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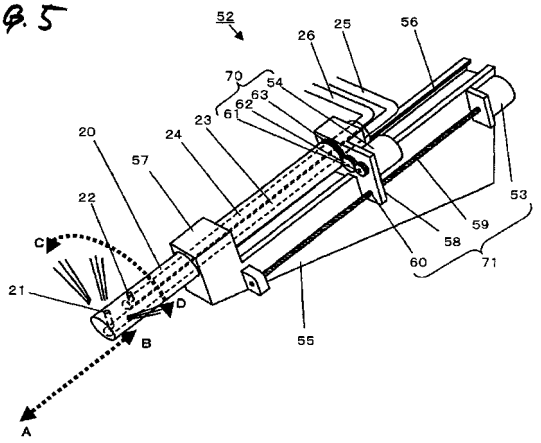
(54) DRYING DEVICE, AND SANITARY RINSING APPARATUS HAVING THE DEVICE

(57) A drying device in accordance with the invention is **characterized by** including: an air blowing portion for blowing pressurized air so as to dry a surface to be dried by a jet of pressurized air whose abutment area to the surface to be dried is narrower than the surface to be dried; and a moving unit for moving the air blowing portion while the jet is being blown such that the jet blown from the air blowing portion sequentially sweeps a substantially entire surface of the surface to be dried, wherein the moving unit includes a first moving device for moving the air blowing portion in a state in which a blowing direction of the jet is being maintained so as to form a predetermined angle with respect to a moving direction of the air blowing portion and a second moving device for moving the air blowing portion in a direction different from that of the moving direction.

For example, this first moving device moves in an advancing/retracting direction of the air blowing portion, and the second moving device deflects the blowing direction of the jet.

FIG. 5



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Description

TECHNICAL FIELD

[0001] The present invention relates to a drying device for drying a wet surface by blowing air and a sanitary washing apparatus equipped with the same.

BACKGROUND ART

[0002] In a sanitary washing apparatus for washing the private parts of the human body, various functions have been devised to realize washing which corresponds to users' preferences. The user performs washing of the private parts by using the sanitary washing apparatus using the various functions, and effected removal of drops of water attached to the private parts with paper such as toilet paper. In recent years, however, a drying device has been proposed as a substitute for the paper such as toilet paper (e.g., refer to patent document 1). Fig. 21 is a schematic plan view illustrating an example of a conventional sanitary washing apparatus equipped with a drying device. Fig. 22 is a schematic side cross-sectional view of this conventional sanitary washing apparatus.

[0003] As shown in Figs. 21 and 22, the sanitary washing apparatus is comprised of a toilet seat 2 disposed on a toilet 1, a toilet cover 3, a main body case 4 of the sanitary washing apparatus, and a washing tank (low tank) 9.

[0004] The main body case 4 has incorporated therein a warm air blowout port 7 for blowing out warm air from a warm air blowing-out device 5; a washing water spray nozzle 8 for spraying warm water onto the private parts of the human body; a washing water supplying pump 11 for supplying warm water to this washing water spray nozzle 8; a warm water tank 12; a high-pressure air accumulator 14 for accumulating the air compressed by an air compressor 13; and a solenoid valve 15 for opening and closing an outlet of the high-pressure air accumulator 14.

[0005] The toilet seat 2 has a cavity 16 provided in its interior and air blowout nozzles 18 consisting of a plurality of holes for blowing air in this cavity 16. The solenoid valve 15 and the cavity 16 are connected by a high-pressure hose 17.

[0006] When a cleaning operation is performed after a human body 10 is seated on the toilet seat 2 and finished defecation, the washing water supplying pump 11 is operated, and warm water is sprayed from the washing water spray nozzle 8 onto a surface to be washed through the warm water tank 12, thereby washing the surface to be washed. After the washing, the air compressor 13 is operated by the drying operation to blow high-pressure air onto the surface to be washed through the high-pressure air accumulator 14, the solenoid valve 15, the high-pressure hose 17, the cavity 16, and the air blowout nozzles 18, to thereby scatter or diffuse the waterdrops attached to the surface to be washed by blowing them off. Next, the warm air blowing-out device 5 is operated to blow warm air onto the surface to be washed from the warm air blowout port 7 through an air duct 6 to thereby dry the surface to be washed.

[0007] In the above-described conventional configuration, as the compressed air in the high-pressure air accumulator 14 is released from the air blowout nozzles 18 provided with a plurality of holes, waterdrops on the surface to be washed are blown off in a short time, and the high-pressure air accumulator 14 and the air compressor 13 are accommodated in the main body case 4.

[0008] Incidentally, to blow a large volume of air at one time as in the conventional example, it has been necessary to make the air compressor 13 or the high-pressure air accumulator 14 large. Accordingly, if the capacity of the air compressor 13 is made small and the high-pressure air accumulator 14 is made large, the main body case 4 becomes disadvantageously large in size for accommodating the high-pressure air accumulator 14. In addition, if the capacity of the air compressor 13 is made large, not only does the vibration noise become large, but also it constitutes a cause of increased cost. Furthermore, if the high-pressure air accumulator is separated from the air compressor and is installed outside the main body case, it becomes conspicuous, so that the appearance of the toilet becomes aggravated.

[0009] As amethodof overcoming these problems, if a single nozzle hole is adopted for blowing air to reduce the amount of air blowing at one time, it becomes possible to miniaturize the apparatus. With this method, however, the area of air blown also becomes small, so that there has been a problem in that it becomes impossible to sufficiently remove the waterdrops on the surface to be washed which is wet in a wide range, and there has been a problem in practical application.

[0010] In addition, the waterdrops which were not peeled off the surface to be washed by a jet of air from a fixed direction undesirably move to a stagnant portion of the jet of air and remain as attached to the surface to be washed. Further, there has been an additional problem in that the waterdrops are spread to the periphery by the jet of air, enlarging the wet area.

[0011] In addition, an air nozzle device has been proposed for the purpose of effecting the movement of a predetermined locus by using a three-dimensional deflecting device so as to realize a nozzle device which is compact and is low in vibration and noise (patent document 1). In the patent document 2, a blown-air three-dimensionally deflecting device is provided in which, in interlocking relation to the blowing of air, the air nozzle is deflected three-dimensionally by being deflected two-dimensionally back and forth and by being deflected two-dimensionally left and right with respect to the blowing direction of air, or a blowout port of the air nozzle is defected three-dimensionally sequentially counter clockwise or clockwise to deflect the blowing direction of air three-dimensionally toward the human body, thereby al-

lowing blown air to be discharged while being moved along a predetermined locus. In addition, since the area of the discharge port of the air nozzle device can be made substantially small with respect to the area of the human body for receiving the air, it is said that it is possible to substantially increase the blowing velocity with a predetermined amount of air and remove waterdrops attached to the vicinities of the private parts within a short time.

[0012] However, although it is not clear from the description of the above-described configuration, it appears that this device deflects the blowing direction of air three-dimensionally. However, there has been a problem in that in a case where actual drying operation is performed by deflecting the blowing direction of the air nozzle on the basis of this description, if attention is focused on the relationship between the angle at which the blown air is applied and the surface to be dried, the waterdrops at the peripheral portion among the waterdrops after washing are further blown away and spread toward the surrounding parts. As a result, since the area of the wet portion becomes enlarged, the surface to be dried becomes large, and it takes time in drying on the contrary.

[0013]

[Patent Document 1] JP-A-58-218531
[Patent Document 2] Japanese Patent No. 3799850

DISCLOSURE OF THE INVENTION

PROBLEMS THAT THE INVENTION IS TO SOLVE

[0014] As described above, in both the patent document 1 and the patent document 2, it has been extremely difficult to dry the surface to be dried efficiently within a short time without enlarging the size of the drying device. The present invention has been devised in view of the above-described circumstances, and an object of the invention is to provide a drying device which is capable of drying the surface to be dried efficiently within a short time without enlarging the size of the drying device, as well as a sanitary washing apparatus equipped with the same.

MEANS FOR SOLVING THE PROBLEMS

[0015] The drying device in accordance with the invention is a drying device for drying a surface to be dried and includes a moving unit which causes a jet of air whose abutment area is narrower than the surface to be dried to move in forward-backward and leftward-rightward directions relative to the surface to be dried, and moves the jet of air such that waterdrops attached to the surface to be dried are blown off while being collected to the central portion of this surface to be dried, thereby allowing the waterdrops gathered at the central portion to be blown off in a concentrated manner.

In addition, the drying device in accordance with the invention includes a moving unit which causes a jet of air whose abutment area is narrower than the surface to be dried to move in forward-backward and leftward-rightward directions relative to the surface to be dried. When the jet of air is blown onto the surface to be dried, the moving unit moves the abutment area of the jet to the central portion while causing the abutment area of the jet to move around by interlocking the forward/backward operation and leftward/rightward operation of the jet of air, so that the jet of air can be applied to the surface to be dried in a wide range.

Namely, the drying device in accordance with the invention is characterized by comprising: an air blowing portion for blowing pressurized air so as to dry a surface to be dried by a jet of pressurized air whose abutment area to the surface to be dried is narrower than the surface to be dried; and a moving unit for moving the air blowing portion while the jet is being blown such that the jet blown from the air blowing portion sequentially sweeps a substantially entire surface of the surface to be dried, wherein the moving unit includes a first moving device for moving the air blowing portion in a state in which a blowing direction of the jet is being maintained so as to form a predetermined angle with respect to a moving direction of the air blowing portion and a second moving device for moving the air blowing portion in a direction different from that of the moving direction.

For example, this first moving device moves in an advancing/retracting direction of the air blowing portion, and the second moving device deflects the blowing direction of the jet.

ADVANTAGES OF THE INVENTION

[0016] According to the invention, the waterdrops attached to the surface to be dried in a wide range can be blown off without being spread even with a small jet of air, so that the surface to be dried can be dried efficiently in a short time without enlarging the size of the drying device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is a perspective view illustrating a state in which a sanitary washing apparatus in accordance with a first embodiment of the invention is mounted on a toilet bowl;

Fig. 2 is a schematic diagram illustrating an example of a remote control device in the sanitary washing apparatus shown in Fig. 1;

Fig. 3 is a block diagram illustrating the configuration of a washing water spraying unit in the sanitary washing apparatus shown in Fig. 1;

Fig. 4 is a block diagram illustrating the configuration of a drying device in the sanitary washing apparatus shown in Fig. 1;

Fig. 5 is aperspective view illustrating the configura-

tion of a drive unit in the drying device in the sanitary washing apparatus shown in Fig. 1;
Fig. 6 is a timing chart illustrating the controlling operation in "posterior washing" and "drying" operation in the sanitary washing apparatus shown in Fig. 1;
Fig. 7 (a) is a schematic cross-sectional view of a state of "posterior washing" in the sanitary washing apparatus shown in Fig. 1;
Fig. 7 (b) is a schematic cross-sectional view of a state of operation of a first step of "drying" in the device;
Fig. 7 (c) is a schematic cross-sectional view of a state of operation of a second step of "drying" in the device;
Fig. 8 is a schematic diagram illustrating moving patterns of a jet of air on the surface to be dried in the first and second steps of "drying" in the sanitary washing apparatus shown in Fig. 1;
Fig. 9 is a schematic diagram illustrating moving patterns of the jet of air on the surface to be dried in third and fourth steps of "drying" in the sanitary washing apparatus shown in Fig. 1;
Fig. 10 is a partial perspective view of a drying nozzle and a swinging device of the drying device in the sanitary washing apparatus in accordance with a second embodiment of the invention;
Fig. 11 is a timing chart illustrating the controlling operation in "posterior washing" and "drying" operation in the sanitary washing apparatus in accordance with a third embodiment of the invention;
Fig. 12 is a schematic diagram illustrating a moving pattern of the jet of air on the surface to be dried in "drying" in the sanitary washing apparatus shown in Fig. 11;
Fig. 13 is a timing chart illustrating the controlling operation in "posterior washing" and "drying" operation in the sanitarywashing apparatus in accordance with a fourth embodiment of the invention;
Fig. 14 is a schematic diagram illustrating a moving pattern of the jet of air on the surface to be dried in "drying" in the sanitary washing apparatus shown in Fig. 13;
Figs. 15 (a) to 15 (c) are diagram illustrating the relationship between the drying nozzle and the human body in the sanitary washing apparatus according to fifth embodiment of the invention;
Figs. 16(a) to 16(c) are diagrams illustrating the relationship between the drying nozzle and the human body in the sanitary washing apparatus in accordance with the fifth embodiment of the invention;
Fig. 17 is a diagram illustrating the drying nozzle in the sanitary washing apparatus in accordance with a sixth embodiment of the invention;
Fig. 18 is a perspective view illustrating the drying nozzle in the sanitary washing apparatus in accordance with a seventh embodiment of the invention;
Fig. 19 is a cross-sectional view illustrating the drying nozzle in the sanitary washing apparatus in accordance with the seventh embodiment of the invention;
Figs. 20 (a) and 20 (b) are diagrams illustrating the drying nozzle in the sanitary washing apparatus in accordance with an eighth embodiment of the invention;
Fig. 21 is a schematic plan view of a conventional sanitary washing apparatus equipped with a drying device; and
Fig. 22 is a schematic cross-sectional view of the conventional sanitary washing apparatus equipped with the drying device.

DESCRIPTION OF REFERENCE NUMERALS AND SIGNS

[0018]

20, 81: air blowing portion (drying nozzle)
30: washing water spraying unit
40: heating unit
42: warm air blowout port
50: drying device
52: moving unit (drive unit)
55: base
55R: base
70, 80: swinging device
71: advancing/retracting driving device
71R: horizontally driving device
100: sanitary washing apparatus
400: toilet seat
E: abutment area
F: surface to be dried
G: central portion

BEST MODE FOR CARRYING OUT THE INVENTION

[0019] Hereafter, a description will be given of the mode for carrying out the invention.
Prior to the description, a description will be given of the concept of the invention.

[0020] First, the drying device in accordance with the invention comprises: an air blowing portion for blowing pressurized air so as to dry a surface to be dried by a jet of pressurized air whose abutment area to the surface to be dried is narrower than the surface to be dried; and a moving unit for moving the air blowing portion while the jet is being blown such that the jet blown from the air blowing portion sequentially sweeps a substantially entire surface of the surface to be dried, wherein the moving unit includes a first moving device for moving the air blowing portion in a state in which a blowing direction of the jet is being maintained so as to form a predetermined angle with respect to a moving direction of the air blowing portion and a second moving device for moving the air blowing portion in a direction different from that of the moving direction.

[0021] According to this configuration, pressurized air can be blown onto the surface to be dried in its entirety

while being sequentially moved over the surface to be dried in a state in which the blowing direction of the jet is being maintained so as to form a predetermined angle with respect to the moving direction of the air blowing portion.

[0022] Waterdrops attached to the surface to be dried are more easily blown away if a jet with a greater air velocity is applied, but if the distance between the waterdrops and the air blowing portion moves away, the air velocity of the jet applied to the waterdrops declines extremely, making it impossible to blow away the waterdrops. For this reason, the waterdrops and the air blowing portion in terms of the distance therebetween should preferably be as close to each other as possible. Accordingly, as the air blowing portion is moved while maintaining the blowing direction of the jet as in the invention, the jet can be applied by maintaining the surface to be dried and the air blowing portion to a close distance, so that the waterdrops attached to the surface to be dried can be blown off efficiently.

[0023] In addition, as the jet is moved over the surface to be dried so as to effect sweeping, the waterdrops attached to the surface to be dried can be blown off while being moved in an arbitrary direction. For example, the waterdrops can be collected to the center of the surface to be dried and can be blown off efficiently.

In particular, in the invention of this application, since pressurized air whose abutment area of the jet is made narrower than the surface to be dried is sequentially moved over the substantially entire surface of the surface to be dried, waterdrops in a wide range can be moved even by the narrowed-down jet of air, and the miniaturization of the drying device becomes possible.

[0024] In addition, in the invention, in the above-described drying device, the first moving device may move in an advancing/retracting direction of the air blowing portion.

Byvirtue of this configuration, the advancing/retracting direction of the air blowing portion becomes a direction along the center line in the forward/backward direction of the surface to be dried, i.e., the buttocks. Accordingly, since the jet from the air blowing portion is blown onto the entire surface to be dried while being sequentially moved in the state in which a predetermined angle is being maintained on the center line of the buttocks, the jet can be applied on the center line of the buttocks which is most likely to become wet on the surface to be dried while the surface to be dried and the air blowing portion are being maintained to a close distance. Hence, the waterdrops attached to the surface to be dried can be blown away efficiently.

[0025] In addition, in the invention, in the above-described drying device, the second moving device may deflect the blowing direction of the jet.

By virtue of this configuration, as for the movement of the air blowing portion in the second moving device, the jet can be moved over the entire surface to be dried by the small operation of merely cyclically deflecting the blowing angle of the air blowing portion, so that the drying device can be miniaturized.

[0026] In addition, in the invention, in the above-described drying device, the second moving device may move in the direction different from that of the moving direction in the state in which the blowing direction of the jet is being maintained.

According to this configuration, since the pressurized air is blown onto the entire surface to be dried while being sequentially moved over the surface to be dried in the state in which both the first moving device and the second moving device maintain the blowing direction of the jet from the air blowing portion, the jet can be applied to the entire surface to be dried while maintaining the surface to be dried and the air blowing portion to a close distance. Accordingly, the waterdrops attached to the surface to be dried can be efficiently blown away or the waterdrops can be moved arbitrarily.

[0027] In addition, in the above-described drying device, the second moving device may deflect the jet by rotating the air blowing portion.

By virtue of this configuration, as for the movement of the air blowing portion in the second moving device, the jet can be moved over the entire surface to be dried by the small operation of merely cyclically rotating the air blowing portion, so that the second moving device is provided with a simple configuration, making it possible to attain the miniaturization of the drying device.

[0028] In addition, in the invention, in the above-described drying device, the second moving device may deflect the blowing direction of the jet blown from the air blowing portion.

By virtue of this configuration, as for the movement of the air blowing portion in the second moving device, the jet can be moved over the entire surface to be dried by the operation of merely cyclically swinging the blowing direction of the jet from the air blowing portion, e.g., by using such as the self-excited deflection of a fluid element, so that the second moving device is provided with a simple configuration, making it possible to attain the miniaturization of the drying device.

[0029] In addition, in the invention, in the above-described drying device, the second moving device may move the air blowing portion in a direction substantially perpendicular to the direction of movement by the first moving device.

According to this configuration, the combination of movement of the air blowing portion by the first moving device and the second moving device provides two-dimensional movement of two axes, so that position coordinates are easily understandable, and movement control is simplified. For this reason, since the combinationmovement of the air blowing portion becomes smooth, the removal of waterdrops attached to the surface to be dried and the movement of waterdrops in an arbitrary direction are facilitated.

[0030] In addition, in the invention, in the above-described drying device, the second moving device may

move the air blowing portion in a circular arc form.

By virtue of this configuration, the second moving device cyclically effects circular arc-shaped reciprocating motion in a fan shape using, for instance, one point as a fulcrum. By virtue of this operation, the operation of blowing pressurized air onto the entire surface to be dried while sequentially moving the pressurized air in the state in which the blowing direction of the jet by the air blowing portion is being maintained by both the first moving device and the second moving device can be realized by a relatively simple configuration. Further, by virtue of this configuration, the waterdrops attached to the surface to be dried can be blown away efficiently or moved arbitrarily.

