on either the inner peripheral surface of the slider or the upper and lower surfaces of the guide rail. Consequently, it is possible to reduce the contact area between the slider and the guide rail, and to reduce sliding resistance.

[0116] As described above, the nozzle device of the present invention includes the nozzle unit including the jet port and the flow passage communicated with the jet ports, the support retractably supporting the nozzle unit, and the actuator moving the nozzle unit forwards and backwards. Then, the actuator includes the flexible rack coupled to the nozzle unit, the gear moving the flexible rack forwards and backwards, and the motor that drives the gear. The support includes the holding part that embraces and supports the nozzle unit at a front end, the guide rail that is disposed behind the holding part and guides the forward and backward motion of the nozzle unit, and the rack guide that guides the forward and backward motion of the flexible rack. Furthermore, in a vicinity of a rear end of the nozzle unit, a sliding unit that is engaged with guide rail to slide is provided. The flexible rack may be coupled to a front part of the sliding unit, and the driving force applied to the nozzle unit through the flexible rack may always act on a middle part of a front end of holding part and a rear end of the sliding unit.

[0117] Consequently, the sliding unit slides along the guide rail. While a front part of the nozzle unit is supported by the holding part, and a rear part of the nozzle unit is supported by the sliding unit, the driving force by the flexible rack is applied to a middle part of these two supporting points. Therefore, it is possible to attain smooth sliding and a stable moving locus of the nozzle unit. As a result, it is possible to move the jet port of the nozzle unit to a proper washing position.

[0118] In the nozzle device of the present invention, the guide rail and the rack guide may be disposed above the nozzle unit, and the nozzle unit may be suspended from the guide rail through the sliding unit.

[0119] Consequently, the sliding unit is disposed above the nozzle unit, and one end of the flexible rack coupled to the sliding unit can be disposed at the substantially uppermost part of the nozzle device. Consequently, a locus formed at a curvature required for smooth driving of the flexible rack can be formed between the substantially uppermost part and the substantially lowermost part of the nozzle device. As a result, an entire height of the nozzle device can be functionally made to be a minimum necessary height.

[0120] Additionally, in the nozzle device of the present invention, the nozzle unit may integrally include the plurality of jet ports including the jet port, the plurality of flow passages individually communicated with the jet ports, and the flow regulating valve that switches supply of washing water to the plurality of flow passages.

[0121] Consequently, washing water can be supplied to the nozzle unit by a single connection tube, and smooth forward and backward motion is possible by the minimum necessary single connection tube that is resistance of forward and backward drive of the nozzle device, and it is possible to downsize the motor, the gear, the flexible rack, and the like related to the drive mechanism, to reduce a size and weight of a whole of the nozzle device.

[0122] In the nozzle device of the present invention, the nozzle unit includes the nozzle main body including the plurality of jet ports and the plurality of flow passages independently communicated with the jet ports, the nozzle cover covering at least a part of the nozzle main body, and the coupling part coupling the nozzle main body and the nozzle cover. Then, the nozzle cover has the jet opening, the nozzle main body and the nozzle cover are slidable with respect to each other such that any of the plurality of jet ports of the nozzle main body faces the jet opening. Furthermore, washing water jetted from each of the jet ports may be jetted outside through the jet opening.

[0123] Consequently, even in a case of the nozzle main body having the plurality of jet ports, a number of jet openings can be reduced compared to a number of jet ports. As a result, the number of parts to which stains adhere is reduced, and therefore cleanliness is improved. Additionally, it is possible to improve a show, and to maintain a sanitary and clean feeling.

[0124] The sanitary washing device of the present invention may include the above nozzle device, and the washing water supply unit that supplies the nozzle device with washing water, the controller that controls the nozzle device and the washing water supply unit, and the toilet seat placed on the upper surface of the toilet bowl.

[0125] Consequently, washing at a proper washing position of each jet port is possible by stable forward and backward motion of the nozzle device. Furthermore, it is possible to downsize the nozzle device, so that it is possible to downsize a whole of the sanitary washing device. As a result, it is possible to implement a comfortable and user-friendly sanitary washing device.

INDUSTRIAL APPLICABILITY

[0126] As described above, in the nozzle device of the present invention, it is possible to attain smooth sliding and a stable moving locus of the nozzle unit, and to attain precise movement to a washing position of each jet port. Therefore, the present invention is also applicable to uses such as other household electrical appliances including sliding mechanisms.

REFERENCE MARKS IN THE DRAWINGS

[0127]

100	sanitary washing device
110	toilet bowl
110a, 300a	upper surface
200	main body
210	sleeve part
211	operation unit
212	operation switch
213	indication lamp
220	deodorizer
230	controller
240	washing water supply unit
241	hydrant
242	constant flow valve
243	cut-off solenoid valve
244	relief valve
245	hot water tank
270	flowing water passage
300	toilet seat
400	toilet lid
500	nozzle device
600	support
610	bottom part
611	water supply joint
612	connection tube
620	inclination part
621	guide rail
622	rack guide
623	front stopper receiving part
624	rear stopper receiving part
630	holding part
640	vertical part
650	nozzle lid
660	support lid
700	nozzle unit
710	nozzle main body
711	buttock washing jet port (jet port)
712	bidet washing jet port (jet port)
713	nozzle cleaning jet port (jet port)
714	buttock washing flow passage (flow passage)
715	bidet washing flow passage (flow passage)
716	nozzle cleaning flow passage (flow passage)
717	coupling receiving part
717a	front depressed part
717b	rear depressed part
720	nozzle cover
721	nozzle cover main body
722	coupling member
723	coupling piece
723a	coupling protrusion
724	jet opening
725	exhaust port
726	nozzle cover stopper
730	coupling part
740	clearance
750	slider (sliding unit)
750a	both side ends
750b	recess
751	engaging piece
800	actuator
810	flexible rack
820	pinion gear
820a	bearing
830	drive motor
900	flow regulating valve
910	valve main body
911	water supply port
920	stepping motor

Claims

1. A nozzle device comprising:

a nozzle unit including a jet port and a flow passage communicated with the jet port;
a support that retractably supports the nozzle unit; and
an actuator that moves the nozzle unit forwards

and backwards,
wherein
the actuator includes a flexible rack coupled to the nozzle unit, a gear that moves the flexible rack forwards and backwards, and a motor that drives the gear,
the support includes a holding part that embraces and supports the nozzle unit at a front end, a guide rail that is disposed behind the holding part and guides forward and backward motion of the nozzle unit, and a rack guide that guides forward and backward motion of the flexible rack,
the nozzle unit includes a sliding unit that is engaged with the guide rail to slide, and
the flexible rack is coupled to a front part of the sliding unit, and driving force applied to the nozzle unit through the flexible rack acts on a middle part of a front end of the holding part and a rear end of the sliding unit.

2. The nozzle device according to claim 1, wherein the guide rail and the rack guide are disposed above the nozzle unit, and the nozzle unit is suspended from the guide rail through the sliding unit.