[0031] In addition, in the invention, in the above-described drying device, the air blowing portion may be a rod-like body having an air blowing port in a vicinity of a distal end thereof, and the moving direction of the first moving device may be a direction along a longitudinal direction of the rod-like body.

By virtue of this configuration, a projecting area in the movement of the rod-like body can be minimized by allowing the longitudinal direction of the rod-like body to the moving direction of the first moving device. Accordingly, in a case where the air blowing portion is advanced or retracted to or from a main body of the drying device with respect to the surface to be dried, the advance or retraction can be effected with a minimal moving locus. Namely, the moving in and out of the air blowing portion can be effected smoothly.

[0032] In addition, in the invention, in the above-described drying device, the moving unit may sweep the jet from the air blowing portion so as to blow off waterdrops attached to the surface to be dried while collecting them to a central portion of the surface to be dried by the jet blown from the air blowing portion.

In a case where the jet of pressurized air is applied to the waterdrops attached to the surface to be dried, if the jet is directly applied, the waterdrops are easily blown away, but if the waterdrops and the jet are positionally offset from each other, the waterdrops merely move along the flow of air and are not blown away in many cases. The jet of pressurized air which is blown onto the surface to be dried has the property of spreading over the entire surface along the surface to be dried. Accordingly, by changing the position of applying the jet of air to the waterdrops attached to the surface to be dried in a spread manner, the direction of flow of air along the surface to be dried is changed to allow the waterdrops to be gathered at the central portion of the surface to be dried.

Consequently, although small waterdrops which are dispersed are not blown off unless a strong jet of air is applied over a wide range, but gathered large waterdrops can be easily blown off even by a small jet of air. Moreover, if the waterdrops are gathered at the central portion of the surface to be dried, the jet of air can be applied by being focused on a narrow range, so that the waterdrops can be blown off efficiently.

[0033] In addition, in the invention, in the above-described drying device, the moving unit may include cyclic movement for cyclically reciprocating the air blowing portion in a fixed direction and gradual movement for moving the cyclic movement in a predetermined direction, and may sweep the abutment area of the jet over the substantially entire surface of the surface to be dried.

The waterdrops attached to the surface to be dried are blown off in linear form or in strip form similar to the locus of cyclicmovement in one cyclicmovement. As the cyclic movement is repeated while the gradual movement is being effected, the blown-off range is consecutively enlarged, and the water attached to the overall surface to be dried is finally blown off.

By virtue of this configuration, as the moving range and the range of the moving angle are gradually made smaller to cause the abutment area of the jet of air to approach the central portion of the surface to be dried, the waterdrops which have spread over the surface to be dried can be continuously blown off while being collected to the central portion without stopping the jet of air. Accordingly, no waste is incurred in operation, and it is possible to shorten the drying time.

[0034] In addition, in the invention, in the above-described drying device, the moving unit may gradually move the air blowing portion from an outer periphery of the surface to be dried toward a substantial center of the surface to be dried while cyclically moving the air blowing portion on substantially tangential lines to a circumference of a circle about a center of the surface to be dried.

By virtue of this configuration, since the jet of air gradually approaches the center while undergoing cyclic movement in a tangential direction to the outer peripheral portion of the waterdrops attached to the surface to be dried, the waterdrops move toward the center of the surface to be dried, and the wet area is prevented from becoming enlarged by being spread to the outer side. Therefore, sweeping can be effected while collecting the waterdrops on the surface to be dried more efficiently.

[0035] In addition, in the invention, in the above-described drying device, the first moving device may effect the gradual movement, and the second moving device may effect the cyclic movement.

By virtue of this configuration, if, for example, the direction of gradual movement is set as the forward and backward direction, the waterdrops attached to the surface to be dried can be easily collected to the central portion from the front side or the back side, so that the waterdrops on the surface to be dried can be removed more efficiently.

[0036] In addition, in the invention, in the above-described drying device, the first moving device may effect the cyclic movement, and the second moving device may effect the gradual movement.

By virtue of this configuration, if, for example, the direction of gradual movement is set as the leftward and rightward direction, the waterdrops attached to the surface to be dried can be easily collected to the central portion from

the left side or the right side, so that the waterdrops on the surface to be dried can be removed more efficiently.

[0037] In addition, in the invention, in the above-described drying device, there may be provided a first step in which a direction of the cyclic movement of the moving unit is set as a leftward and rightward direction of the surface to be dried, and the gradual movement is effected from a predetermined position forward of a center of the surface to be dried toward a substantial center thereof, and a second step in which the gradual movement is effected from a predetermined position backward of the center of the surface to be dried toward the substantial center thereof, and the first step and the second step may be executed.

By virtue of this configuration, as the moving range and the range of moving angle are gradually made smaller to thereby cause the abutment area of the jet of air to approach the central portion of the surface to be dried, it is possible to continuously blow off the waterdrops which have spread over the surface to be dried, while collecting them toward the central portion without stopping the jet of air. Accordingly, no waste is incurred in operation, and it is possible to shorten the drying time.

[0038] In addition, in the invention, in the above-described drying device, there may be provided a first step in which a direction of the cyclic movement of the moving unit is set as a forward and backward direction of the surface to be dried, and the gradual movement is effected from a predetermined position on one side either leftward or rightward of a center of the surface to be dried toward a substantial center thereof, and a second step in which the gradual movement is effected from a predetermined position on another side leftward or rightward of the center of the surface to be dried toward the substantial center thereof, and the first step and the second step may be executed.

By virtue of this configuration, the waterdrops attached forwardly of the center of the surface to be dried are moved toward the center in the above-described first step, while the waterdrops attached backwardly of the center of the surface to be dried are moved toward the center in the above-described second step. Hence, all the waterdrops attached to the surface to be dried can be gathered to the central portion from the front side and the back side.

[0039] In addition, in the invention, in the above-described drying device, there may be provided a first step in which a direction of the cyclic movement of the moving unit is set as a leftward and rightward direction of the surface to be dried, and the gradual movement is effected from a predetermined position forward of a center of the surface to be dried toward a substantial center thereof, a second step in which the gradual movement is effected from a predetermined position backward of the center of the surface to be dried toward the substantial center thereof, a third step in which a direction of the cyclic movement of the moving unit is set as a forward and backward direction of the surface to be dried, and the gradual movement is effected from a predetermined position on one side either leftward or rightward of the center of the surface to be dried toward a substantial center thereof, and a fourth step in which the gradual movement is effected from a predetermined position on another side leftward or rightward of the center of the surface to be dried toward the substantial center thereof, and the first to fourth steps may be executed.

By virtue of this configuration, the waterdrops attached forwardly of the center of the surface to be dried are moved toward the center in the above-described first step, while the waterdrops attached backwardly of the center of the surface to be dried are moved toward the center in the above-described second step. Further, the waterdrops attached to one side either leftward or rightward of the center of the surface to be dried are moved toward the center in the above-described third step, while the waterdrops attached to the other side leftward or rightward of the center of the surface to be dried are moved toward the center in the above-described fourth step. Hence, all the waterdrops attached to the surface to be dried can be gathered to the central portion from the forward/backward and leftward/rightward directions.

[0040] In addition, in the invention, in the above-described drying device, the moving unit may move the abutment area of the jet to the central portion while moving the abutment area of the jet around from a peripheral portion of the surface to be dried.

By virtue of this configuration, in a case where the jet of pressurized air is applied to the waterdrops attached to the surface to be dried, if the jet is directly applied to the waterdrops or to their vicinities, the waterdrops are easily blown away. Accordingly, as the position of applying the jet of air to the waterdrops attached to the surface to be dried in a spread manner is moved to the center while being made to move around, the waterdrops are gathered at the central portion of the surface to be dried.

As a result, since the jet can be applied in a concentrated manner on the waterdrops gathered at the central portion of the surface to be dried, the waterdrops can be blown off efficiently, and the miniaturization of the drying device is made possible.

[0041] In addition, in the invention, in the above-described drying device, the moving unit may move the abutment area of the jet to the central portion of the surface to be dried while moving the abutment area of the jet around on a polygonal shape made up by substantially tangential lines to a circumference of a circle about a center of the surface to be dried.

By virtue of this configuration, as the moving unit moves the abutment area of the jet to the central portion of the surface to be dried while moving the abutment area of the jet around on a polygonal shape made up by substantially tangential lines to a circumference of a circle about the center of the surface to be dried, since the abutment area of the jet of air approaches the center while the polygonal shape is being gradually made smaller while moving on the polygonal shape from the outer

peripheral portion of the surface to be dried, the waterdrops move toward the center of the surface to be dried, and the wet area is prevented from becoming enlarged by being spread to the outer side. Moreover, if the waterdrops are gathered at the central portion of the surface to be dried, the jet of air can be applied by being focused on a narrow range, so that the waterdrops can be blown off efficiently.

[0042] In addition, in the invention, in the above-described drying device, the moving unit may move the abutment area of the jet to the central portion of the surface to be dried while moving the abutment area of the jet around on a substantial circumference of a circle about a center of the surface to be dried.

By virtue of this configuration, since the jet of air hence gradually approaches the center while undergoing cyclic movement in a tangential direction to the outer peripheral portion of the waterdrops attached to the surface to be dried, the waterdrops move toward the center of the surface to be dried, and the wet area is prevented from becoming enlarged by being spread to the outer side.

[0043] In addition, in the invention, the above-described drying device may further comprise a controller for controlling the moving unit, wherein the controller gradually moves the moving unit from one end of the surface to be dried through a center thereof to another end thereof while causing the moving unit to effect cyclic movement at an end of a drying step.

By virtue of this configuration, the waterdrops remaining in a previous drying step can be removed reliably. Further, after the waterdrops have been gathered at the central portion of the surface to be dried, if the moving unit is gradually moved from one end of the surface to be dried through the center thereof to another end thereof, the waterdrops can be easily removed.

[0044] In addition, in the invention, the above-described drying device may further comprise a heating unit for heating air; and a warm air blowout port for blowing out warm air heated by the heating unit.

By virtue of this configuration, as the waterdrops are blown off by blowing pressurized air onto the surface to be dried from the air blowing portion, and warm air heated by the heating unit is additionally blown toward the surface to be dried, the surface to be dried can be dried efficiently in a short time. In addition, since water on the surface to be dried can be removed by the warm air, comfortability after drying improves. Further, it is possible to prevent a sensation of cold air due to the jet of pressurized air.

[0045] In addition, in the invention, in the above-described drying device and a sanitary washing apparatus equipped with the same, the sanitarywashing apparatus may comprise a mountable toilet seat; and a washing water spraying unit for spraying washing water toward the surface to be washed.

As the washing water spraying unit and the drying device are provided, it is possible to optimally set the positional relationship between the surface to be washed and the surface to be dried, so that efficient drying becomes possible. In addition, automation of the operation from washing to drying also becomes possible, and ease of use improves.

[0046] It should be noted that the washing water spraying unit and the air blowing portion may be formed by one nozzle, or may be formed by independent two nozzles and may be respectively configured so as to be capable of advancing and retracting independently.

[0047] In addition, the drying device for drying a surface to be dried by a jet of pressurized air whose abutment area to the surface to be dried is narrower than the surface to be dried may comprise: an air blowing portion for blowing pressurized air; and a moving unit for sequentially moving the abutment area of the jet from the air blowing portion over a substantially entire surface of the surface to be dried, wherein the moving unit may effect the movement so as to blow off waterdrops attached to the surface to be dried by a jet from the air blowing portion while collecting them to the central portion of the surface to be dried.

[0048] In a case where the jet of pressurized air is applied to the waterdrops attached to the surface to be dried, if the jet is directly applied, the waterdrops are easily blown away, but if the waterdrops and the jet are positionally offset from each other, the waterdrops merely move along the flow of air and are not blown away in many cases. The jet of pressurized air which is blown onto the surface to be dried has the property of spreading over the entire surface along the surface to be dried. Accordingly, by changing the position of applying the jet of air to the waterdrops attached to the surface to be dried in a spread manner, the direction of flow of air along the surface to be dried is changed to allow the waterdrops to be gathered at the central portion of the surface to be dried.

[0049] Consequently, although small waterdrops which are dispersed are not blown off unless a strong jet of air is applied over a wide range, but gathered large waterdrops can be easily blown off even by a small jet of air. Moreover, if the waterdrops are gathered at the central portion of the surface to be dried, the jet of air can be applied by being focused on a narrow range, so that the waterdrops can be blown off efficiently.

In particular, in the invention, since pressurized air whose abutment area of the jet is made narrower than the surface to be dried is sequentially moved over the substantially entire surface of the surface to be dried, waterdrops in a wide range can be moved even by the narrowed-down jet of air, and the miniaturization of the drying device becomes possible.

[0050] In addition, the above-described moving unit may move the abutment area of the jet over a substantially entire surface of the surface to be dried by combining cyclic movement for effecting cyclic reciprocation in a substantially fixed direction and gradual movement for moving the cyclic movement in a predetermined direction. Consequently, the waterdrops attached to the sur-

face to be dried are blown off in linear form or in strip form similar to the locus of cyclic movement in one cyclic movement. As the cyclic movement is repeated while the gradual movement is being effected, the blown-off range is consecutively enlarged, and the water attached to the overall surface to be dried can be finally blown off.

[0051] Furthermore, the above-described moving unit may effect gradual movement from an outer periphery of the surface to be dried toward a substantial center of the surface to be dried while effecting cyclic movement on substantially tangential lines to a circumference of a circle about a center of the surface to be dried. As a result, since the jet of air gradually approaches the center while undergoing cyclic movement in a tangential direction to the outer peripheral portion of the waterdrops attached to the surface to be dried, the waterdrops move toward the center of the surface to be dried, and the wet area is prevented from becoming enlarged by being spread to the outer side.

[0052] Furthermore, as the direction of the cyclic movement of the above-described moving unit is set as the leftward and rightward direction of the drying device, and the direction of the gradual movement is set as the forward and backward direction thereof, the waterdrops attached to the surface to be dried can be easily gathered to the central portion from the front side or the back side.

[0053] Furthermore, as the direction of the cyclic movement of the above-described moving unit is set as the forward and backward direction of the drying device, and the direction of the gradual movement is set as the leftward and rightward direction thereof, the waterdrops attached to the surface to be dried can be easily gathered to the central portion from the left side or the right side.

[0054] Furthermore, there are provided a first step in which the direction of the cyclic movement of the above-described moving unit is set as a leftward and rightward direction of the drying device, and the gradual movement is effected from a predetermined position forward of the center of the surface to be dried toward a substantial center thereof, and a second step in which the gradual movement is effected from a predetermined position backward of the center of the surface to be dried toward the substantial center thereof, and the first step and the second step are executed in combination. As a result, the waterdrops attached forwardly of the center of the surface to be dried are moved toward the center in the above-described first step, while the waterdrops attached backwardly of the center of the surface to be dried are moved toward the center in the above-described second step. Hence, all the waterdrops attached to the surface to be dried can be gathered to the central portion from the front side and the back side.

[0055] Furthermore, there are provided a first step in which the direction of the cyclic movement of the above-described moving unit is set as the forward and leftward direction of the drying device, and the gradual movement is effected from a predetermined position on one side either leftward or rightward of the center of the surface to be dried toward a substantial center thereof, and a second step in which the gradual movement is effected from a predetermined position on another side leftward or rightward of the center of the surface to be dried toward the substantial center thereof, and the first and second steps are executed in combination. As a result, the waterdrops attached on one side either leftward or rightward of the center of the surface to be dried are moved toward the center in the above-described first step, while the waterdrops attached to the other side are moved toward the center in the above-described second step. Hence, all the waterdrops attached to the surface to be dried can be gathered to the central portion from the left and right sides.

[0056] Furthermore, there are provided a first step in which the direction of the cyclic movement of the moving unit is set as the leftward and rightward direction of the drying device, and the gradual movement is effected from a predetermined position forward of the center of the surface to be dried toward the center, a second step in which the gradual movement is effected from a predetermined position backward of the center of the surface to be dried toward the center, a third step in which the direction of the cyclic movement of the moving unit is set as the forward and backward direction, and the gradual movement is effected from a predetermined position on one side either leftward or rightward of the center of the surface to be dried toward the center, and a fourth step in which the gradual movement is effected from a predetermined position on another side leftward or rightward of the center of the surface to be dried toward the center, and the first to fourth steps are executed in combination. As a result, the waterdrops attached forwardly of the center of the surface to be dried are moved toward the center in the above-described first step, while the waterdrops attached backwardly of the center of the surface to be dried are moved toward the center in the above-described second step. Further, the waterdrops attached to one side either leftward or rightward of the center of the surface to be dried are moved toward the center in the above-described third step, while the waterdrops attached to the other side leftward or rightward of the center of the surface to be dried are moved toward the center in the above-described fourth step. Hence, all the waterdrops attached to the surface to be dried can be gathered to the central portion from the forward/backward and leftward/rightward directions.

[0057] Furthermore, if a step is combined in which the direction of the cyclic movement of the above-described moving unit is set as the leftward and rightward direction of the drying device, the gradual movement is started from a predetermined position forward of the center of the surface to be dried toward the center, the center is passed, and the gradual movement is effected to a predetermined position backward of the center, then the jet of air can be applied to the entire waterdrops attached to the surface to be dried, thereby making it possible to blow off the waterdrops. In addition, if this step is exe-

cuted after gathering the waterdrops on the surface to be dried to the central portion, the waterdrops can be blown off more easily.

[0058] Furthermore, as the above-described moving unit is configured as drive unit for moving and/or rotating the air blowing portion, it becomes possible to execute the cyclic movement and gradual movement of the moving unit for moving the abutment area of the jet by using solely or in combination drive unit for driving the air blowing portion in either the forward/backward direction or the leftward/rightward direction and a drive unit for rotating the air blowing portion in a substantially vertical direction or in a substantially horizontal direction. Hence, it becomes possible to move the abutment area over the entire surface to be dried.

[0059] Furthermore, as the configuration adopted is such that there are provided a swinging device for swinging the jet from the air blowing portion in the leftward and rightward direction and an advancing/retracting device for reciprocating the air blowing portion in the forward and backward direction, it becomes possible to move the abutment area of the jet in the leftward and rightward direction by the swinging device and move it in the forward and backward direction by the advancing/retracting device. Hence, it becomes possible to move the abutment area of the jet over the entire surface of the surface to be dried.

[0060] Furthermore, as the sanitary washing apparatus is comprised of a mountable toilet seat, a washing water spraying unit for spraying washing water toward the private parts of a human body, and the above-described drying device, waterdrops are blown off while being gathered to the central portion of the surface to be dried by moving a jet of air from the air blowing portion back and forth and left and right with respect to the surface to be dried to which waterdrops are widely attached due to washing. Therefore, drying can be performed efficiently in a short time without spreading the waterdrops to the surroundings. In addition, since the waterdrops can be blown off even with a small jet of air, the drying device can be made compact, and the overall sanitary washing apparatus can be made small.

[0061] Furthermore, since there are provided a heating unit for heating a gas and a warm air blowout port for blowing out warm air heated by the heating unit, the waterdrops are blown off by blowing pressurized air onto the surface to be dried from the air blowing portion, and warm air heated by the heating unit is additionally blown toward the surface to be dried, so that the surface to be dried can be dried efficiently in a short time. In addition, since water on the surface to be dried can be removed by the warm air, comfortability after drying improves. Further, it is possible to prevent a sensation of cold air due to the jet of pressurized air.