3. The nozzle device according to claim 1, wherein the nozzle unit integrally includes:

a plurality of jet ports includings the jet port;
a plurality of flow passages independently communicated with the respective jet ports; and
a flow regulating valve that switches supply of washing water to the plurality of flow passages.

4. The nozzle device according to claim 1, wherein the nozzle unit includes:

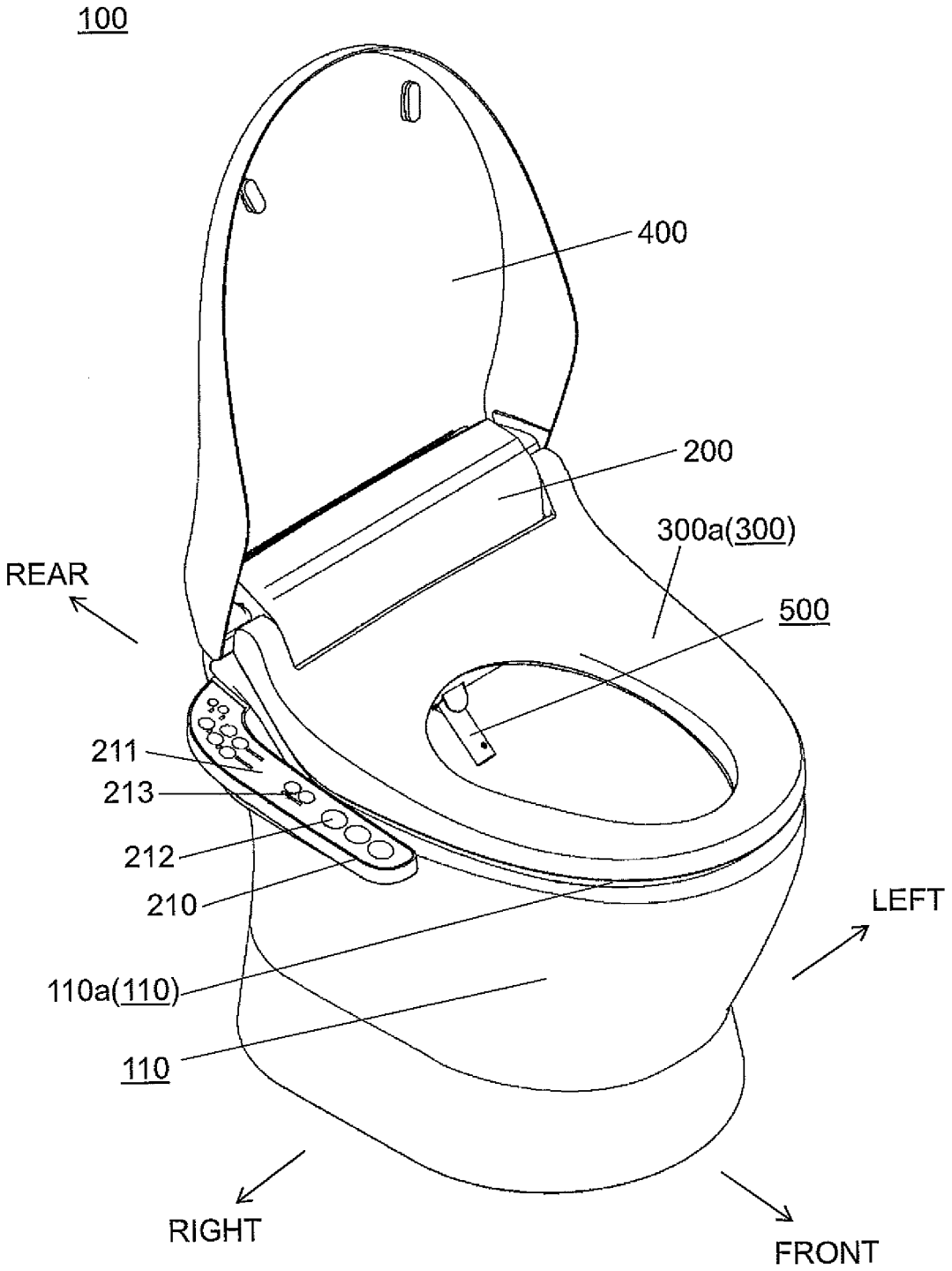
a nozzle main body including a plurality of jet ports and a plurality of flow passages independently communicated with the jet ports;
a nozzle cover covering at least a part of the nozzle main body; and
a coupling part coupling the nozzle main body and the nozzle cover, and

the nozzle cover has a jet opening, the nozzle main body and the nozzle cover are slidable with respect to each other such that any of the plurality of jet ports of the nozzle main body faces the jet opening, and washing water jetted from each of the jet ports is jetted outside through the jet opening.

5. A sanitary washing device comprising:

the nozzle device according to claim 1;
a washing water supply unit that supplies the nozzle device with washing water;
a controller that controls the nozzle device and the washing water supply unit; and
a toilet seat placed on an upper surface of a toilet bowl.

FIG. 1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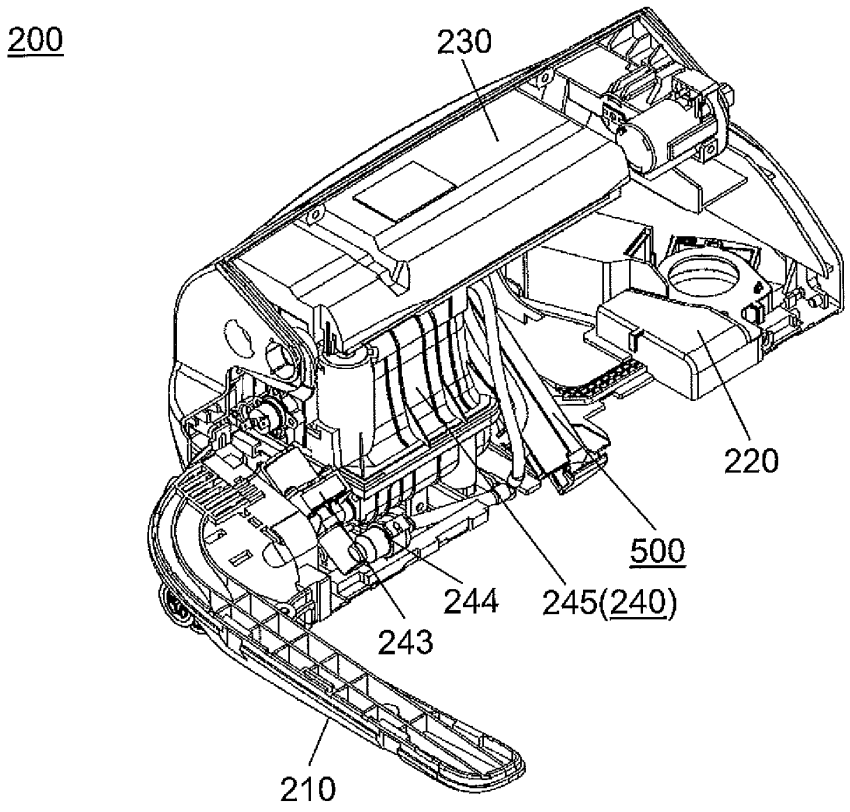
213
212
210
LEFT
110a(110)
110
RIGHT
FRONT