[0062] In addition, the following form is also effective. In the invention, the drying device for drying a surface to be dried by a jet of pressurized air whose abutment area to the surface to be dried is narrower than the surface to be dried comprises: an air blowing portion for blowing pressurized air; and a moving unit for sequentially moving the abutment area of the jet from the air blowing portion over a substantially entire surface of the surface to be dried, wherein the moving unit may effect the movement so as to blow off waterdrops attached to the surface to be dried by a jet from the air blowing portion while collecting them to the central portion of the surface to be dried.

[0063] In a case where the jet of pressurized air is applied to the waterdrops attached to the surface to be dried, if the jet is directly applied to the waterdrops or to their vicinities, the waterdrops are easily blown away. Accordingly, a jet with its abutment area is blown onto the waterdrops attached to the surface to be dried in a spread manner consecutively over the entire surface of the surface to be dried.

[0064] The waterdrops attached to the surface to be dried in a wide range can be efficiently blown off even by a jet of pressurized air whose abutment area is narrowed down, and the miniaturization of the drying device is made possible.

[0065] In addition, particularly in the above-described configuration, the moving unit may move the abutment area of the jet to the central portion while moving the abutment area of the jet around from a peripheral portion of the surface to be dried.

[0066] As a result, as the abutment area of the jet is made to move around from the peripheral portion of the surface to be dried and is moved to the central portion while the peripheral range is being made smaller, the waterdrops are blown off from the peripheral portion toward the central portion, and all the waterdrops gathered at the central portion can be finally blown away. Therefore, it is possible to efficiently blow off the waterdrops attached to the surface to be dried in a wide range even by a jet of pressurized air whose abutment area is narrowed down, and the miniaturization of the drying device is made possible.

[0067] In addition, in the above-described configuration, as the moving unit moves the abutment area of the jet to the central portion of the surface to be dried while moving the abutment area of the jet aroundon apolygonal shape made up by substantially tangential lines to a circumference of a circle about the center of the surface to be dried, since the abutment area of the jet of air approaches the center while the polygonal shape is being gradually made smaller while moving on the polygonal shape from the outer peripheral portion of the surface to be dried, the waterdrops move toward the center of the surface to be dried, and the wet area is prevented from becoming enlarged by being spread to the outer side. Moreover, if the waterdrops are gathered at the central portion of the surface to be dried, the jet of air can be applied by being focused on a narrow range, so that the waterdrops can be blown off efficiently.

[0068] In addition, in the above-described configuration, as the moving unit moves the abutment area of the

jet to the central portion of the surface to be dried while moving the abutment area of the jet around on a circumference of a circle about the center of the surface to be dried, the entire waterdrops attached to the surface to be dried can be collected toward the central portion in such a manner as to surround the waterdrops by making the diameter of the circumference gradually smaller. Therefore, efficient drying can be performed without causing the waterdrops to scatter to the outside.

[0069] In addition, in the invention, as the sanitary washing apparatus is comprised of a mountable toilet seat, a washing water spraying unit for spraying washing water toward the private parts of a human body, and the drying device in accordance with any one of the above-described first to fourth aspects of the invention, a jet of pressurized air is moved to the central portion while being moved around from the peripheral portion of the surface to be dried with respect to the surface to be dried to which waterdrops are widely attached due to washing. Therefore, the jet is spread widely over the entire surface of the surface to be dried, and drying can be performed efficiently in a short time. In addition, since the waterdrops can be blown off even with a small jet of air, the drying device can be made compact, and the overall sanitary washing apparatus can be made small.

[0070] In addition, in the above-described configuration, since there are provided a heating unit for heating air and a warm air blowout port for blowing out warm air heated by the heating unit, the waterdrops are blown off by blowing pressurized air onto the surface to be dried from the air blowing portion, and warm air heated by the heating unit is additionally blown toward the surface to be dried. Hence, the surface to be dried can be dried efficiently in a short time. In addition, since water on the surface to be dried can be removed by the warm air, comfortability after drying improves. Further, it is possible to prevent a sensation of cold air due to the jet of pressurized air.

[0071] Hereafter, a description will be given of the embodiments of the invention with reference to the drawings. It should be noted that the invention is not limited by these embodiments.

(First Embodiment)

[0072]

Fig. 1 is a perspective view illustrating a state in which a sanitary washing apparatus in accordance with an embodiment of the invention is mounted on a toilet bowl.

[0073] As shown in Fig. 1, a sanitary washing apparatus 100 in accordance with an embodiment of the invention is mounted on a toilet bowl 600.

[0074] The sanitary washing apparatus 100 is comprised of a main body 200, a remote control device 300, a toilet seat 400, and a cover 500.

[0075] The toilet seat 400 and the cover 500 are openably attached to the main body 200. Further, the main body 200 is provided with a drying device 50 including a drying nozzle 20 which is an air blowing portion, a washing water spraying unit 30 for spraying washing water, and a heating unit 40, and a controller is incorporated therein. The controller in the main body 200 controls the drying device 50, the heating unit 40, and the washing water spraying unit 30 on the basis of a signal transmitted by the remote control device 300, as will be described later. The controller in themainbody 200 also controls a deodorizing device and the like (not shown) provided in the main body 200.

[0076] The drying device 50 includes an air pump 51 for supplying pressurized air; the drying nozzle 20 for blowing this pressurized air; and a drive unit 52 for driving the drying nozzle 20 to move back and forth and left and right the jet of the pressurized air blown from the drying nozzle 20. The pressurized air blown from the drying device 50 has a capability of 20 to 30 m per second in terms of the air velocity with which it collides against the surface to be dried. The pressurized air abuts against the surface to be dried with an abutment area of an approximately 1-cm size in diameter.

[0077] A washing nozzle portion 33 of the washing water spraying unit 30 is integrally formed with the drying nozzle 20. The washing water spraying unit 30 is comprised of a switching valve for opening and closing the supply of tap water to other than the washing nozzle portion 33, a warm water heating device 31 for heating the tap water, and a changeover valve 32 for changing over the flow channel between the direction of the washing nozzle portion 33 and the direction of the interior of the toilet bowl 600, the drive unit 52 being used jointly by the drying nozzle 20.

[0078] The heating unit 40 is comprised of an air fan 41 for supplying warm air by sending air to an incorporated heater and a duct 43 for introducing this warm air to a warm air blowout port 42. The configuration provided is such that the flow rate of the warm air blowing out from the warm air blowout port 42 is a velocity of not more than 10 m per second, which is slower than the flow rate of the pressurized air blown from the aforementioned drying device 50, and the abutment area against the surface to be dried is wide, allowing the warm air to be diffused over the substantially entire surface of the surface to be dried.

[0079] Fig. 2 is a schematic diagram illustrating an example of the remote control device 300 shown in Fig. 1.

[0080] As shown in Fig. 2, the remote control device 300 has a plurality of LEDs (light emitting diodes) 301, a plurality of adjustment switches 302, a posterior switch 303, a stimulation switch 304, a stop switch 305, a bidet switch 306, a drying switch 307, and a deodorizing switch 308.

[0081] The adjustment switch 302, the posterior switch 303, the stimulation switch 304, the stop switch 305, the bidet switch 306, the drying switch 307, and the deodor-

izing switch 308 are pressingly operated by a user. Consequently, the remote control device 300 transmits by radio a predetermined signal to the controller provided in the main body 200 which will be described later.

[0082] The controller in the main body 200 receives the predetermined signal transmitted by radio from the remote control device 300, and controls the washing water spraying unit 30, the heating unit 40, and the drying device 50. For example, when the user pressingly operates the posterior switch 303 or the bidet switch 306, the washing nozzle portion 33 in the main body 200 shown in Fig. 1 is moved to spray the washing water onto the surface to be washed of the human body. When the stimulation switch 304 ispressinglyoperated, thewashingnozzle portion 33 is reciprocatingly driven back and forth by the drive unit 52 of the main body 200 shown in Fig. 1 to shift the washing water, thereby imparting stimulations to the private parts of the human body,

[0083] In addition, when the drying switch 307 is pressingly operated, the drying nozzle 20 of the drying device 50 shown in Fig. 1, while being driven by the drive unit 52, blows the pressurized air supplied from the air pump 51 onto the surface to be dried of the human body after washing. At this time, the heating unit 40 is also operated to blow warm air from the warm air blowout port 42, thereby applying the warm air onto the substantially entire surface of the surface to be dried.

[0084] When stop switch 305 is pressingly operated, the operation of each of the washing water spraying unit 30, the heating unit 40, and the drying device 50 is stopped, and the drying nozzle 20 is accommodated into the main body 200.

[0085] Further, when the deodorizing switch 308 is pressingly operated, the deodorizing device (not shown) in the sanitary washing apparatus 100 removes the odor from the surrounding air.

[0086] The adjustment switch 302 includes air volume adjustment switches 302a and 302b, temperature adjustment switches 302c and 302d, and nozzle position adjustment switches 302e and 302f.

[0087] When the user pressingly operates the nozzle position adjustment switches 302e or 302f, the set position of a central portion of the drying nozzle 20 of the drying device 50 in the sanitary washing apparatus 100 shown in Fig. 1 is changed. When the temperature adjustment switch 302c or 203d is pressingly operated, the temperature of the warm air blown from the heating unit 40 is changed. Further, when the air volume adjustment switch 302a or 302b is pressed, the volume of pressurized air supplied from the air pump 51 of the drying device 50 is changed. The plurality of LEDs (light emitting diodes) 301 light up as the adjustment switch 302 is pressed.

[0088] Next, a description will be given of the washing water spraying unit 30 provided in the main body 200. Fig. 3 is a block diagram illustrating the configuration of the washing water spraying unit 30.

[0089] The washing water spraying unit 30 shown in Fig. 3 includes an on-off valve 34, the warm water heating device 31, the changeover valve 32, the washing nozzle portion 33, the drive unit 52, a forward/backward driving motor 53, a left-right driving motor 54, and a controller 150.

[0090] The controller 150 of the washing water spraying unit 30 controls the operation of the on-off valve 34, the warm water heating device 31, the changeover valve 32, the forward/backward driving motor 53, and the left-right driving motor 54.

[0091] Next, a description will be given of the drying device 50 provided in the main body 200. Fig. 4 is a block diagram illustrating the configuration of the drying device 50.

[0092] The drying device 50 shown in Fig. 4 includes the drying nozzle 20, the air pump 51, the drive unit 52, the controller 150, the forward/backward driving motor 53, the left-right driving motor 54, the air fan 41, the heater 43, and the warm air blowout port 42. The aforementioned drive unit 52, forward/backward driving motor 53, left-right driving motor 54, and controller 150 are used jointly by the aforementionedwashing water spraying unit 30.

[0093] The controller 150 of the drying device 50 controls the operation of the air pump 51, the forward/backward driving motor 53, the left-right driving motor 54, the air fan 41, and the heater 43.

[0094] Fig. 5 is a perspective view illustrating the configuration of the drive unit 52 in the drying device 50.

[0095] The drive unit 52 shown in Fig. 5 is comprised of the drying nozzle 20, a swinging device 70 for swinging the jet of air from the drying nozzle 20 in left and right directions, an advancing/retracting driving device 71 for reciprocating the jet of air in forward and backward directions, and a base 55. This drive unit 52 as the moving unit allows the abutment area with respect to the surface to be dried of the pressurized air blown from the drying nozzle 20 to be arbitrarily moved over the entire surface to be dried.

[0096] The drying nozzle 20 has a hollow cylindrical shape and is provided with an air nozzle hole 21 and a washing water nozzle hole 22 which are located in a circumferential direction of the hollow cylinder in the vicinity of its distal end. The drying nozzle 20 is provided in its interior with an air cavity 23 for leading the pressurized air to the air nozzle hole 21 and a water cavity 24 for leading washing water into the washing water nozzle hole 22. Namely, this drying nozzle 20 is configured to also serve as the washing nozzle portion 33.

[0097] The pressurized air from the air pump 51 is connected so as to be supplied from an air tube 25 into the air cavity 23, while washing water from the changeover valve 32 is connected so as to be supplied from a water tube 26 into the water cavity 24. The air tube 25 and the water tube 26 are formed of a soft material such as rubber since a twisting or bending force acts when the drying nozzle 20 is rotated or driven back and forth.

[0098] The base 55 allows the drying nozzle 20 to be

disposed in an inclined manner on its upper surface along a rail portion 56 configured in such a manner as to be tilted forward, and the drying nozzle 20 is held by being passed through a guide portion 57 provided with a hole therein and disposed on a leading end of the base. This guide portion 57 is formed of a material excellent in slidability and is provided with an appropriate clearance so that the dryingnozzle 20 smoothly rotates and slides. In addition, a slider 58 which slides along the rail portion 56 is provided on an upper surface of the base 55 to rotatably hold a terminating end of the drying nozzle 20. Further, the drying nozzle 20 is driven along the rail portion 56 in conformity with the operation of the slider 58.

[0099] The advancing/retracting driving device 71 serving as a first moving device is comprised of the forward/backward driving motor 53, the slider 58, and a threaded portion 59, and the back-forth driving motor 53 is disposed on a rear portion of the base 55 and is connected so as to forwardly and reversely rotate the threaded portion 59 disposed in parallel to the rail portion 56. This threadedportion 59 is set through a nut portion 60 of the slider 58, such that the slider 58 is driven on the rail portion 56 as the threaded portion 59 is rotated. Accordingly, the drying nozzle 20, which is held by the slider 58, is retractably driven back and forth in conjunction with the rotation of the forward/backward driving motor 53. Here, the forward direction denotes an A direction in Fig. 5, while the backward direction denotes a B direction. The forward direction corresponds to the front side direction of the toilet user seated on the toilet seat 400, while the backward direction corresponds to the back side direction of the toilet user.

[0100] The swinging device 70 serving as a second moving device consists of the left-right driving motor 54, a gear A 61, a gear B 62, and a gear C 63 which are disposed on the slider 58, the rotation of the left-right driving motor 54 being transmitted to the drying nozzle 20 via the gear A 61, the gear B 62, and the gear C 63. Accordingly, the drying nozzle 20 is rotated in correspondence with the forward or reverse rotation of the left-right driving motor 54, so that the jet of air blown from the air nozzle hole 21 is swung in left and right directions C and D in Fig. 5.

[0101] Hereafter, a description will be given of the controlling operation in the controller 150 with additional reference to Figs. 6, 7, 8, and 9. Fig. 6 is a timing chart of the controlling operation in "posterior washing" and "drying" operation, and Figs. 7(a) to 7(c) are schematic cross-sectional views of the states of "posterior washing" and "drying" operation. Figs. 8 and 9 are schematic diagrams illustrating moving patterns of an abutment area E of the jet on the surface to be dried in the state of "drying" operation.

[0102] As shown in Fig. 6, at a timing T0 in a state in which no operation has been performed, the drying nozzle 20 (washing nozzle portion 33) in its back and forth direction is disposed in an accommodating position at a rear end. The drying nozzle 20 in its left and right direction is angularly set to a detecting position of a position sensor (not shown) for detecting the position of a central portion provided in the swinging device 70. This angle serves as a central angle, and jetting angles of the air nozzle hole 21 and the washing water nozzle hole 22 are set in an upward direction.

[0103] At T1 when the user pressingly operates the posterior switch 303 of the remote control device 300, the on-off valve 34 is opened, and tap water flows into the warm water heating device 31. When an incorporated flow rate sensor (not shown) detects the water flow, the energization of the warmwater heating device 31 is started, and the heated warm water begins to be supplied. At this time, since the changeover valve 32 is set to the flow channel on the toilet bowl side, warm water which has become sufficiently warm is discharged into the toilet bowl 600.

[0104] At a timing T2 when the temperature of warm water flowing out from the warm water heating device 31 has reached a predetermined temperature (e.g., 36°C), the forward/backward driving motor 53 is operated to forwardly advance the washing nozzle portion 33 to the position of the central portion (e.g., 100 mm forward). Then, at T3, the washing water is changed over to the washing nozzle portion 33 side by the changeover valve 32 to spray washing water onto the user' s surface to be washed. Power control of the warm water heating device 31 is effected by using known PID or FF control such that the detection temperature of the temperature sensor (not shown) for detecting the temperature of the outflowing warm water is set to a set temperature (e.g., 40°C). In addition, the flow rate of the washing water is set to a rate of the user's preference by adjusting the valve opening of the changeover valve 32. As for the wet state of the surface to be washed in this posterior washing, waterdrops flow and wet not only the central portion where the washing water is directly applied but also its peripheral portions.

[0105] At T4 in Fig. 6 when the user, upon finishing the posterior washing, pressingly operates the stop switch 305 of the remote control device 300, the washing water is changed over to the toilet bowl 600 side by the changeover valve 32 to stop the spraying of the washing water from the washing nozzle portion 33; at the same time, the energization of the warm water heating device 31 is stopped, and the forward/backward driving motor 53 is reversely rotated to retract the washing nozzle portion 33 to the accommodating position. Then, at T5, the on-off valve 34 is closed to shut off the passing water, thereby completing the washing operation.

[0106] It should be noted that although in this embodiment a description has been given of the operation in posterior washing, the fundamental sequence is similar also in the cases of bidet washing in which the bidet switch 306 of the remote control device 300 is pressing operated and stimulation washing in which the stimulation switch 304 is pressingly operated. In the case of bidet washing, however, the washing nozzle position and the

flow rate setting are changed to those corresponding to the bidet, whereas, in the case of stimulation washing, the operation of minutely driving the washing nozzle portion 33 back and forth during the spraying of washing water from the washing nozzle portion 33 is added.

[0107] Next, at T6 when the user pressingly operates the drying switch 307 of the remote control device 300, control is started for operating the air fan 41 and the heater 43 to blow out warm air from the warm air blowout port 42. The temperature of the warm air blown out is controlled to an appropriate temperature by subjecting the amount of energization of the heater 43 to feedback control. The warm air is then blown onto the substantially entire surface of the surface to be dried, i.e., the user's washed surface, from the warm air blowout port 42

[0108] At this time, the air pump 51 is simultaneously operated for a short time duration (e.g., 1 second), and pressurized air is momentarily spurted from the air nozzle hole 21 of the drying nozzle 20. This operation blows off the waterdrops attached to the surface of the drying nozzle 20 in a state in which the drying nozzle 20 is at the accommodating position, to prevent the reattachment of the waterdrops to the user. It should be noted that if the pressurized air is momentarily spurted from the air nozzle hole 21 of the drying nozzle 20 in the state in which the drying nozzle 20 is at the accommodating position, the drying nozzle 20 is dried efficiently by the air reflected from wall surfaces.

[0109] Subsequently, while the drying nozzle 20 is being advanced forward up to a foremost position (e.g., 150 mm forward) by operating the back-forth driving motor 53, the left-right angle of the drying nozzle 20 is angularly changed to a right end angle (e.g., +50°C) by operating the left-right driving motor 54.

[0110] At T7, the operation of the air pump 51 is started to start the blowing of compressed air from the air nozzle hole 21 with respect to the surface to be dried.