FIG. 2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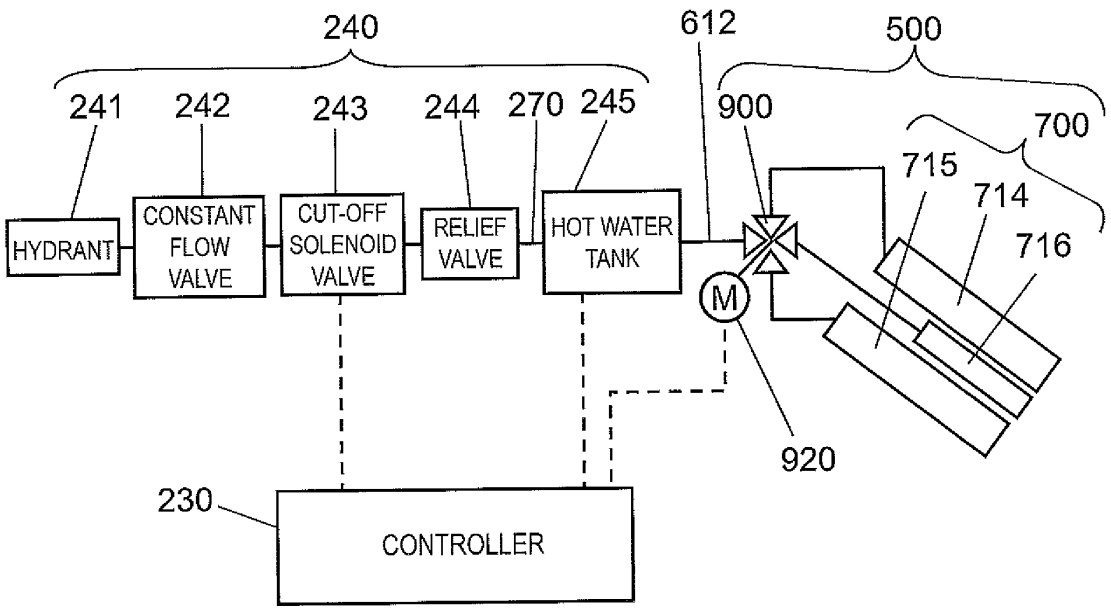
220
500
244
245(240)
243
210

FIG. 3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612
500
241
242
243
244
270
245
900
700
715
714
716
HYDRANT
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CUT-OFF SOLENOID VALVE
RELIEF VALVE
HOT WATER TANK
M
920
230
CONTROLLER

FIG. 4

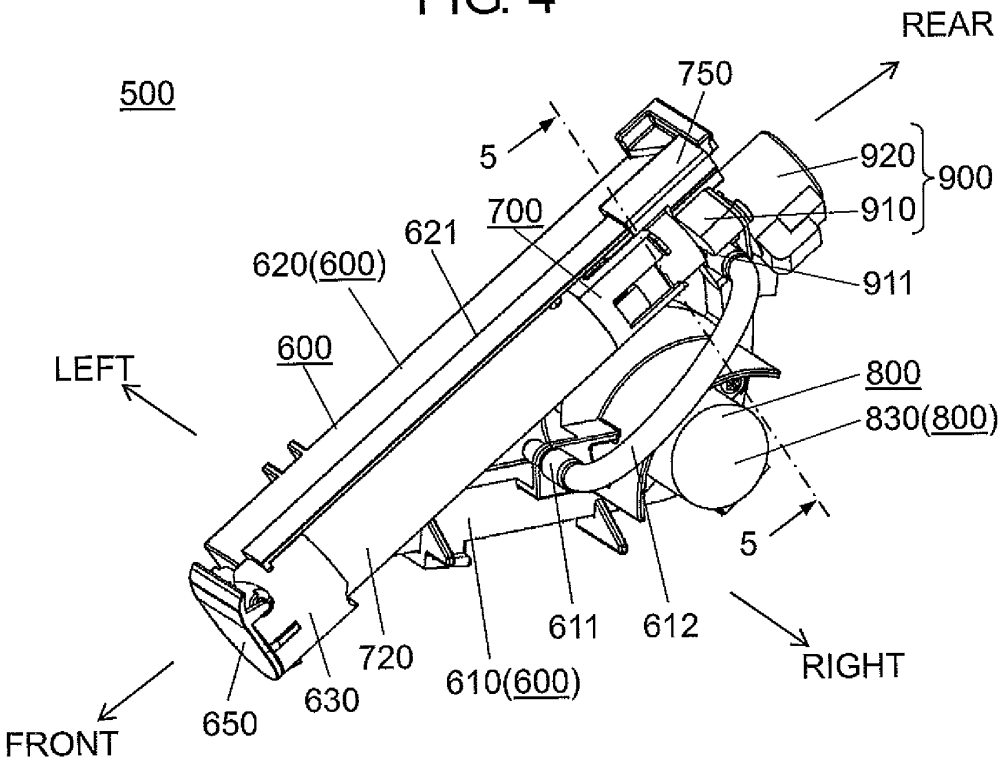

REAR
500
750
5
920
900
910
700
621
620(600)
911
600
LEFT
800
830(800)
5
611
612
720
610(600)
RIGHT
630
650
FRONT

FIG. 5

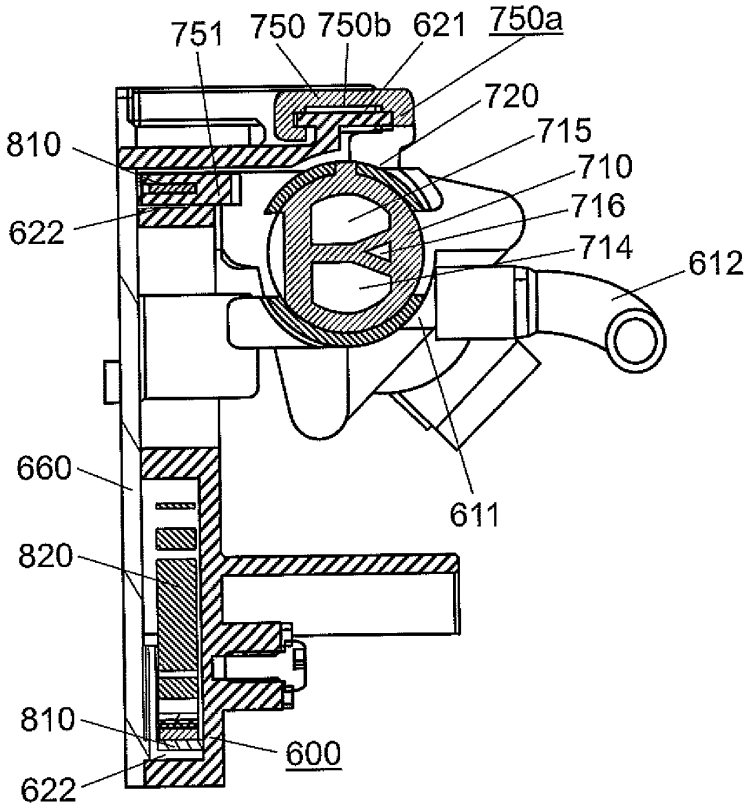
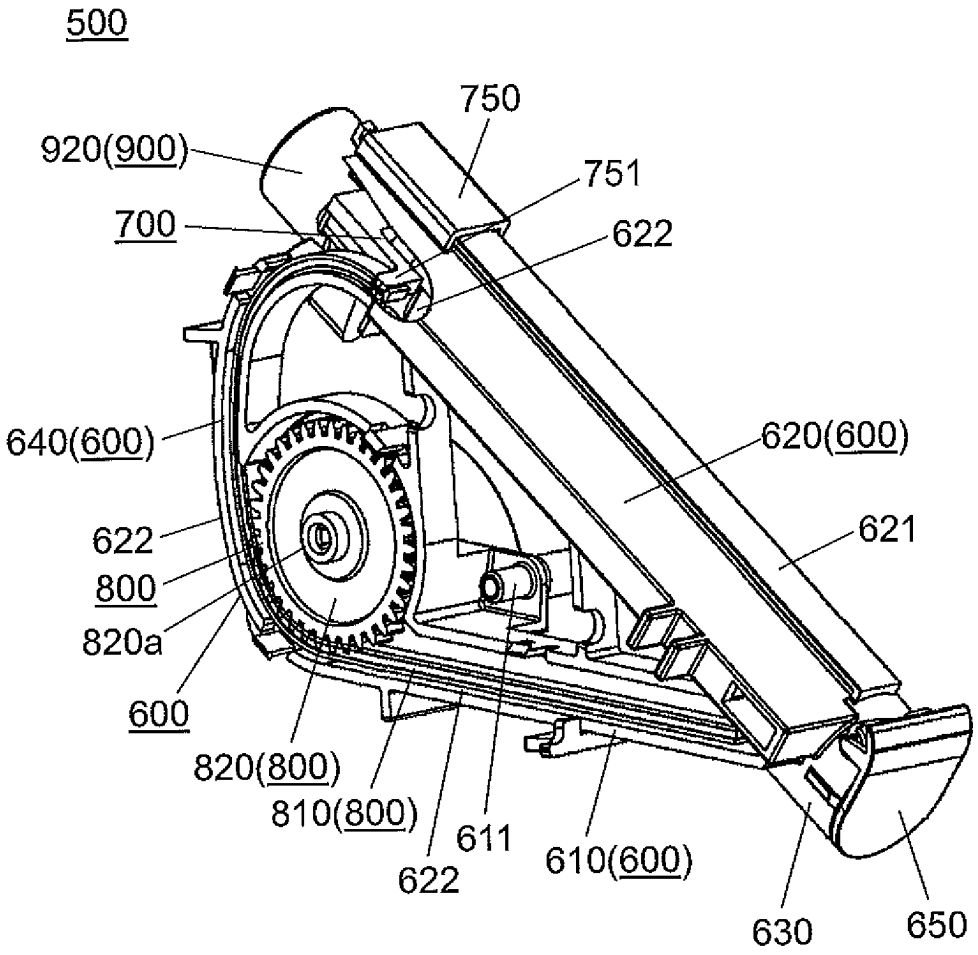

751
750
750b
621
750a
720
715
810
710
716
622
714
612
660
611
820
810
600
622

FIG. 6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920(900)
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640(600)
620(600)
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820a
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810(800)
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610(600)
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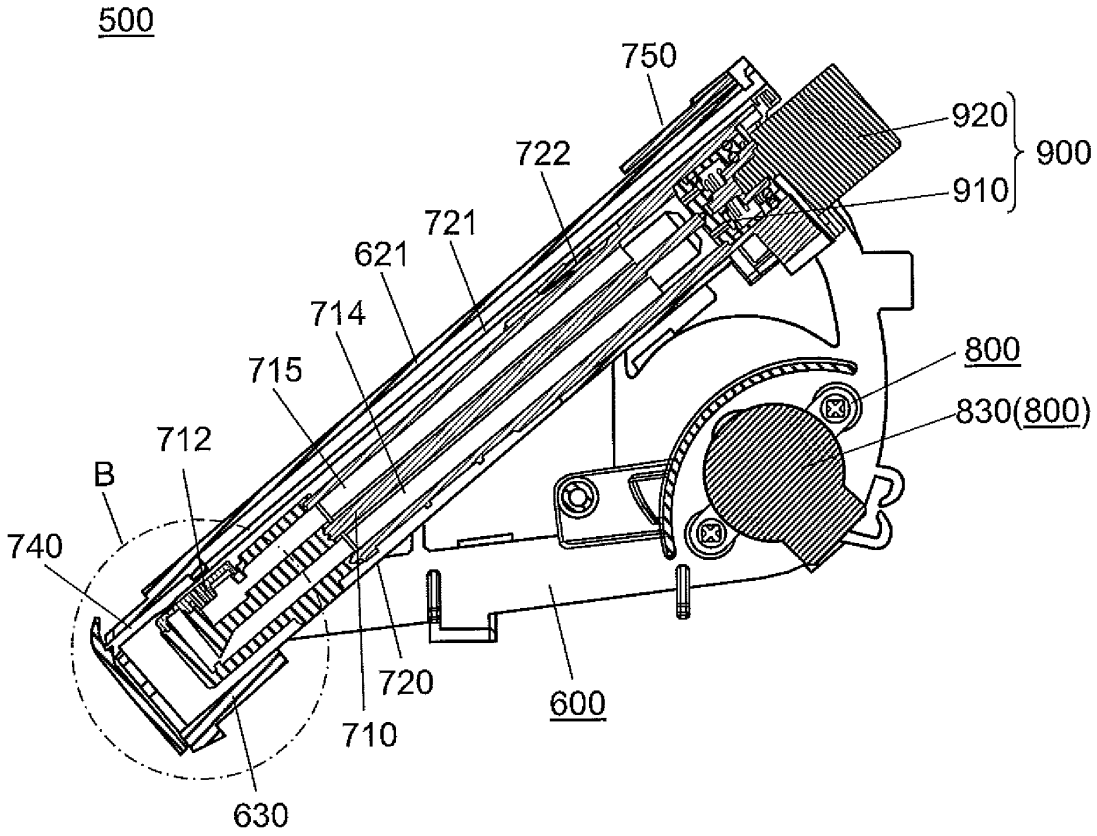
650