[0111] Then, in a first step from T7 to T8, by controlling operating directions and operating speeds of the left-right driving motor 54 and the back-forth driving motor 53 of the drive unit 52, the drying nozzle 20 in its forward and backward driving is reciprocatingly operated at high speed in a predetermined range (e.g., between 50 mm and 150 mm forward), and the drying nozzle 20 in terms of its left-right angle is concurrently driven slowly toward the central angle from a right end angle to a right-side predetermined angle (e.g., between +50° and +20°). In the operation of this first step, the jet of air from the drying nozzle 20 gradually approaches the central portion while moving at high speed from the right-side predetermined position of the user' s surface to be dried in the forward and backward directions. Accordingly, as shown in an operation pattern P1 in Fig. 8, the abutment area E of the jet of air gradually advances and moves toward a central portion G while undergoing cyclic movement in which the abutment area E reciprocates at high speed in a tangential direction to a right end of a surface F to be dried, so that a zigzag moving path is depicted as shown in the drawing. As a result, as shown in Fig. 7(b), the waterdrops attached in such a manner as to be spread toward the right side of the surface to be dried can be blown off while being collected toward the central portion.

[0112] At T8 in Fig. 6, the air pump 51 is temporarily stopped, and the left-right angle of the drying nozzle 20 is angularly changed to a left end angle (e.g., -50°). Then, at T9, the operation of the air pump 51 is resumed to start the blowing of the compressed air.

[0113] Then, in a second step from T9 to T10, the drying nozzle 20 in its forward and backward driving is reciprocatingly operated at high speed in a predetermined range (e.g., between 50 mm and 150 mm forward) in the same way as in the first step, and the drying nozzle 20 in terms of its left-right angle is concurrently driven slowly toward the central angle from a left end angle to a left-side predetermined angle (e.g., between -50 ° and -20°). In the operation of this second step, the jet of air from the drying nozzle 20 gradually moves and approaches the central portion while undergoing cyclic movement in which the jet of airmoves at high speed from the left-side predetermined distance of the user's surface to be dried in the forward and backward directions. Accordingly, as shown in an operation pattern P2 in Fig. 8, the abutment area E of the jet of air gradually advances and moves toward the central portion G while undergoing cyclic movement in which the abutment area E reciprocates at high speed in a tangential direction to a left end of the surface F to be dried, so that a zigzag moving path is depicted as shown in the drawing. As a result, as shown in Fig. 7(c), the water drops attached in such a manner as to be spread toward the left side of the surface to be dried can be blown off while being collected toward the central portion.

[0114] The waterdrops remaining as attached to the surface to be washed in the above-described first step and second step remain centering on the central portion and in the fore and aft portions thereof. Here, in a case where there have been remaining waterdrops collected at the central portion, these waterdrops are efficiently dried by the warm air blown from the warm air blowout port 42.

[0115] In the buttocks of the human body, prominences are formed on both left and right sides with respect to the central portion of washing including the anus and the penis, so that when the human body is seated on the toilet seat, both left and right sides are lower than the central portion of washing. Accordingly, washing water is liable to spread and wet both sides, and if the jet of air is applied to the central portion at the outset during drying, the attached waterdrops spread widely to left and right, enlarging the wet area. Efficient drying can be carried out since the waterdrops on the surface to be washed are blown off while being prevented from spreading to left and right in the first step and the second step, as described above. As sweeping is effected by moving the air blowout hole 22 along the central portion of washing while maintaining the blowing angle by the advancing/

retracting driving device 71 serving as the first moving device, the washing waterdrops attached to the user's posterior can be removed such that the waterdrops are collected toward the center of air blow which is sequentially cyclical. Accordingly, not only are the washing waterdrops attached to the surface to be washed not spread more than is necessary, but the waterdrop removal efficiency can be increased as the washing waterdrops are gathered at one location.

[0116] At T10 which is a point of time of completion of the second step, the drying nozzle 20 is advanced forward up to the forward most position. Then, in a third step from T10 to T11, while the drying nozzle 20 in its forward and backward driving is being slowly retracted from the forwardmost position toward the central portion, the drying nozzle 20 in terms of its left-right angle is concurrently reciprocatingly driven at high speed from the right end angle to the left end angle. In the operation of this third step, the jet of air from the drying nozzle 20 gradually approaches the central portion from the forward predetermined position toward the rear while moving over the surface to be dried at high speed in the left and right directions. Accordingly, as shown in an operation pattern P3 in Fig. 9, the abutment area E of the jet of air gradually advances and moves toward the central portion G while undergoing cyclic movement in which the abutment area E reciprocates at high speed in a tangential direction to a leading end of the surface F to be dried, so that a zigzag moving path is depicted as shown in the drawing. As a result, the waterdrops remaining on the forward side of the central portion G of the surface to be dried can be blown off while being collected toward the central portion G.

[0117] At T11 in Fig. 6, the air pump 51 is temporarily stopped, and the forward-backward position of the drying nozzle 20 is moved to a backward predetermined position (50 mm forward). Then, at T12, the operation of the air pump 51 is resumed to start the blowing of the compressed air.

[0118] Then, in a fourth step from T12 to T13, while the drying nozzle 20 in its forward and backward driving is being slowly advanced from the backward predetermined position toward the central portion, the drying nozzle 20 in terms of its left-right angle is concurrently reciprocatingly driven at high speed from the right end angle to the left end angle. In the operation of this fourth step, the jet of air from the drying nozzle 20 gradually approaches the central portion from the predetermined distance in the rear toward the front side while moving over the surface to be dried at high speed in the left and right directions. Accordingly, as shown in an operation pattern P4 in Fig. 9, the abutment area E of the jet of air gradually advances and moves toward the central portion G while undergoing cyclic movement in which the abutment area E reciprocates at high speed in a tangential direction to a rear end of the surface F to be dried, so that a zigzag moving path is depicted as shown in the drawing. As a result, the waterdrops remaining on the backward side of the central portion G of the surface to be dried can be blown off while being collected toward the central portion G.

[0119] By virtue of the above-described first to fourth steps, the waterdrops remaining as attached to the surface to be dried remain only on the central portion.

[0120] A description will be given of the operation with respect to the waterdrops which are attached to the surface to be dried in the above-described first to fourth steps.

In terms of the driving direction of the jet of air with respect to the surface to be dried during the operation of each step, the moving speed in the substantially tangential direction to the central portion is made sufficiently faster than the speed at which the jet of air moves toward the central portion. Therefore, in terms of the direction of the flow of air which spreads as a result of collision against the surface to be dried, flow components in the vertical direction to the aforementioned substantially tangential direction increase. Accordingly, the waterdrops attached between the central portion and the jet of air which is driven in this substantially tangential direction are, in action, pushed by the air flow in the vertical direction to the substantially tangential direction and move toward the central portion. The, the jet of air is made to gradually approach the central portion, the waterdrops come to be gathered toward the central portion. By performing this operation from the four directions, i.e., rightward, leftward, forward, and backward directions, in the first to fourth steps, the waterdrops are gathered at the central portion.

[0121] At T13, the air pump 51 is stopped again, and the forward-backward position of the drying nozzle 20 is moved to a forward predetermined position (e.g., 130 mm forward) . Then, at T14, the operation of the air pump 51 is resumed to start the blowing of the compressed air.

[0122] Then, in a fifth step from T14 to T15, while the drying nozzle 20 in its forward and backward driving is started to be retracted from the forward predetermined position, is made to pass the central portion, and is retracted slowly up to a backward predetermined distance (e.g., 50 mm forward) rearwardly of the central portion. Concurrently, the drying nozzle 20 in terms of its left-right angle is reciprocatingly driven at high speed from the right end angle to the left end angle. In the operation of this fifth step, while undergoing cyclic movement in which the jet of air from the drying nozzle 20 moves over the surface to be dried at high speed in the left and right directions, the jet of air from the drying nozzle 20 gradually moves from the forward predetermined position toward the rear and approaches the central portion, further passes through the central portion, and gradually moves to the predetermined position in the rear. Accordingly, since the position where the jet of air is applied to the surface to be dried gradually moves from the forward side through the central portion toward the rear side, it is possible to completely blow off the waterdrops remaining at the central portion of the surface to be dried.

[0123] At T15, the air pump 51 is stopped, and the drying nozzle 20 in its forward and backward direction is moved to the accommodating position at the rear end. The drying nozzle 20 in its left and right direction is returned to the central angle. Then, at T16 when the user pressingly operates the stop switch 305 of the remote control device 300, the operation of the air fan 41 and the heater 43 is stopped, thereby completing the blowing out of warm air from the warm air blowout port 42.

[0124] As described above, in this embodiment, when the jet of air from the drying nozzle 20 is blown onto the surface to be dried, warm air is blown from the warm air blowout port 42 onto the surface to be dried, so that drying can be carried out more efficiently, and it is possible to prevent a feeling of cold air in the jet of air.

[0125] In addition, since posterior washing, bidet washing, and drying are configured by one nozzle, and the drive unit is also used jointly, it is possible to reduce the installation area of the nozzle, and since the number of parts can be small, space saving and low cost can be realized.

[0126] Furthermore, since the pressurized air for drying is configured to be blown from the single nozzle hole, the flow velocity of the jet of air can be increased even at a low flow rate, and high drying performance can be obtained even with a small-capacity air pump. Namely, since the flow velocity of the jet is large, energy with which the waterdrops are pulled off when the jet is applied to the waterdrops attached to the surface to be dried becomes large, the waterdrops can be blown off efficiently.

[0127] It should be noted that although in this embodiment posterior washing and bidet washing are carried out by the identical nozzle hole, but may be configured by respectively disposing single nozzle holes in one hollow cylinder, or respectively independent nozzles and drive units may be disposed for posterior washing and bidet washing

[0128] In addition, although in this embodiment washing and drying are configured by one hollow cylinder, and the drive unit is used jointly, the washing and drying may be configured by respectively independent nozzles and drive units.

[0129] Further, although in this embodiment the drying nozzle is configured by the single nozzle hole, it is possible to adopt a configuration in which pressurized air is blown fromaplurality of nozzle holes, and pluralities of drying nozzles and drive units may be disposed. Furthermore, the drying time can be shortened by effecting driving by a plurality of jets of air so as to collect waterdrops on the surface to be dried to the central portion. In addition, although in this embodiment the flow velocity of the pressurized air is set to 20 to 30 mm per second, a velocity of not less than 10 m per second is minimally required for obtaining the effect of blowing off the waterdrops, and the size of the nozzle hole and the number of the nozzle holes, which are factors of setting of the expanse of the abutment area of the jet, need to be selected by taking into consideration the capacity of the air pump and the flow velocity of the pressurized air.

[0130] In addition, although in this embodiment the entire drying nozzle is configured to be driven by the drive unit as the moving unit, the invention is not limited to the same, and the abutment area of the jet is moved by changing the blowing direction of the jet by moving only the air nozzle hole of the drying nozzle or only a peripheral member including the air nozzle hole or by changing an angle thereof. Still alternatively, a configuration is conceivable, among others, in which a current direction changing device for changing the direction of the jet is provided on the forward side of the air nozzle.

[0131] In addition, although in this embodiment the first step through the fifth step are sequentially executed, each step may be repeatedly executed, or the order of the steps may be shifted. Still further, the first and second steps may be omitted, or the third and fourth steps may be omitted.

[0132] In addition, as the drying nozzle is gradually moved from one end of the surface to be dried through the center to the other end thereof while being subjected to cyclic movement at the end of the drying process, it is possible to reliably remove the remaining waterdrops.

(Second Embodiment)

[0133] Next, a description will be given of a sanitary washing apparatus in accordance with a second embodiment of the invention.

[0134] The sanitary washing apparatus in accordance with the second embodiment differs from the sanitary washing apparatus in accordance with the first embodiment in the following aspects.

[0135] Fig. 10 is a partial perspective view of the drying nozzle of the drying device and the swinging device in the sanitary washing apparatus in accordance with the second embodiment of the invention.

[0136] A swinging device 80 shown in Fig. 10 includes a rotating shaft portion 83 connected integrally to a proximal portion 82 of a drying nozzle 81 which is an air blowing portion, a slider 85 for supporting the rotating shaft portion 83 rotatably about an axis 84 of the rotating shaft portion 83, a left-right driving motor 86 for rotating the rotating shaft portion 83, and a gear A 87 and a gear B 88 for transmitting the torque of the left-right driving motor 86 to the rotating shaft portion 83.

[0137] The forward/backward driving function based on the slider 85 is similar to that in the first embodiment, and the nut portion 60 is similarly constructed.

[0138] In the same way as in the first embodiment, the drying nozzle 20 in terms of its internal configuration has a hollow cylindrical shape and is provided with the air nozzle hole 21 and the washing water nozzle hole 22 which are located in the circumferential direction of the hollow cylinder in the vicinity of its distal end. The drying nozzle 20 is provided in its interior with the air cavity (not shown) for pressurized air and the water cavity (not shown) for washing water. A difference from the first em-

bodiment lies in that the proximal portion 82 of the drying nozzle 81 is integrally connected to the rotating shaft portion 83, and the drying nozzle 81 reciprocatingly swings in a fan shape about this rotating shaft portion 83.

[0139] In the above-described configuration, the driving of the jet of air to left and right is effected as the position of the air nozzle hole 21 itself is moved left and right predetermined positions by rotating the drying nozzle 81 up to predetermined angles by controlling the forward and reverse rotation of the left-right driving motor 86.

[0140] Then, since a jet 89 of air from the air nozzle hole 21 is blown while substantially maintaining perpendicularity with respect to the surface to be dried, the peeling action with respect to waterdrops attached to the surface to be dried becomes high. In addition, since the action whereby the waterdrops tends to move to outside the surface to be dried can be further suppressed, the collection of the waterdrops to the central portion is facilitated. Further, even if the jet of air is moved left and right, the distance until the jet is applied to the surface to be dried does not move away, so that a jet whose air flow velocity is high can be applied to the surface to be dried, and waterdrops removal capacity can be further improved.

(Third Embodiment)

[0141] Next, a description will be given of a sanitary washing apparatus in accordance with a third embodiment of the invention.

[0142] The sanitarywashing apparatus in accordance with the third embodiment differs from the sanitary washing apparatus in accordance with the first embodiment in the following aspects.

[0143] Fig. 11 is a timing chart of the controlling operation in "posterior washing" and "drying" operation by the controller of the sanitarywashing apparatus. Fig. 12 is a schematic diagram illustrating a moving pattern of the abutment area of the jet of air with respect to the surface to be dried in the state of "drying" operation.

[0144] In the third embodiment, in the meantime from T7 till T13 in Fig. 11, the abutment area E of the jet of air is moved over the outer peripheral portion of the surface F to be dried shown in Fig. 12, sequentially in the order of backward m1, leftward m2, forward m3, rightward m4, and backward m5, and its drive range is thus made to gradually approach the central portion G.

[0145] Specifically, from T7 to T8 in Fig. 11, the operating directions and operating speeds of the left-right driving motor 54 and the back-forth driving motor 53 of the drive unit 52 are interlocked, and the drying nozzle 20 in its forward and backward driving is moved backward at high speed in a predetermined range (e.g., from 150 mm to 50 mm forward), while the drying nozzle 20 in terms of its left-right angle is concurrently driven slowly leftward from a right end angle through a predetermined angle (e.g., from +50° to +45°).

[0146] Next, from T8 to T9, the drying nozzle 20 in its forward and backward driving is slowly moved forward a predetermined distance (e.g., from 50 mm to 55 mm forward), and the drying nozzle 20 in terms of its left-right angle is concurrently driven leftward at high speed over a predetermined angular range (e.g., from +45° to -50°).

[0147] Next, from T9 to T10, the drying nozzle 20 is moved forward at high speed over a predetermined range (e.g., from 55 mm to 150 mm forward), andthedryingnozzle20intermsofitsleft-right angle is concurrently driven slowly rightward over a predetermined angular range (e.g., from -50° to -450°).

[0148] Next, from T10 to T11, the drying nozzle 20 is slowly moved backward a predetermined distance (e.g., from 150 mm to 145 mm forward), and the drying nozzle 20 in terms of its left-right angle is concurrently driven at high speed over a predetermined angular range (e.g., from -45° to +45°).

[0149] Further, from T11 to T12, the drying nozzle 20 is moved backward at high speed over a predetermined range (e.g., from 145 mm to 55 mm forward), and the drying nozzle 20 in terms of its left-right angle is concurrently driven slowly leftward over a predetermined angle (e.g., from +45° to +40°).

[0150] The predetermined range and the predetermined angular range are gradually made smaller while repeating the above-described operation, to thereby cause the abutment area of the jet of air to approach the central portion G of the surface to be dried.

[0151] With this method, it is possible to continuously blow off the waterdrops which have spread over the surface to be dried, while collecting them toward the central portion without stopping the air pump. Accordingly, no waste is incurred in operation, and it is possible to shorten the drying time.

(Fourth Embodiment)

[0152] Next, a description will be given of a sanitary washing apparatus in accordance with a fourth embodiment of the invention.

[0153] The sanitary washing apparatus in accordance with the fourth embodiment differs from the sanitary washing apparatus in accordance with the first embodiment in the following aspects.

[0154] Fig. 13 is a timing chart of the controlling operation in "posterior washing" and "drying" operation by the controller of the sanitarywashing apparatus. Fig. 14 is a schematic diagram illustrating a moving pattern of the abutment area of the jet of air with respect to the surface to be dried in the state of "drying" operation.

[0155] In the fourth embodiment, in the meantime from T7 till T13 in Fig. 13, the abutment area E of the j et of air is sequentially moved clockwise over the outer peripheral portion of the surface F to be dried shown in Fig. 14, and its radius r is gradually made smaller and is made to approach the central portion G.

[0156] Specifically, as shown in the forward/backward

moving distance and the angle in the left-right direction of the drying nozzle 20 from T7 to T8 in Fig. 11, reciprocal driving is respectively effected sinusoidally with respect to the central portion of the surface to be dried, and the setting is provided by setting the respective reciprocal driving frequencies identically and by offsetting the phases by 90 degrees. Namely, when the forward/backward moving distance is at the position of the central portion (T7, T9), the drying nozzle 20 in terms of its angle in the left-right direction is driven at the right or left end. Conversely, when the angle in the left-right direction is at the central angle (T8, T10), the drying nozzle 20 in terms of its forward/backward moving distance is driven at the forward end or the backward end. Then, driving is effected to make the amplitude of reciprocal driving gradually smaller to allow the moving range of the jet to approach the central portion G.

[0157] According to this embodiment, since the abutment area of the jet of air moves in such a manner as to depict a circle on the surface to be dried, the waterdrops located on the inner side of this circle can be blown off while being collected toward the central portion without being spread to the outer side. Accordingly, waterdrops can be reliably removed, and there is no wastefulness in the operation, so that the drying time can be shortened.

[0158] It should be noted that although in the above-described embodiment the abutment area of the jet of air is configured to depict a circle on the surface to be dried, the abutment area of the jet of air may be moved to the central portion of the surface to be dried while being moved around on a substantially polygonal shape made up by substantially tangential lines to the circumference of a circle about the center of the surface to be dried. This simplifies the configuration of the drive unit. In addition, since the abutment area of the jet of air approaches the center while the polygonal shape is being gradually made smaller while moving on the polygonal shape from the outer peripheral portion of the surface to be dried, the waterdrops move toward the center of the surface to be dried, and the wet area is prevented from becoming enlarged by being spread to the outer side. Moreover, if the waterdrops are gathered at the central portion of the surface to be dried, the jet of air can be applied by being focused on a narrow range, so that the waterdrops can be blown off efficiently.

(Fifth Embodiment)

[0159] Next, a description will be given of a sanitary washing apparatus in accordance with a fifth embodiment of the invention.