FIG. 7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830(800)
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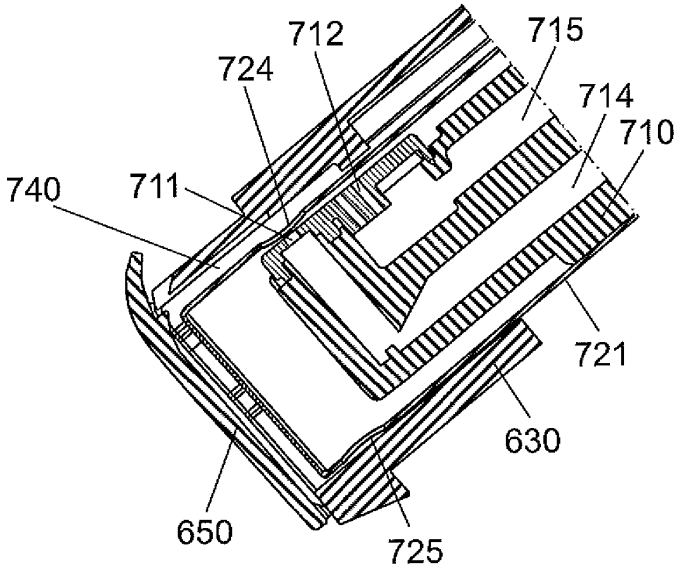
FIG. 8


712
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724
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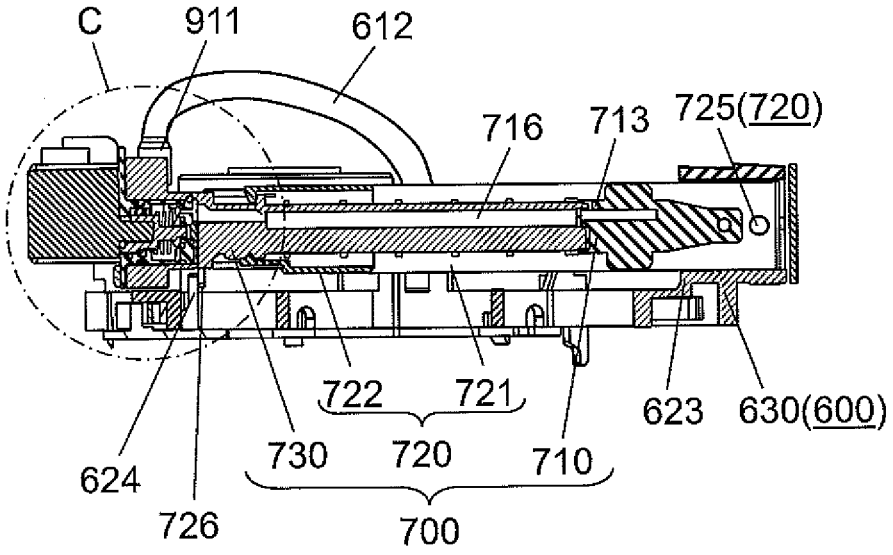
725

FIG. 9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725(720)
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FIG. 10

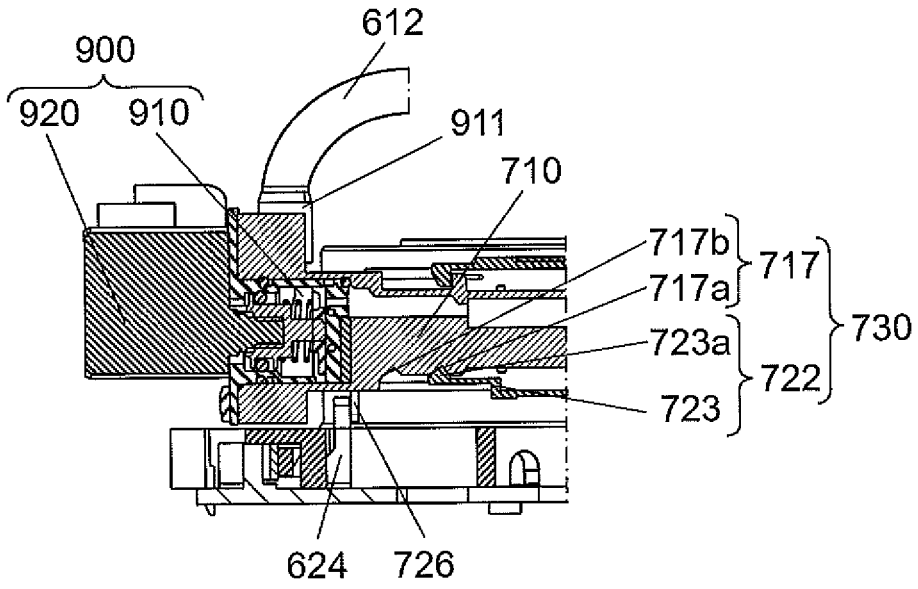
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FIG. 11

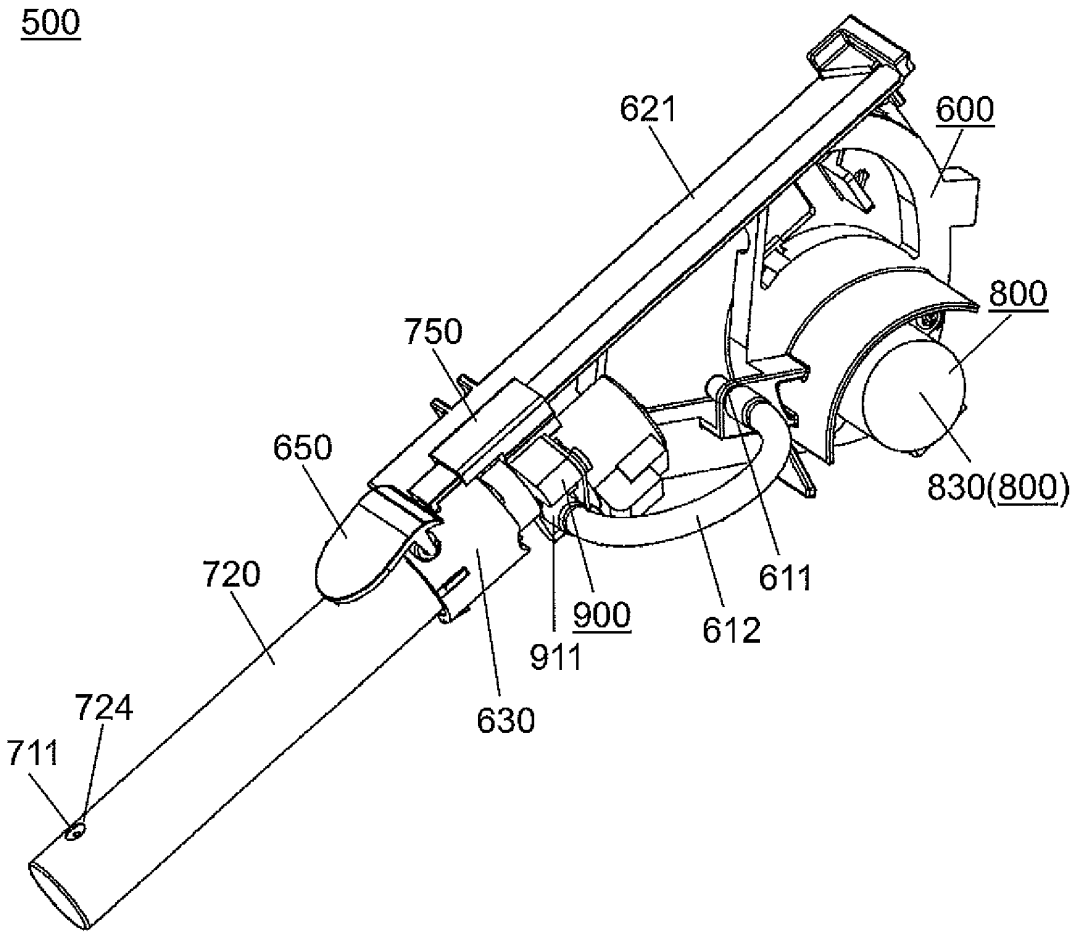

FIG. 12

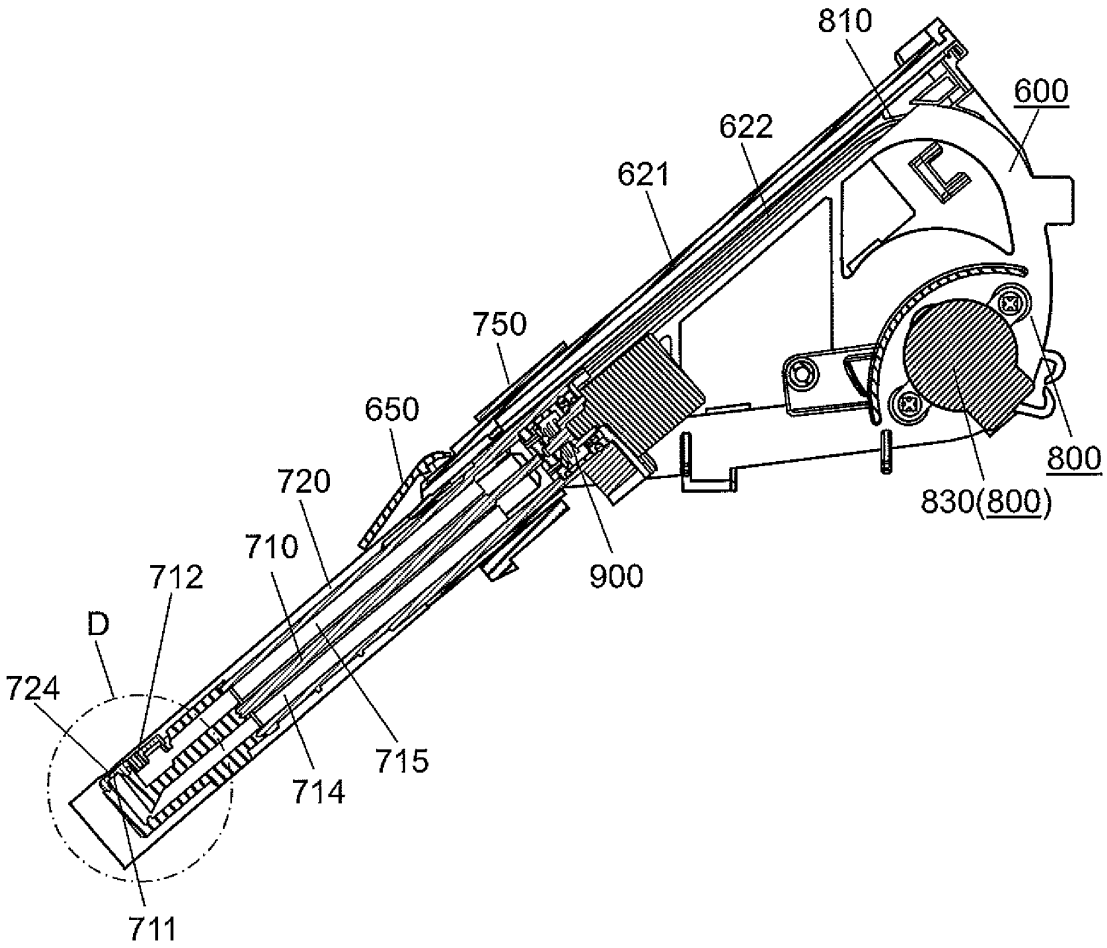
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FIG. 13

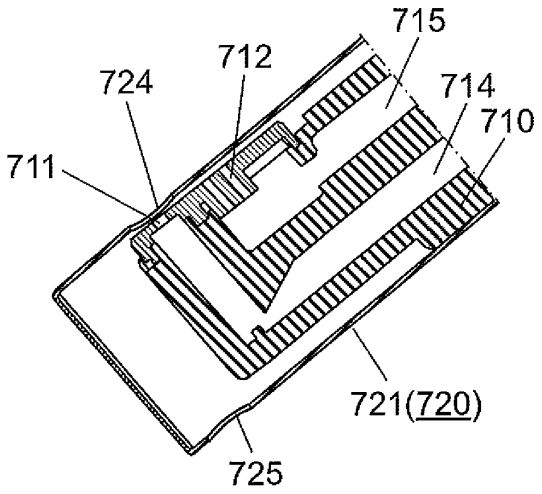
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FIG. 14

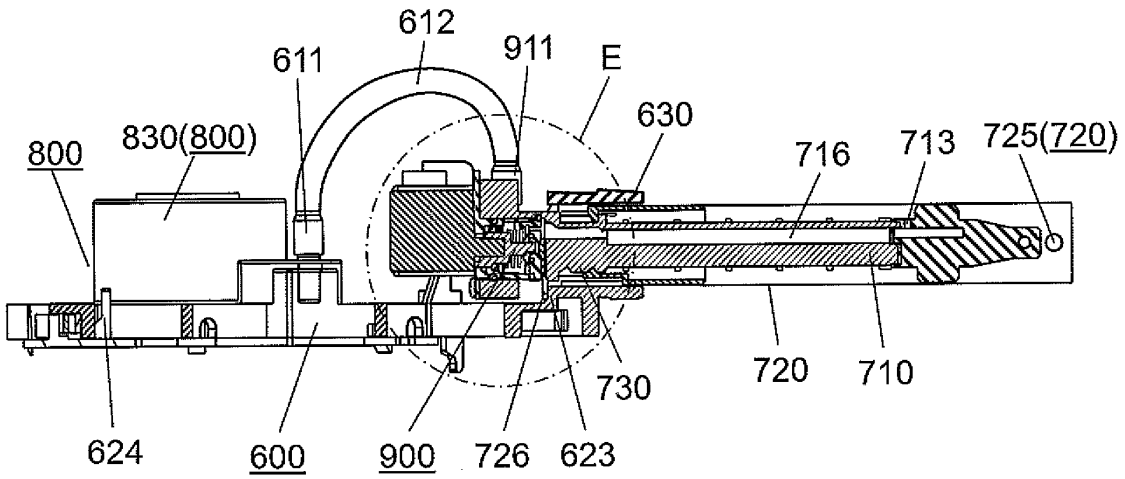
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FIG. 15