[0160] In the sanitary washing apparatus in accordance with the fifth embodiment as well, waterdrops in an area A of attachment of washing water is removed efficiently by sweeping the surface F to be dried by the jet of air from the drying device. The sanitary washing apparatus in accordance with this fifth embodiment differs from the sanitary washing apparatus in accordance with the third and fourth embodiments in the following aspects.

[0161] Figs. 15 and 16 are diagrams illustrating the relationship between the position of the drying nozzle 20 and the abutment area. Here, since the plan is similar to that of the third embodiment, the plan view will be omitted, but is similar to Fig. 12. Namely, the abutment area of the jet of air with respect to the surface to be dried in the operating state moves in the same way as the moving pattern shown in Fig. 12. In this embodiment, however, when the jet of air is controlled, the blowing direction of the drying nozzle 20 is not changed, but the position of the drying nozzle 20 is changed such that the position of the distal end of the drying nozzle 20 is to be located immediately below the blowing position. The position of a point G in Fig. 12 corresponds to Figs. 15 (a) and Fig. 16(a); m1 corresponds to Figs. 15(b) and Fig. 16(c) m2 corresponds to Figs. 15(c) and Fig. 16(c); m3 corresponds to Figs. 15(c) and Fig. 16(b); and m4 corresponds to Figs. 15(b) and Fig. 16(b).

[0162] In this configuration, the arrangement provided is such that the jet of air is applied substantially perpendicularly to the surface to be dried, and according to this configuration the collided flow of air spreads radially about the axis of the jet of air along the surface to be dried. By virtue of this air flowing along the surface to be dried, waterdrops attached to the surface to be dried are moved or scattered in the direction away from the axis of the jet of air. Accordingly, as the central positionof this jet of air is moved horizontally from the position in Fig. 15 (a) and Fig. 16 (a) to the position in Fig. 15 (b) and Fig. 16 (b) and further to the position in Fig. 15 (c) and 16 (c), and sequentially in the order of m1, m2, m3, m4, and m5, as shown in Fig. 12, the attached waterdrops are blown off while being moved in the direction toward the central portion G, so that drying proceeds efficiently.

[0163] However, if the jet of air is applied not perpendicularly to the surface to be dried but in an inclined manner, the flow of colliding air spreads centering on a direction in which the spreading angle is gentler, and the radial spread collapses. As for this colliding angle, if the angle of inclination from perpendicularity becomes large, the spreading of the colliding air takes place only in the direction in which the angle is gentler, and the spread becomes small. In the case where the blowing direction of air is thus applied to the surface to be dried by being offset forward/backward and leftward/rightward, the jet of air which is applied to the surface to be dried is applied substantially perpendicularly to the surface to be dried at the central portion of the air blowout port, but at a position remote from the central portion the jet of air is applied to the surface to be dried in such a manner as to be inclined outward. For this reason, there has been a problem in that the spreading of the jet toward the center is lost, and the attached waterdrops are spread to the outer side of the surface to be dried. In this embodiment, however, such a problem is not present, and drying proceeds very efficiently, as described above.

[0164] It should be noted that, in Figs. 16(a) to 16(c), the drying nozzle is configured to be tiltedslightly forward-so as to conform on an average to the angle of the surface of the buttocks of the human body. As a result, the distance between the drying nozzle and the surface to be dried of the buttocks can be substantially fixed, so that the colliding speed of the jet of air is not dampened, and efficient waterdrop removal can be carried out.

[0165] It should be noted that the area A of attachment of washing water refers to a range where the buttocks surface becomes wet and spreads when water for washing the human body, after being spurted from the washing water spraying device, spreads with its spurting momentum or runs and flows along the buttocks surface. The surface to be dried is set to be equivalent to the area of attachment of washing water, or an area wider than the same is set as the surface to be dried. As the air is thus blown from the outer peripheral portion of the surface to be dried, it is possible to prevent the waterdrops from spreading to the outer side of the surface to be dried.

[0166] Thus, in this embodiment, since the jet of air is configured to be constantly blown in a perpendicular direction without changing the direction of the blow nozzle 20, drying can be carried out efficiently.

(Sixth Embodiment)

[0167] Next, a description will be given of a sanitary washing apparatus in accordance with a sixth embodiment of the invention.

In this embodiment, the drive unit 52 described in the first embodiment is characterized by being comprised of, in addition to the advancing/retracting driving device 71 serving as the first moving device for driving the nozzle in its forward and backward direction, a horizontally driving device 71R serving as a second moving device for driving the nozzle so as to effect substantially linear movement in a direction perpendicular to the direction of driving by this advancing/retracting driving device 71.

[0168] Fig. 17 is a perspective view illustrating the configuration of the drive unit 52 in the drying device 50. The advancing/retracting driving device 71 is formed in the same way as in the first embodiment shown in Fig. 5, and a description thereof will be omitted, identical portions being denoted by the same reference numerals.

[0169] The drive unit 52 shown in Fig. 17 is comprised of the drying nozzle 20, the advancing/retracting driving device 71 for reciprocating the jet of air from the drying nozzle 20 in the forward and backward directions, the horizontally driving device 71R serving as the second moving device for driving the nozzle so as to effect substantially linear movement in a direction perpendicular to the direction of driving by the advancing/retracting driving device 71, and a base 55R for supporting the he advancing/retracting driving device 71 and the horizontally driving device 71R. This drive unit 52 as the moving unit allows the abutment area with respect to the surface to be dried of the pressurized air blown from the drying nozzle 20 to be sweepingly moved over the entire surface to be dried.

[0170] In the same way as in the above-described first embodiment, the dryingnozzle 20 has a hollow cylindrical shape and is provided with an air nozzle hole 21 and a washing water nozzle hole 22 which are located in a circumferential direction of the hollow cylinder in the vicinity of its distal end. The drying nozzle 20 is provided in its interior with an air cavity (not shown) for leading the pressurized air to the air nozzle hole 21 and a water cavity (not shown) for leading washing water into the washing water nozzle hole 22. Namely, this drying nozzle 20 is configured to also serve as the washing nozzle portion.

[0171] The base 55R allows the horizontally driving device 71R to be disposed in an inclined manner on its upper surface along the rail portion 56 configured in such a manner as to be tilted forward. The drying nozzle is configured to be horizontally driven as it is slid on a horizontally driving rail 56R provided in the horizontally driving device 71R. In addition, the slider 58 which slides along the rail portion 56 is provided on the upper surface of the base 55R, and the horizontally driving device 71R is fixed to the slider 58. The horizontally driving device 71R is driven along the rail portion 56 in conformity with the operation of the slider 58. Meanwhile, as the drying nozzle 20 is slid by a slider 58R on the horizontally driving rail 56R provided in the horizontally driving device 71R, the drying nozzle 20 is also capable of being horizontally moved in addition to being driven forward and backward.

[0172] The advancing/retracting driving device 71 serving as the first moving device is comprised of the forward/backward driving motor 53, the slider 58, and the threaded portion 59. The horizontally driving device 71R is mounted on the slider 58 and is configured to move integrally with the slider 58. A horizontally driving motor 53R is connected such that the slider 58R horizontally moves on the rail 56R which is disposed on an intermediate portion of the base 55R and is arranged perpendicularly to the rail portion 56. The threaded portion 59 is set through the nut portion 60 of the slider 58, and the slider 58 is driven so as to slide on the rail portion 56 as the threaded portion 59 is rotated. In addition, the drying nozzle 20 is set in a nut portion 60R of the slider 58R, and the slider 58R is drivenon the rail portion 56R as the horizontally driving motor 53R rotates. Accordingly, the drying nozzle 20, which is held by the sliders 58 and 58R, is retractably driven back and forth and is horizontally driven in conjunction with the rotation of the forward/backward driving motor 53 and the horizontally driving motor 53R. Here, the forward direction denotes the A direction in Fig. 17, while the backward direction denotes the B direction. The forward direction corresponds to the front side direction of the toilet user seated on the toilet seat 400, while the backward direction corresponds to the back side direction of the toilet user. In addition, it is to be understood that the horizontal direction refers to a direction connecting C' and D'.

Thus, longitudinal and transverse linear driving becomes

possible.

(Seventh Embodiment)

[0173] Next, a description will be given of a sanitary washing apparatus in accordance with a seventh embodiment of the invention.
This embodiment is a modification of the nozzle structure and is characterized in that the second moving device is configured to swing the blowing direction of the jet blown from the above-described air blowing portion. Namely, the drive unit 52 described in the first embodiment is provided with, in addition to the advancing/retracting driving device 71 serving as the first moving device for driving the nozzle in its forward and backward direction, a self-excited fluid element 121 making use of the Co and a effect as the second moving device, as shown in Figs. 18 and 19. By virtue of this fluid element 121, the jet of air is made transversely movable. Fig. 18 is a perspective view of an essential portion, and Fig. 19 is a cross-sectional view cut along a plane including an air blowout hole 121C. The characteristic lies in that the blowing direction of air is swung in directions R and S by the self-excited fluid element 121 in directions perpendicular to the driving direction of this advancing/retracting driving device 71.

[0174] Fig. 18 is a perspective view illustrating the configuration of an essential portion of the drive unit 52 in the drying device 50. The advancing/retracting driving device 71 is formed in the same way as in the first embodiment shown in Fig. 5, and is configuredtomove in the advancing and retracting directions A and B. A description thereof will be omitted, and identical portions are denoted by the same reference numerals.

[0175] In this fluid element, pressurized air formed inside a nozzle 120 is transported through an air cavity 123. The fluid element is comprised of the air blowout hole 121C of a fan-shaped cross section disposed in the vicinity of a leading end of this air cavity 123 and communicating with the air cavity 123, as well as a first and a second feedback hole 121A and 121B arranged symmetrically about a center of the air blowout hole 121C in such a manner as to respectively extend from vicinities of this air cavity 123 and to be open at vicinities of an open end of the aforementioned air blowout hole 121C.

[0176] In this fluid element, the jet which is blown from the air cavity 123 into the air blowout hole 121C tends to be attached to a wall surface 120A or 120B making up the air blowout hole 121C owing to the Co and a effect. Further, the jet which is attached to the wall surface 120A is peeled off the wall surface 120A by the flow from the feedback hole 121A and is attached to the wall surface 120B.

[0177] Meanwhile, the jet attached to the wall surface 120B is peeled off the wall surface 120B by the flow from the feedback hole 121B and is attached again to the wall surface 120A.

[0178] The jet thus undergoes self-excitation between the wall surfaces 120A and 120B.
By using this fluid element, it becomes possible to move the blowing direction of air through self-excitation without separately providing a driving source.

[0179] It should be noted that although in this embodiment this fluid element is used as the second moving device, this fluid elementmaybe added to the air blowout hole in the above-described first to sixth embodiments. This makes it possible to effect drying more efficiently.

(Eighth Embodiment)

[0180] Next, a description will be given of a sanitary washing apparatus in accordance with an eighth embodiment of the invention. In this embodiment, a description will be given of the configuration for removingwaterdrops attached to the nozzle.
After completion of washing, if the drying step is started with the waterdrops remaining attached to the nozzle, the waterdrops attached to the nozzle are blown together with the air blown out from the air blowout hole and can be attached to the surface to be dried. In this embodiment, however, a description will be given of the sanitary washing apparatus equipped with a device for removing the waterdrops attached to the nozzle.

[0181] Fig. 20(a) is a schematic diagram of the drying device 50 accommodated in a main body case 50C, and Fig. 20(b) is an explanatory diagram illustrating a state in which the nozzle is being dried.
After completion of washing, the nozzle 20 is temporarily placed in an accommodated position, as shown in Fig. 20(b).

[0182] At this time, air is configured to be blown out from the air blowout hole 21 in the state in which the nozzle is accommodated in a nozzle accommodating case 21C. This blown air is reflected by the nozzle accommodating case 21C and a shutter 90 to blow off the waterdrops attached to the outer periphery of the nozzle, thereby drying the nozzle surface.

[0183] When nozzle drying is thus completed, the shutter 90 is opened, and the dried nozzle is advanced from the nozzle accommodating case 21C and effects advancing and retracting movement in the vicinity of the surface to be dried to thereby start the drying step.
Drying can thus be carried out efficiently.

[0184] It should be noted that this nozzle drying is effective not only after the washing of the human body but also at the time of waterdrop removal after nozzle cleaning.

[0185] When, for example, a person leaves the toilet room, and the human body detection ceases to be effected by a human body detecting unit or the like, cleaning water is passed through a water channel for nozzle cleaning by a cleaning nozzle for nozzle cleaning of the washing nozzle. The shutter 90, i.e., a shielding unit, shields the direction of facing the toilet bowl and prevents cleaning water from dropping immediately into the toilet bowl, and this washing water washes away and removes stains

around the nozzle. The water which cleaned the periphery of the nozzle 20 drops into the toilet bowl together with the stains from the opening at the end of a bent portion of the shutter 90, so that no problem is presented. In addition, the operation of this nozzle cleaning may be configured to be performed without fail also after using the washing nozzle, in which case, also after defecation, effective cleaning is possible when filthy water and waste scattered during defecation are attached.

[0186] In addition, if grooves serving as flow channels or ribs allowing water to run thereon are provided on that surface of the shutter 90, i.e., the shielding unit, which faces the nozzle 20, in order to allow washing water or cleaning water to flow, cleaning water can be guided such that the cleaning water efficiently flows round to the periphery of the nozzle.

[0187] It should be noted that although in the above-described first to sixth embodiments a description has been given of the case where one nozzle is used for washing and drying, it goes without saying that a washing nozzle and a drying nozzle may be provided separately.

INDUSTRIAL APPLICABILITY

[0188] As described above, the drying device and the sanitary washing apparatus equipped with the same in accordance with the invention efficiently blow off waterdrops and effects drying even with a small amount of air; therefore, the invention is applicable to not only the sanitary washing apparatus but also the drying of the human body which is wet with a shower, hand washing, or the like. In addition, the invention is also applicable to uses in waterdrop removal and drying in a washing device of such as a dish washer, a car washer, a parts washer, and the like.

Claims

1. A drying device comprising:

an air blowing portion for blowing pressurized air so as to dry a surface to be dried by a jet of pressurized air whose abutment area to the surface to be dried is narrower than the surface to be dried; and

a moving unit for moving the air blowing portion while the jet is being blown such that the jet blown from the air blowing portion sequentially sweeps a substantially entire surface of the surface to be dried,

wherein the moving unit includes a first moving device for moving the air blowing portion in a state in which a blowing direction of the jet is being maintained so as to form a predetermined angle with respect to a moving direction of the air blowing portion and a second moving device for moving the air blowing portion in a direction different from that of the moving direction.

2. The drying device according to claim 1, wherein the first moving device moves in an advancing/retracting direction of the air blowing portion.

3. The drying device according to claim 1 or 2, wherein the second moving device deflects the blowing direction of the jet.

4. The drying device according to claim 1 or 2, wherein the second moving device moves in the direction different from that of the moving direction in the state in which the blowing direction of the jet is being maintained.

5. The drying device according to claim 3, wherein the second moving device deflects the jet by rotating the air blowing portion.

6. The drying device according to claim 3, wherein the second moving device deflects the blowing direction of the jet blown from the air blowing portion.

7. The drying device according to claim 4, wherein the second moving device moves the air blowing portion in a direction substantially perpendicular to the direction of movement by the first moving device.

8. The drying device according to claim 4, wherein the second moving device moves the air blowing portion in a circular arc form.

9. The drying device according to any one of claims 1 to 8, wherein the air blowing portion is a rod-like body having an air blowing port in a vicinity of a distal end thereof, and the moving direction of the first moving device is a direction along a longitudinal direction of the rod-like body.

10. The drying device according to claim 1, wherein the moving unit sweeps the jet from the air blowing portion so as to blow off waterdrops attached to the surface to be dried while collecting the waterdrops to a central portion of the surface to be dried by the jet blown from the air blowing portion.

11. The drying device according to claim 1, wherein the moving unit includes cyclic movement for cyclically reciprocating the air blowing portion in a fixed direction and gradual movement for moving the cyclic movement in a predetermined direction, and sweeps the abutment area of the jet over the substantially entire surface of the surface to be dried.

12. The drying device according to claim 10, wherein the moving unit gradually moves the air blowing portion from an outer periphery of the surface to be dried

toward a substantial center of the surface to be dried while cyclically moving the air blowing portion on substantially tangential lines to a circumference of a circle about a center of the surface to be dried.

13. The drying device according to claim 11, wherein the first moving device effects the gradual movement, and the secondmoving device effects the cyclic movement.

14. The drying device according to claim 11, wherein the first moving device effects the cyclic movement, and the second moving device effects the gradual movement.

15. The drying device according to claim 11, wherein there are provided a first step in which a direction of the cyclic movement of the moving unit is set as a leftward and rightward direction of the surface to be dried, and the gradual movement is effected from a predetermined position forward of a center of the surface to be dried toward a substantial center thereof, and a second step in which the gradual movement is effected from a predetermined position backward of the center of the surface to be dried toward the substantial center thereof, and the first step and the second step are executed.

16. The drying device according to claim 11, wherein there are provided a first step in which a direction of the cyclic movement of the moving unit is set as a forward and backward direction of the surface to be dried, and the gradual movement is effected from a predetermined position on one side either leftward or rightward of a center of the surface to be dried toward a substantial center thereof, and a second step in which the gradual movement is effected from a predetermined position on another side leftward or rightward of the center of the surface to be dried toward the substantial center thereof, and the first step and the second step are executed.

17. The drying device according to claim 13 or 14, wherein there are provided a first step in which a direction of the cyclic movement of the moving unit is set as a leftward and rightward direction of the surface to be dried, and the gradual movement is effected from a predetermined position forward of a center of the surface to be dried toward a substantial center thereof, a second step in which the gradual movement is effected from a predetermined position backward of the center of the surface to be dried toward the substantial center thereof, a third step in which a direction of the cyclic movement of the moving unit is set as a forward and backward direction of the surface to be dried, and the gradual movement is effected from a predetermined position on one side either leftward or rightward of the center of the surface to be dried toward a substantial center thereof, and a fourth step in which the gradual movement is effected from a predetermined position on another side leftward or rightward of the center of the surface to be dried toward the substantial center thereof, and the first to fourth steps are executed.

18. The drying device according to claim 10, wherein the moving unit moves the abutment area of the jet to the central portion while moving the abutment area of the jet around from a peripheral portion of the surface to be dried.

19. The drying device according to claim 18, wherein the moving unit moves the abutment area of the jet to the central portion of the surface to be dried while moving the abutment area of the jet around on a polygonal shape made up by substantially tangential lines to a circumference of a circle about a center of the surface to be dried.

20. The drying device according to claim 18, wherein the moving unit moves the abutment area of the jet to the central portion of the surface to be dried while moving the abutment area of the jet around on a substantial circumference of a circle about a center of the surface to be dried.

21. The drying device according to any one of claims 10 to 20, further comprising a controller for controlling the moving unit,
wherein the controller gradually moves the moving unit from one end of the surface to be dried through a center thereof to another end thereof while causing the moving unit to effect cyclic movement at an end of a drying step.

22. The drying device according to any one of claims 1 to 21, further comprising a heating unit for heating air; and a warm air blowout port for blowing out warm air heated by the heating unit.

23. A sanitary washing apparatus comprising a toilet seat which can be mounted on the drying device according to any one of claims 1 to 22; and a washing water spraying unit for spraying washing water toward the surface to be washed.