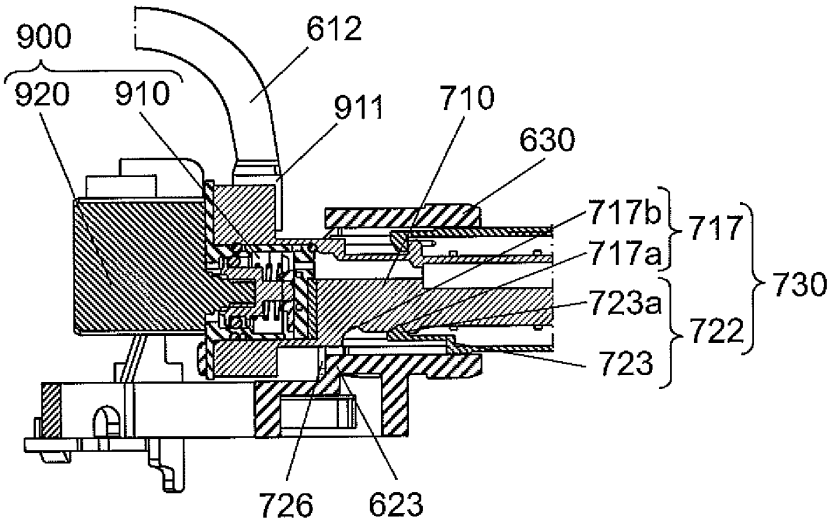
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FIG. 16

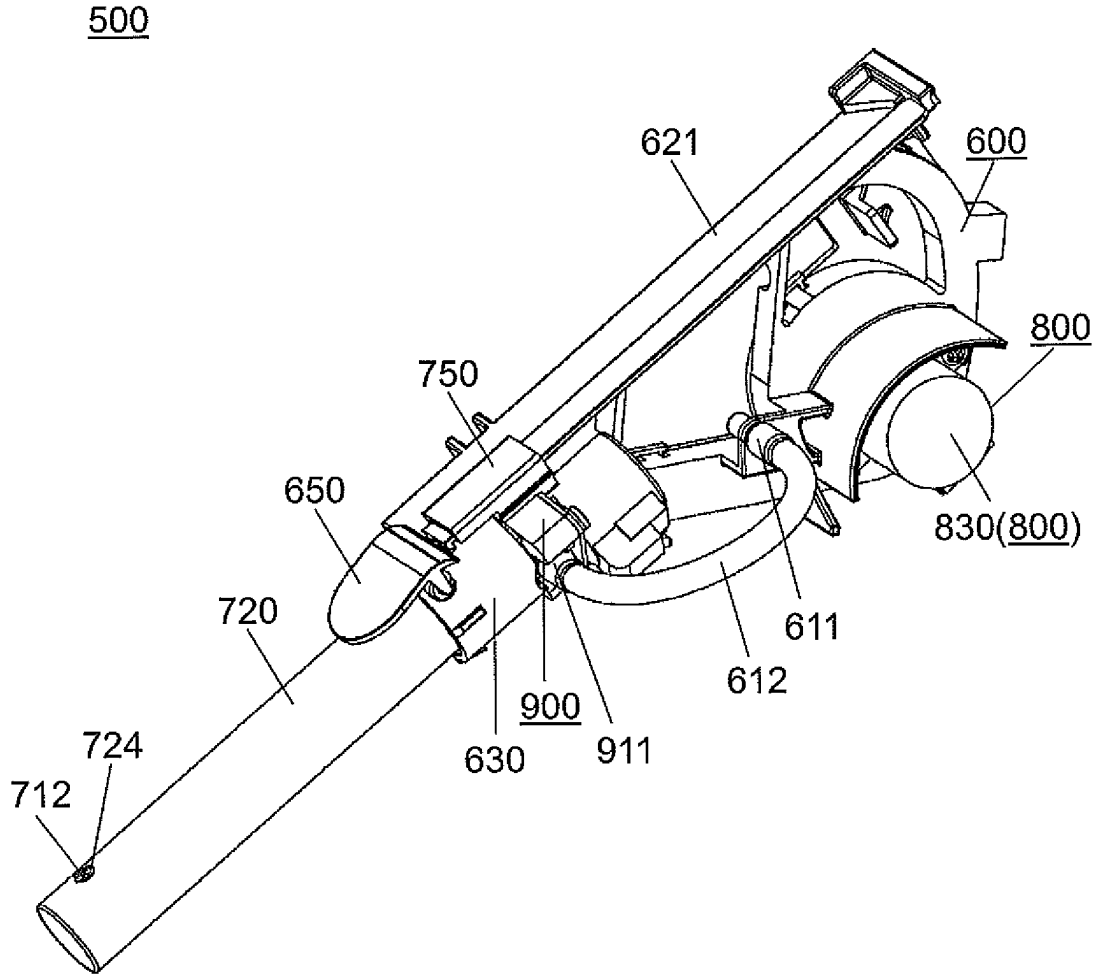

FIG. 17

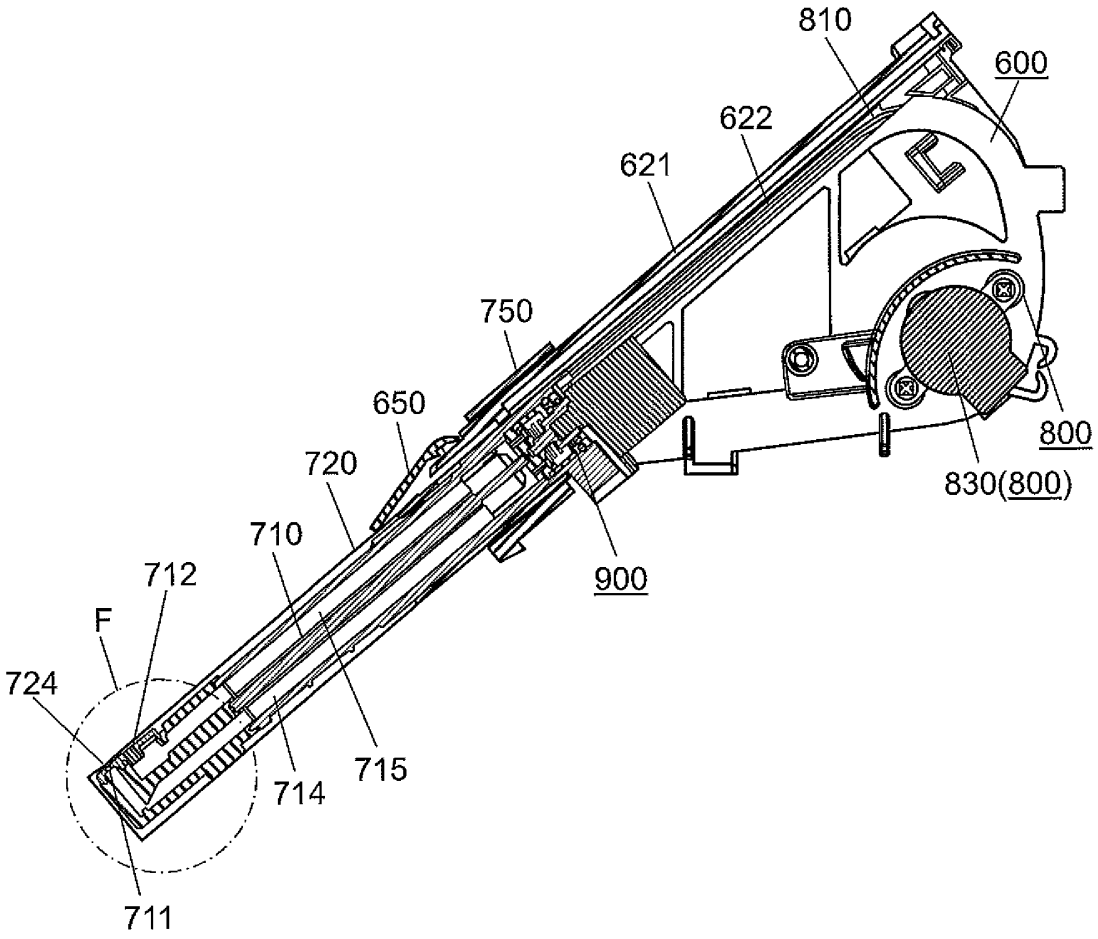
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FIG. 18

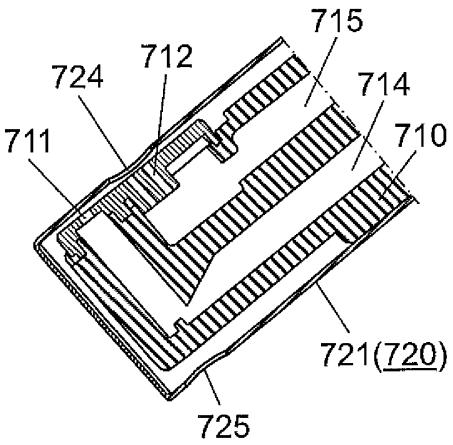
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FIG. 19

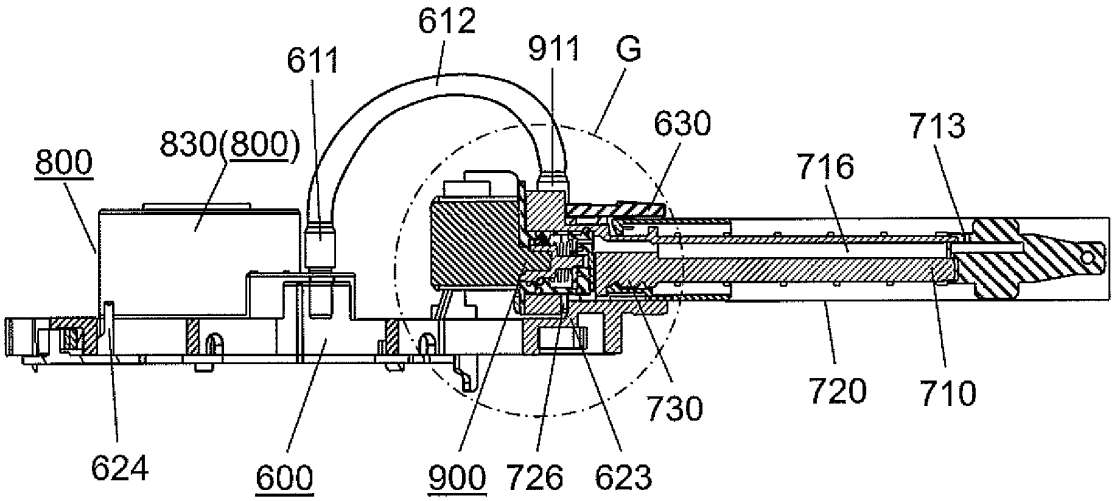
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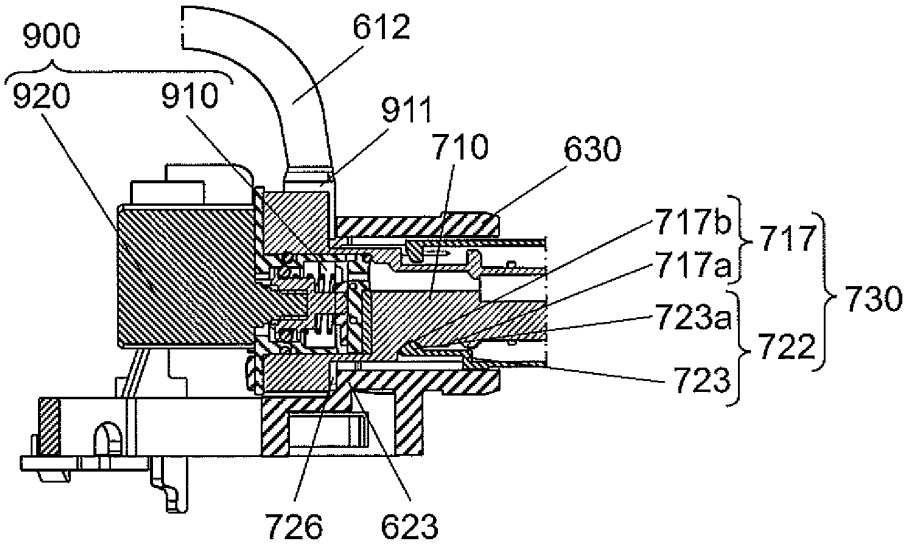
FIG. 20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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/000206

A. CLASSIFICATION OF SUBJECT MATTER
E03D9/08(2006.01)i, *B05B13/04*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E03D9/08, B05B13/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2014
Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	JP 2012-122321 A (TOTO Ltd.), 28 June 2012 (28.06.2012), paragraphs [0029] to [0044]; fig. 2 to 6 & US 2012/0117722 A1 & DE 102011086263 A & DE 102011086263 A1 & CN 102465565 A & KR 10-2012-0052168 A & TW 201224255 A	1,5 3,4 2
Y A	JP 2007-297814 A (Matsushita Electric Industrial Co., Ltd.), 15 November 2007 (15.11.2007), paragraphs [0020], [0023], [0024] & WO 2007/125662 A1 & CN 101400862 A & KR 10-1104428 B & CN 103215999 A	3 2

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 February, 2014 (28.02.14)	11 March, 2014 (11.03.14)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/000206

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2012-12873 A (Panasonic Corp.), 19 January 2012 (19.01.2012), paragraphs [0046] to [0048] & WO 2012/001980 A1 & CN 102449242 A & KR 10-2012-0028870 A	4 2
A	JP 3042429 U (Daiichi Kasei Co., Ltd.), 21 October 1997 (21.10.1997), entire text; all drawings (Family: none)	1-5
A	WO 2007/091691 A1 (TOTO Ltd.), 16 August 2007 (16.08.2007), paragraphs [0134] to [0168] & US 2010/0162475 A1 & EP 1988225 A1 & CN 101016749 A & KR 10-2009-0008183 A & TW 00I336365 B & CN 101041970 A & CN 101012664 A	1-5

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Patent documents cited in the description

- JP 4793992 B **[0004]**