FIG. 1

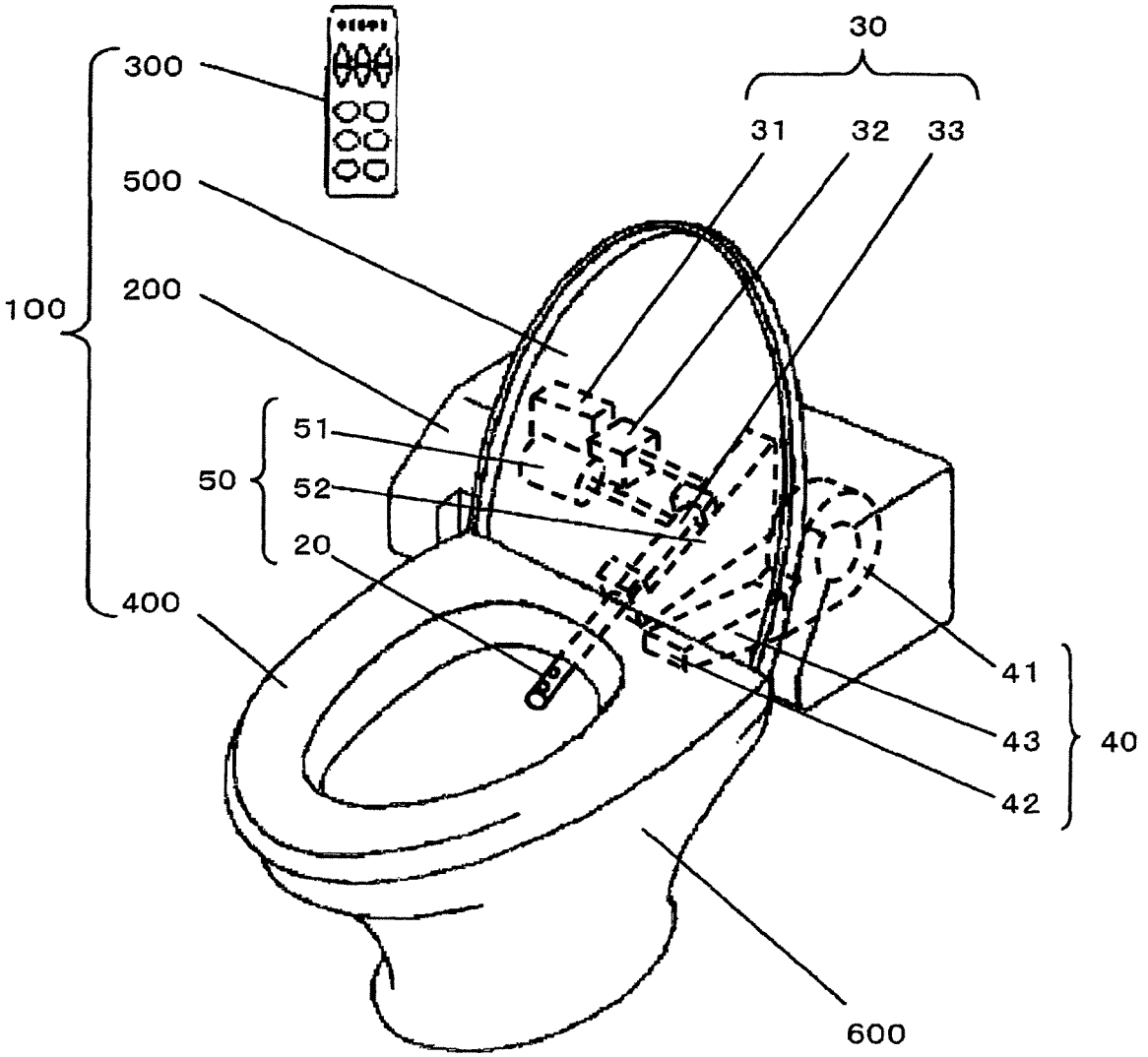
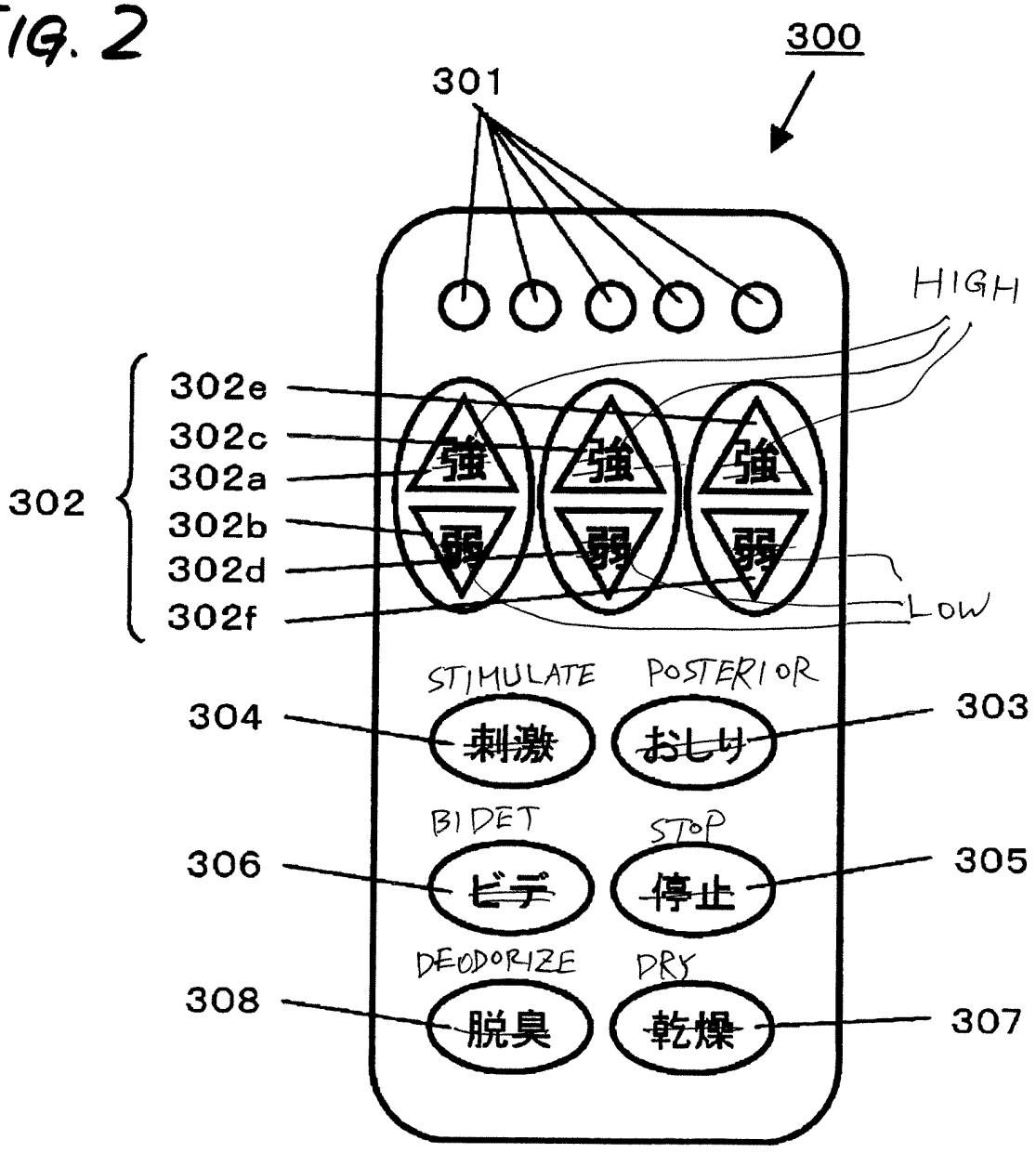


FIG. 2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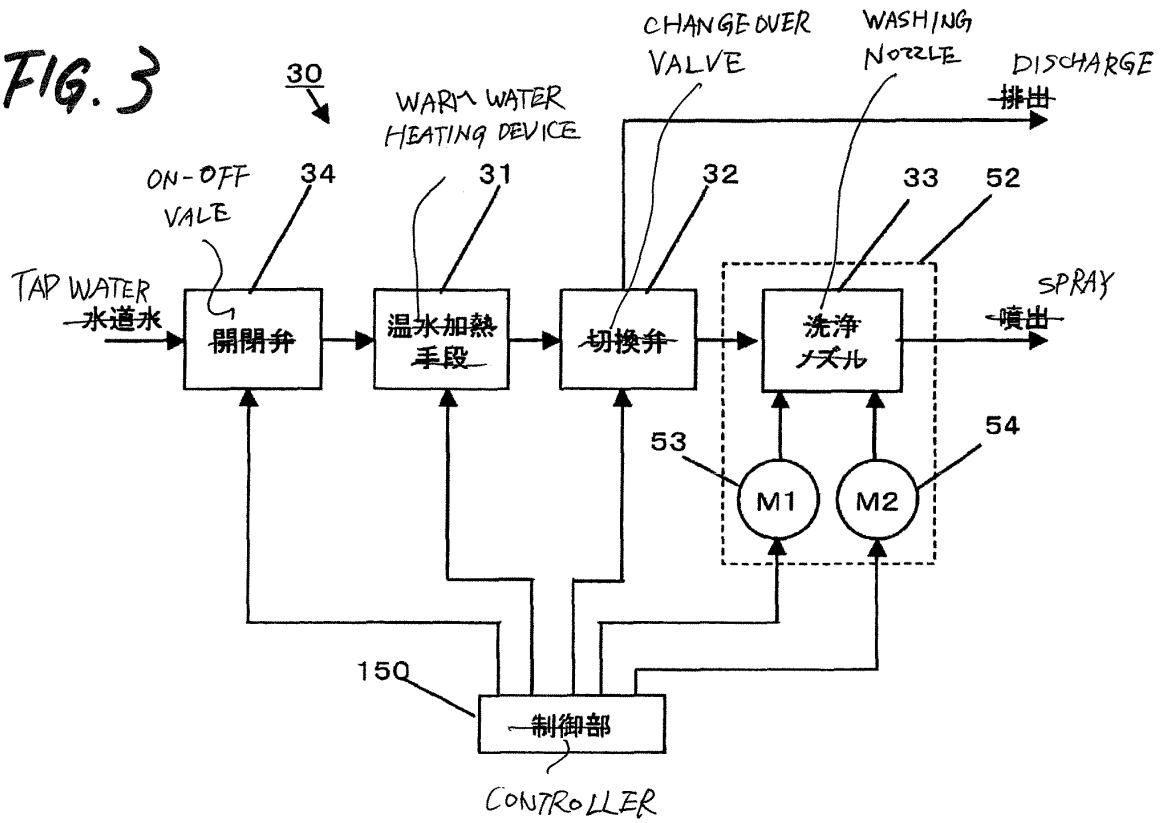
301
HIGH
LOW
302
302e
302c
302a
302b
302d
302f
強
弱
STIMULATE
POSTERIOR
304
刺激
おしり
303
BIDET
STOP
306
ビデ
停止
305
DEODORIZE
DRY
308
脱臭
乾燥
307

FIG. 3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WARM WATER HEATING DEVICE
CHANGEOVER VALVE
WASHING NOZZLE
DISCHARGE
排出
ON-OFF VALE
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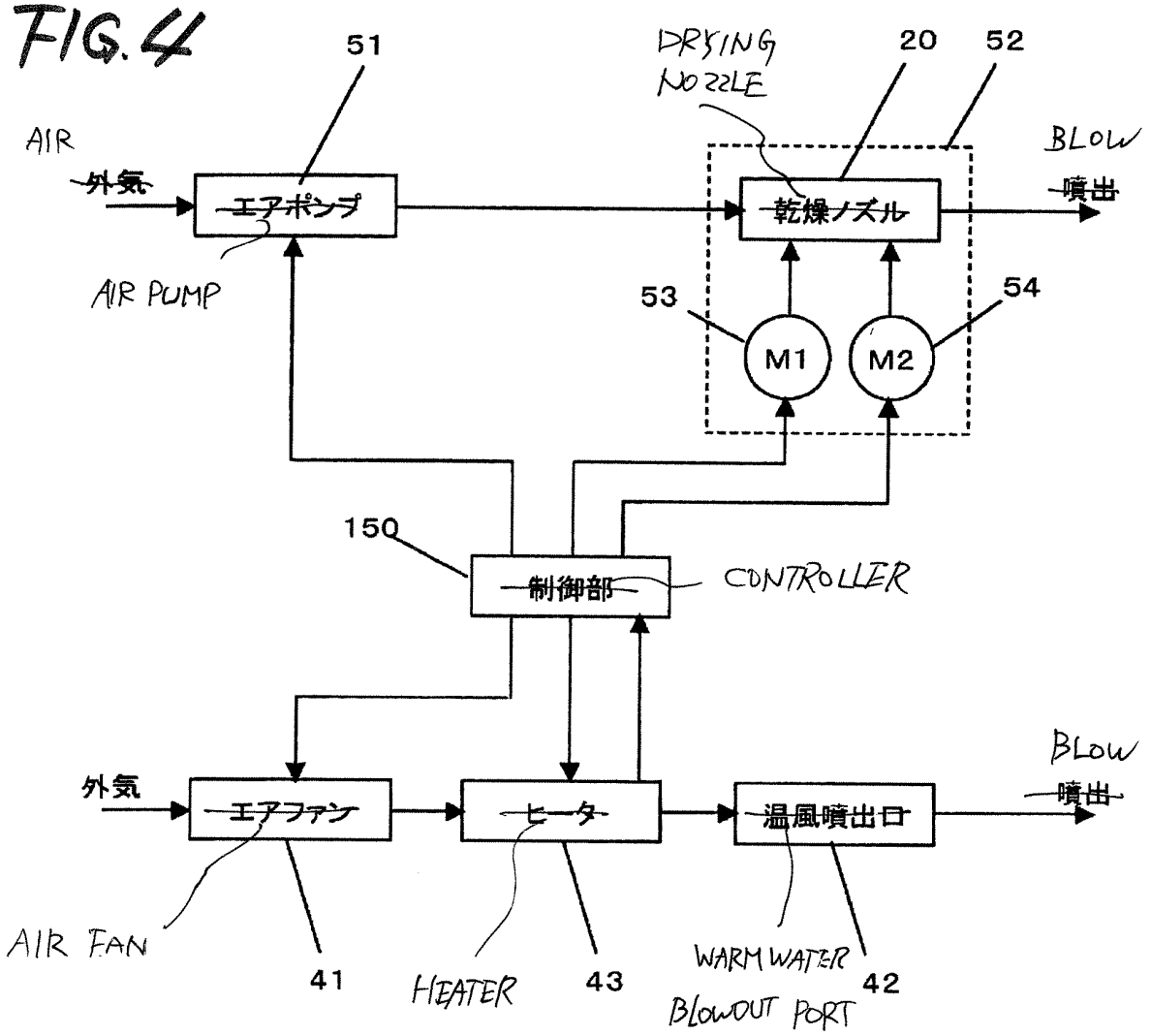
31
32
33
52
TAP WATER
水道水
開閉弁
温水加熱手段
切換弁
洗浄ノズル
SPRAY
噴出
53
54
M1
M2
150
制御部
CONTROLLER

FIG. 4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DRYING NOZZLE
20
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外気
エアポンプ
乾燥ノズル
BLOW
噴出
AIR PUMP
53
54
M1
M2
150
制御部
CONTROLLER
外気
エアファン
ヒータ
温風噴出口
BLOW
噴出
AIR FAN
41
HEATER
43
WARM WATER
BLOWOUT PORT
42

FIG. 5

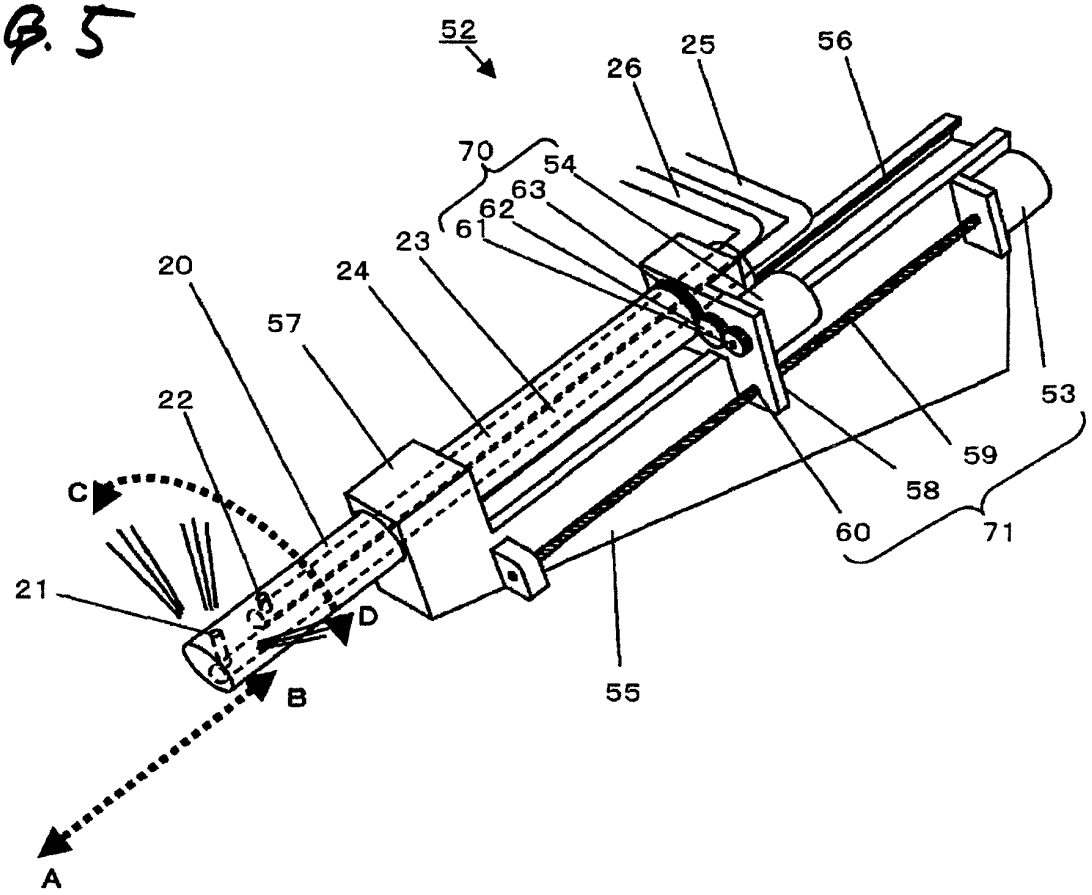
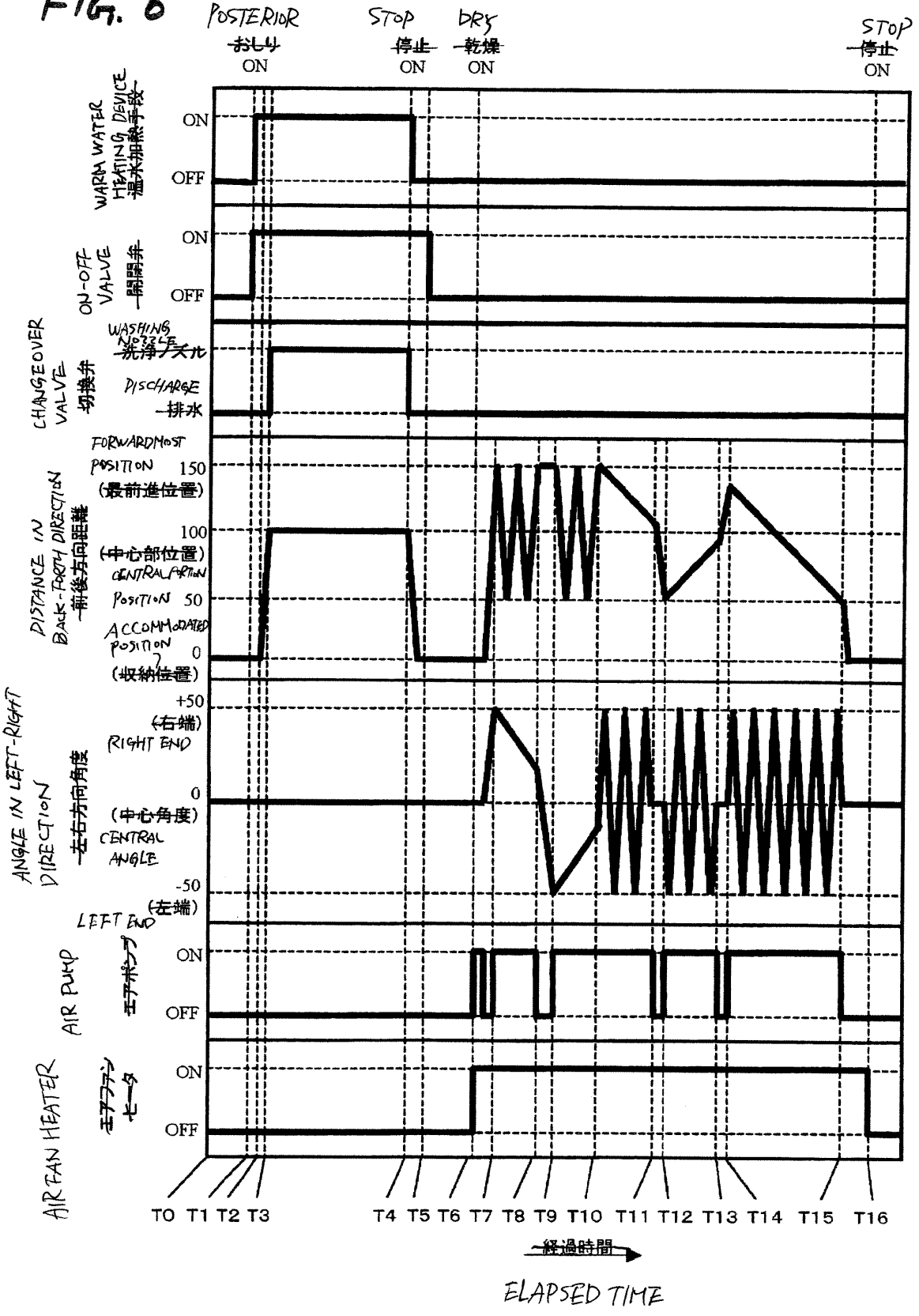


FIG. 6


POSTERIOR
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STOP
停止
ON
DRY
乾燥
ON
STOP
停止
ON
WARM WATER HEATING DEVICE
温水加熱手段
ON
OFF
ON-OFF VALVE
開閉弁
ON
OFF
CHANGEOVER VALVE
切換弁
WASHING NOZZLE
洗浄ノズル
DISCHARGE
排水
DISTANCE IN BACK-FORTH DIRECTION
前後方向距離
FORWARDMOST POSITION
(最前進位置)
150
100
(中心部位置)
CENTRAL PORTION
POSITION
50
ACCOMMODATED POSITION
(収納位置)
0
ANGLE IN LEFT-RIGHT DIRECTION
左右方向角度
+50
(右端)
RIGHT END
0
(中心角度)
CENTRAL ANGLE
-50
(左端)
LEFT END
AIR PUMP
エアポンプ
ON
OFF
AIR FAN HEATER
エアファンヒータ
ON
OFF
T0 T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13 T14 T15 T16
経過時間
ELAPSED TIME

FIG. 7(a)

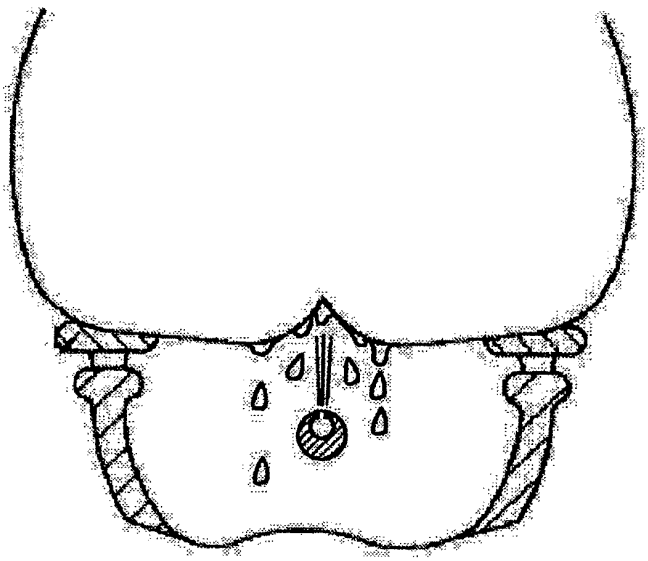


FIG. 7(b)

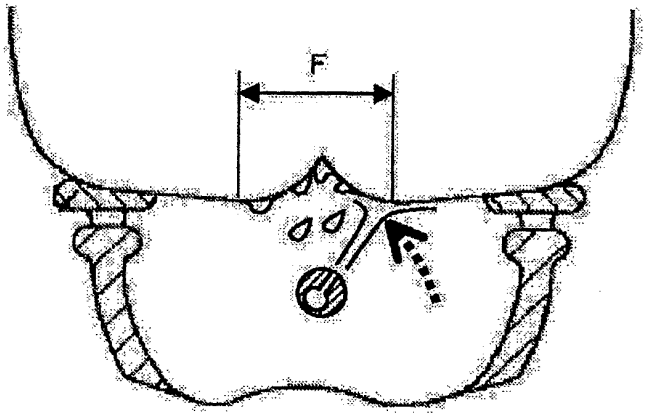


FIG. 7(c)

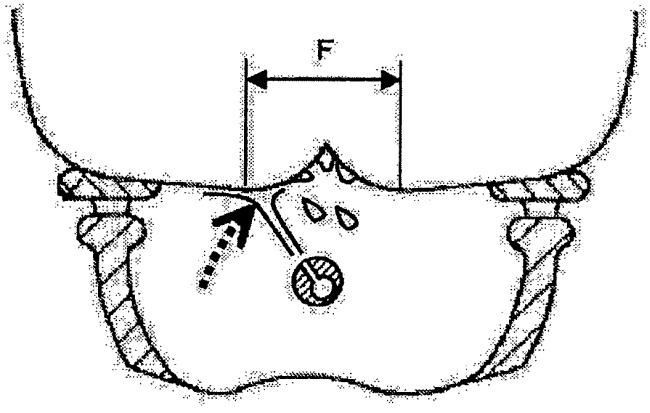


FIG. 8

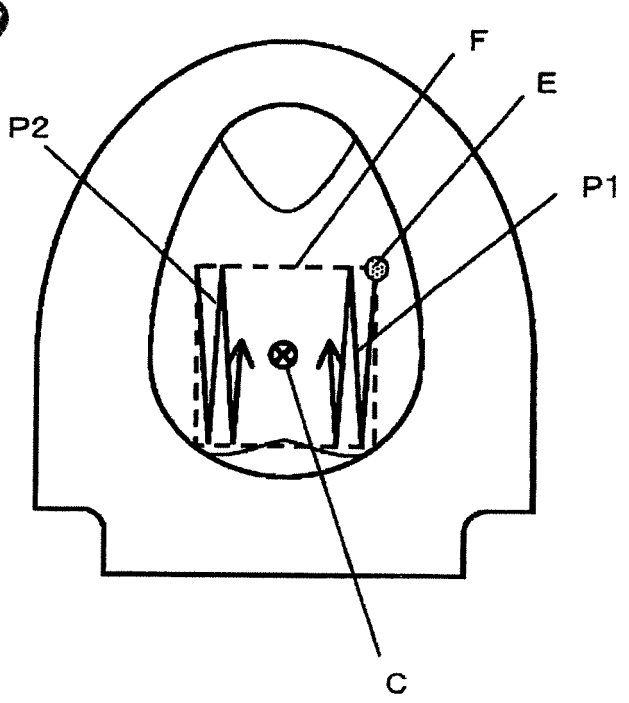


FIG. 9

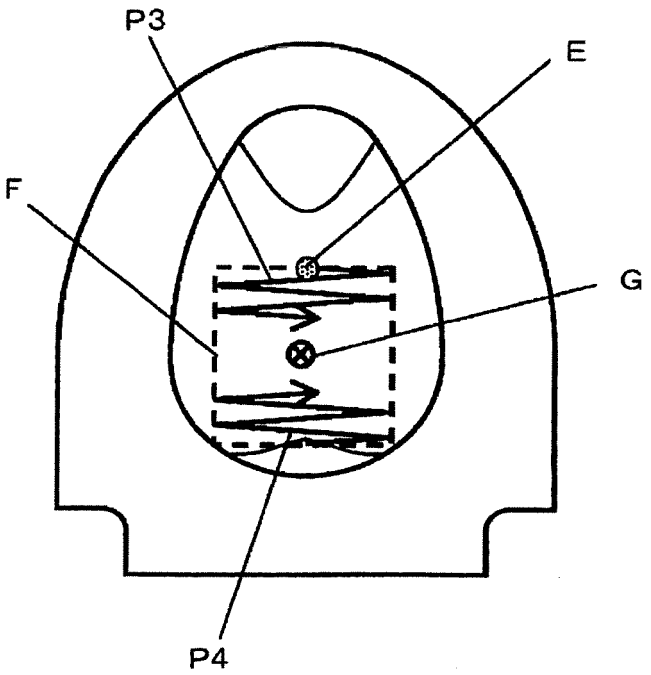


FIG. 10

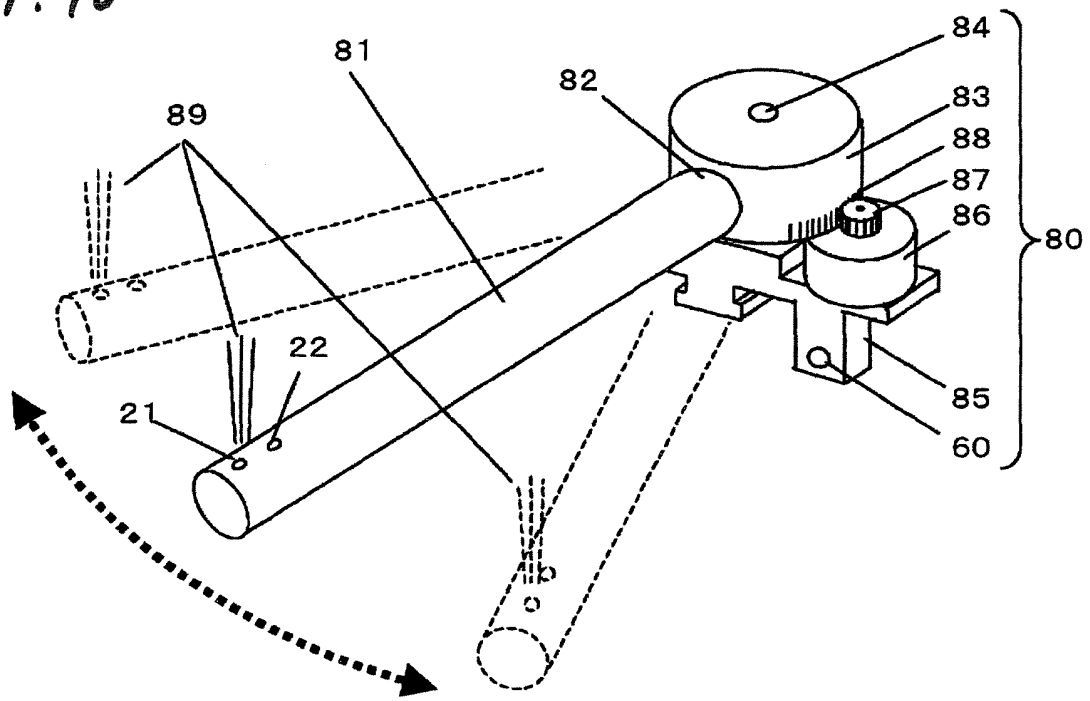
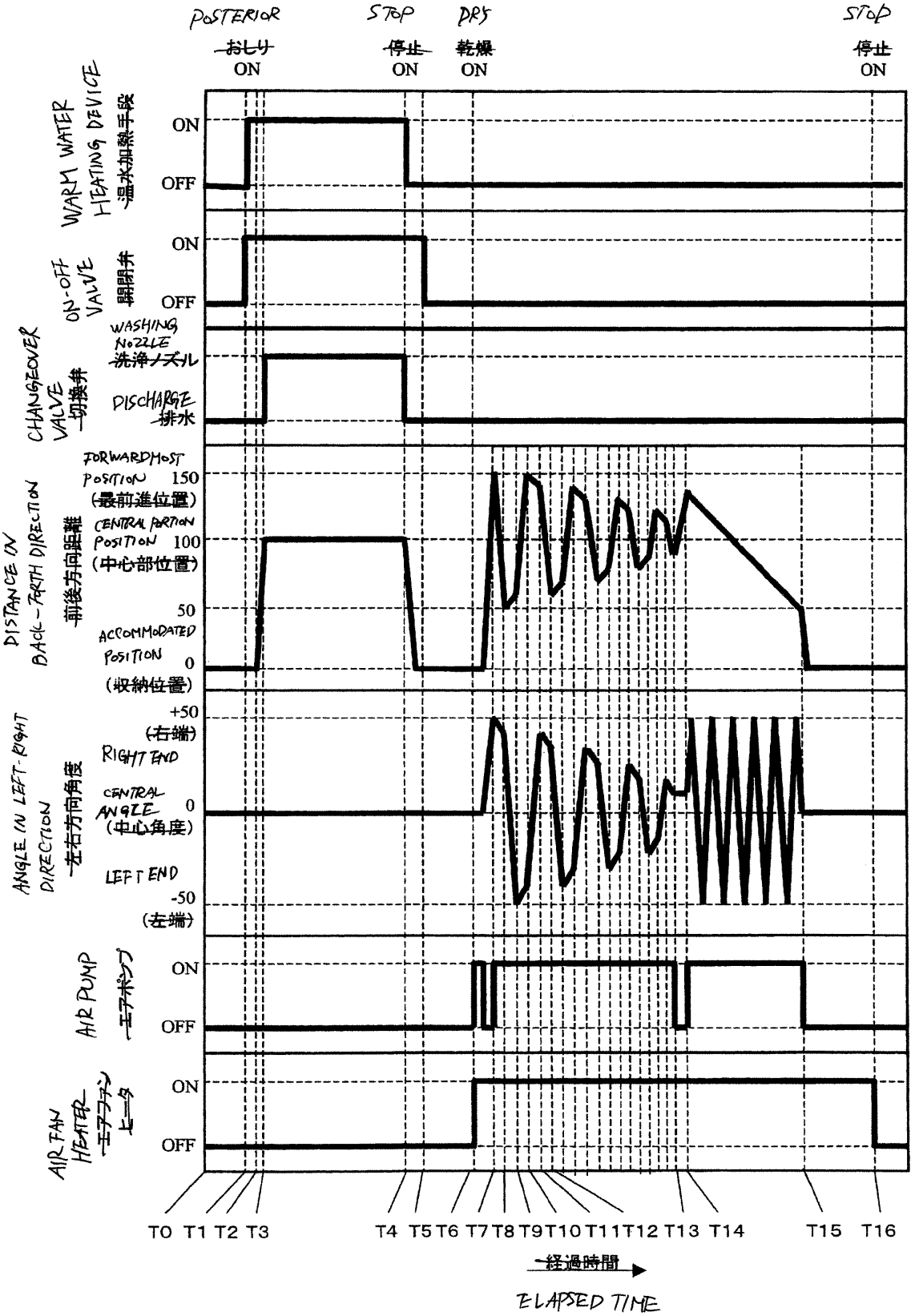


FIG. 11


POSTERIOR
おしり
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STOP
停止
ON
DRY
乾燥
ON
STOP
停止
ON
WARM WATER HEATING DEVICE
温水加熱手段
ON
OFF
ON-OFF VALVE
開閉弁
ON
OFF
CHANGEOVER VALVE
切換弁
WASHING NOZZLE
洗浄ノズル
DISCHARGE
排水
DISTANCE IN BACK-FORTH DIRECTION
前後方向距離
FORWARDMOST POSITION 150
(最前進位置)
CENTRAL PORTION POSITION 100
(中心部位置)
50
ACCOMMODATED POSITION 0
(収納位置)
ANGLE IN LEFT-RIGHT DIRECTION
左右方向角度
+50
(右端)
RIGHT END
CENTRAL ANGLE 0
(中心角度)
LEFT END
-50
(左端)
AIR PUMP
エアポンプ
ON
OFF
AIR FAN HEATER
エアファンヒータ
ON
OFF
T0 T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13 T14 T15 T16
経過時間
ELAPSED TIME

FIG. 12

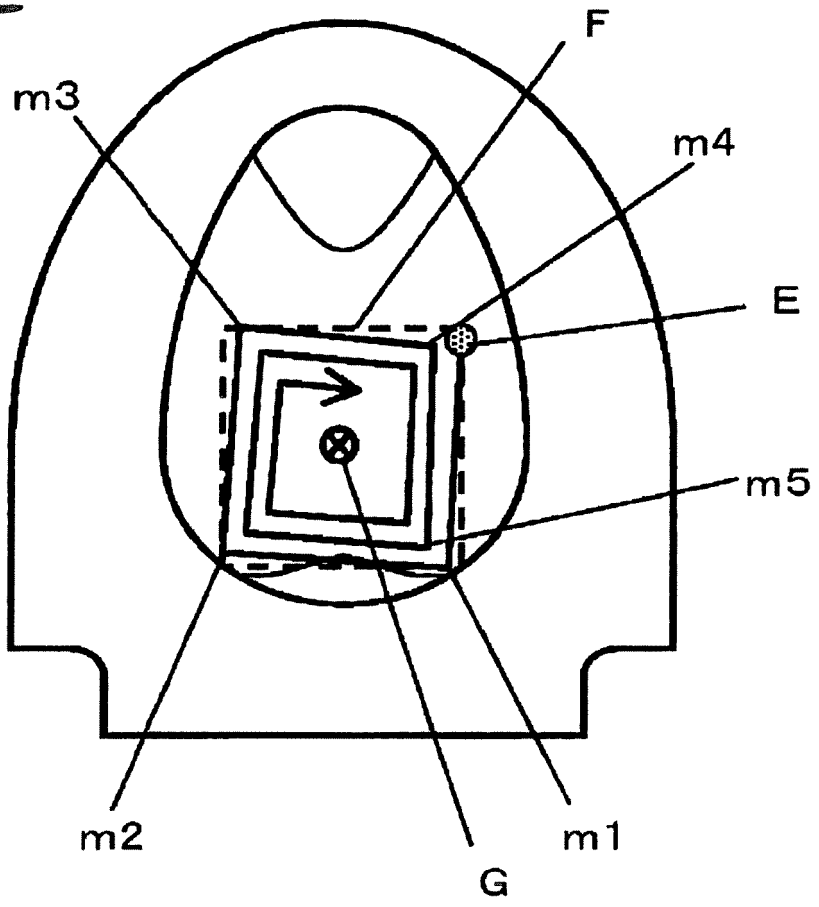
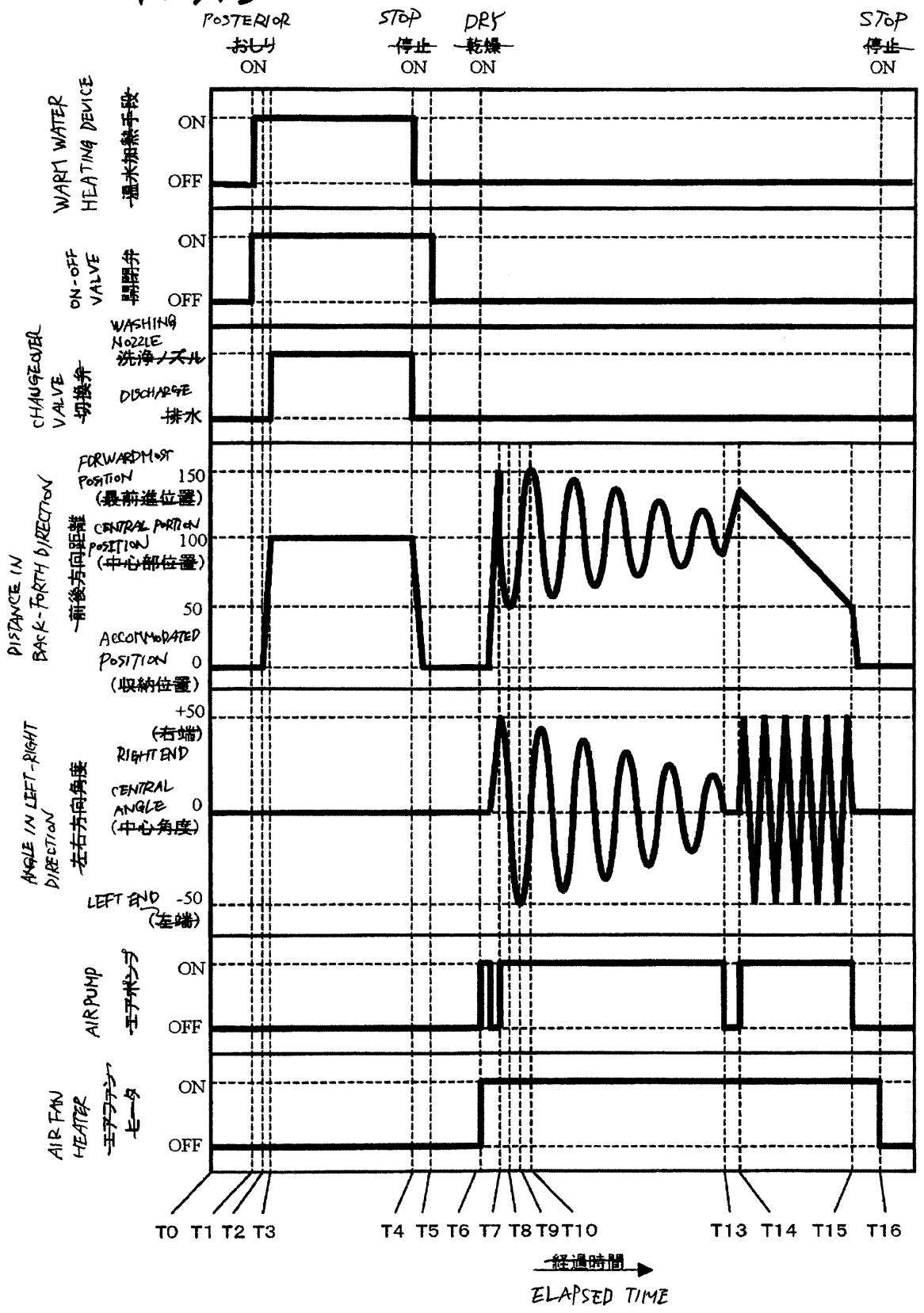


FIG 13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DRY
乾燥
ON
STOP
停止
ON
WARM WATER HEATING DEVICE
温水加熱手段
ON
OFF
ON-OFF VALVE
開閉弁
ON
OFF
CHANGEOVER VALVE
切換弁
WASHING NOZZLE
洗浄ノズル
DISCHARGE
排水
DISTANCE IN BACK-FORTH DIRECTION
前後方向距離
FORWARDMOST POSITION
(最前進位置)
150
CENTRAL PORTION POSITION
(中心部位置)
100
50
ACCOMMODATED POSITION
(収納位置)
0
ANGLE IN LEFT-RIGHT DIRECTION
左右方向角度
+50
(右端)
RIGHT END
CENTRAL ANGLE
(中心角度)
0
LEFT END
(左端)
-50
AIR PUMP
エアポンプ
ON
OFF
AIR FAN HEATER
エアファンヒータ
ON
OFF
T0 T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T13 T14 T15 T16
経過時間
ELAPSED TIME

FIG. 14

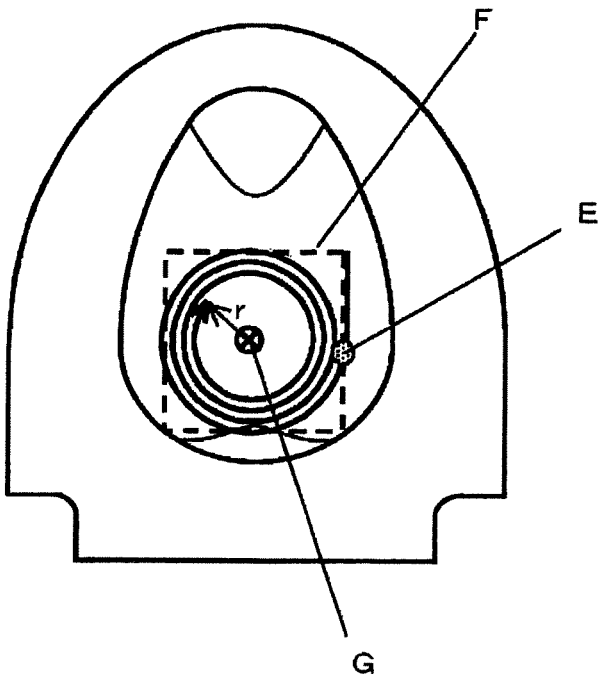


FIG. 15(a)

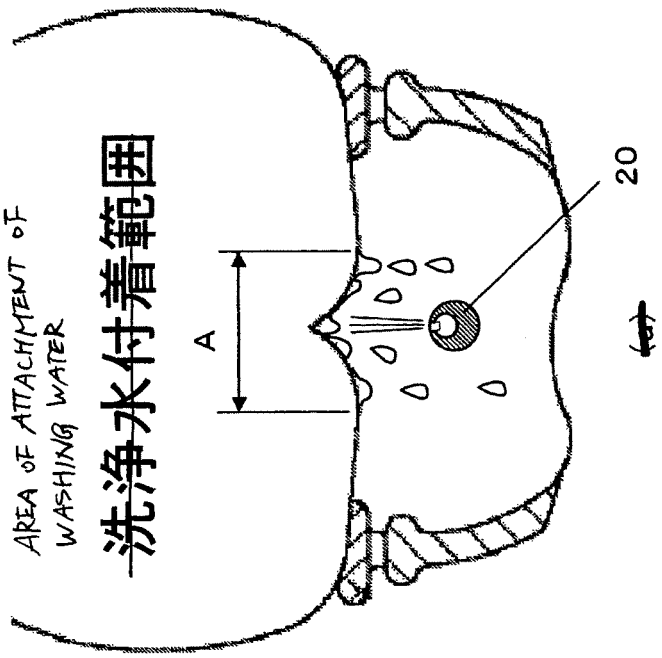


FIG. 15(b)

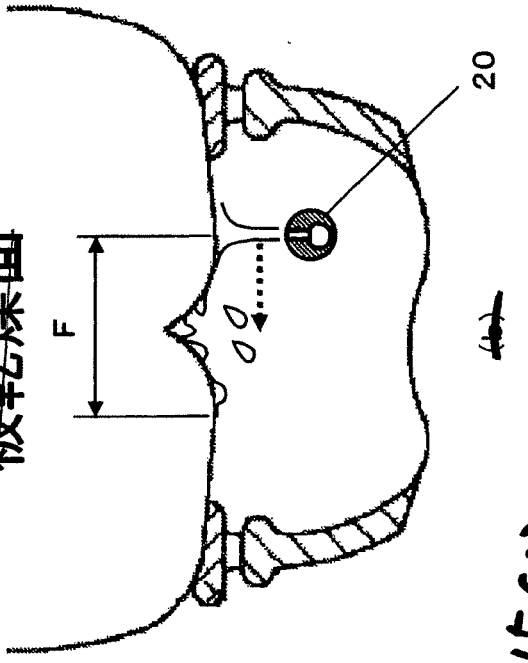


FIG. 15(c)

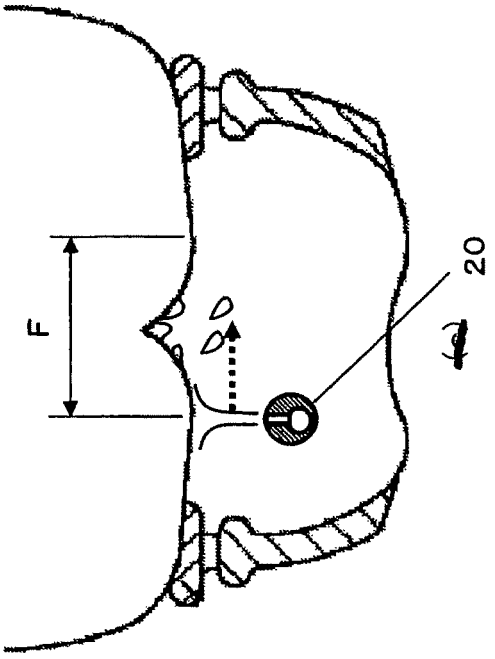


FIG. 16(a)

AREA OF ATTACHMENT OF WASHING WATER

~~洗浄水付着範囲~~

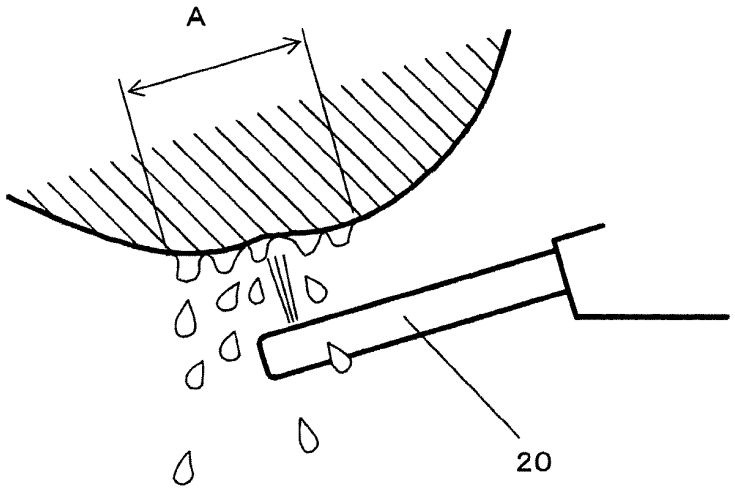


FIG. 16(b)

SURFACE TO BE DRIED

~~被乾燥面~~

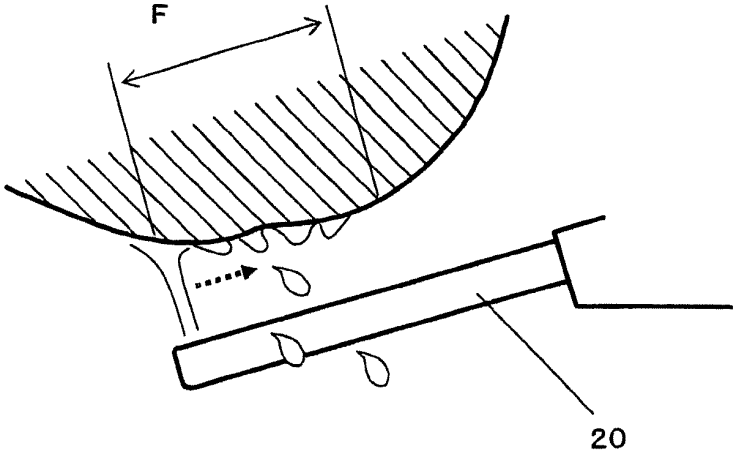
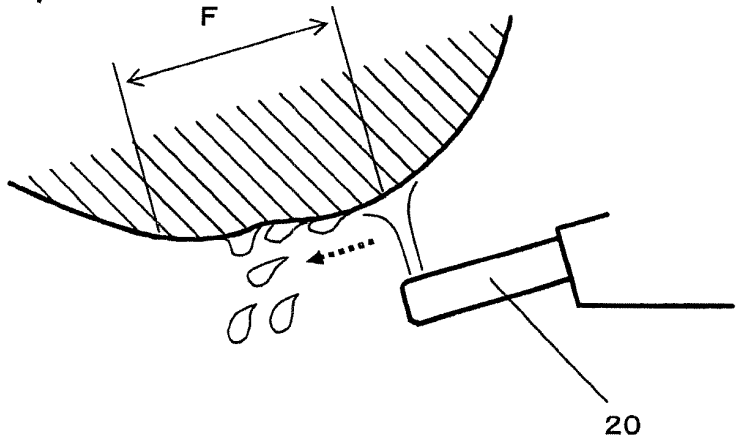


FIG. 16(c)



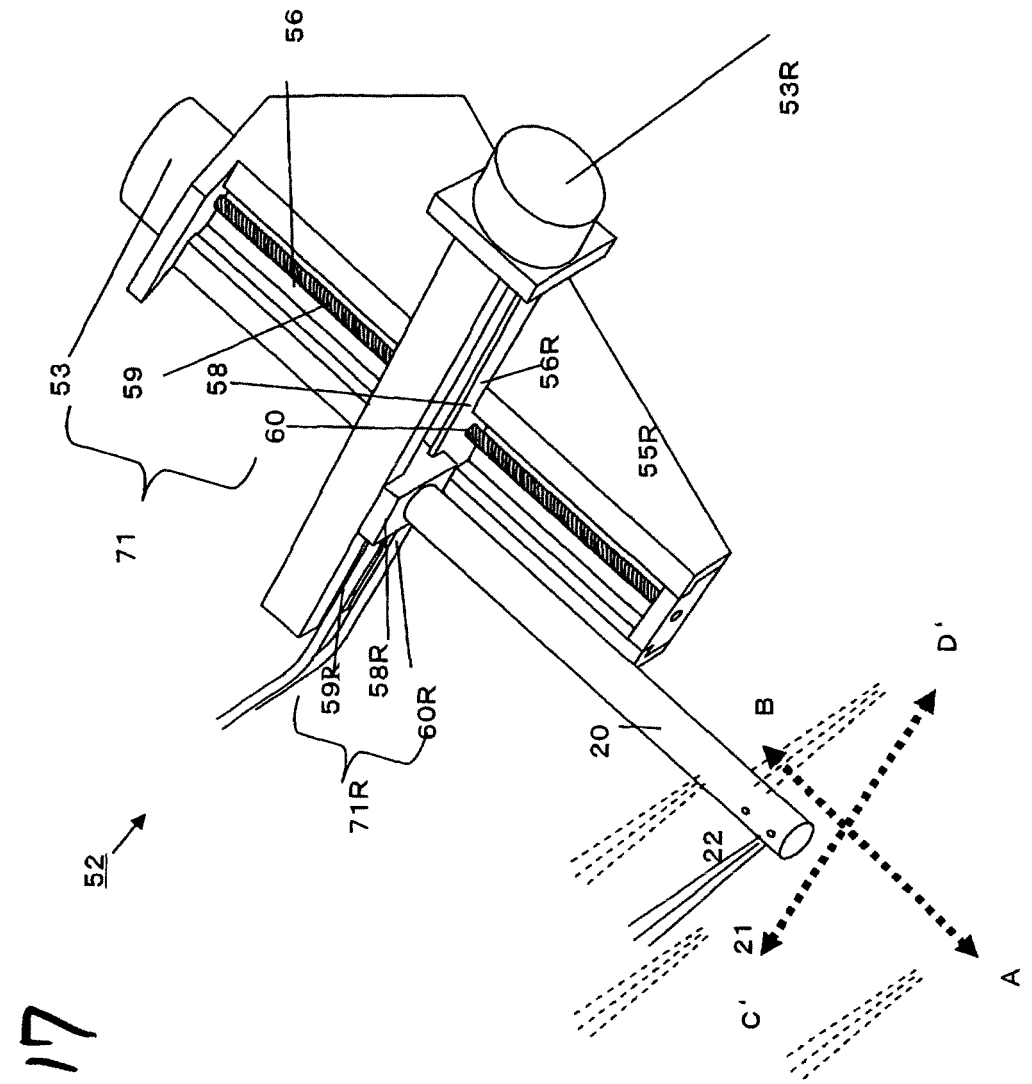


FIG. 17

FIG. 18

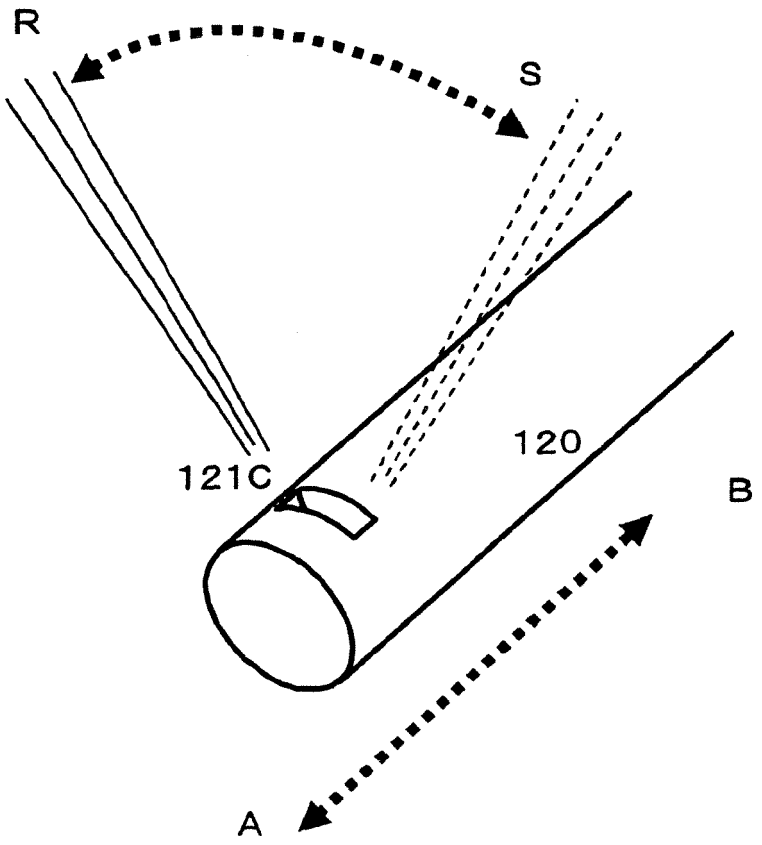
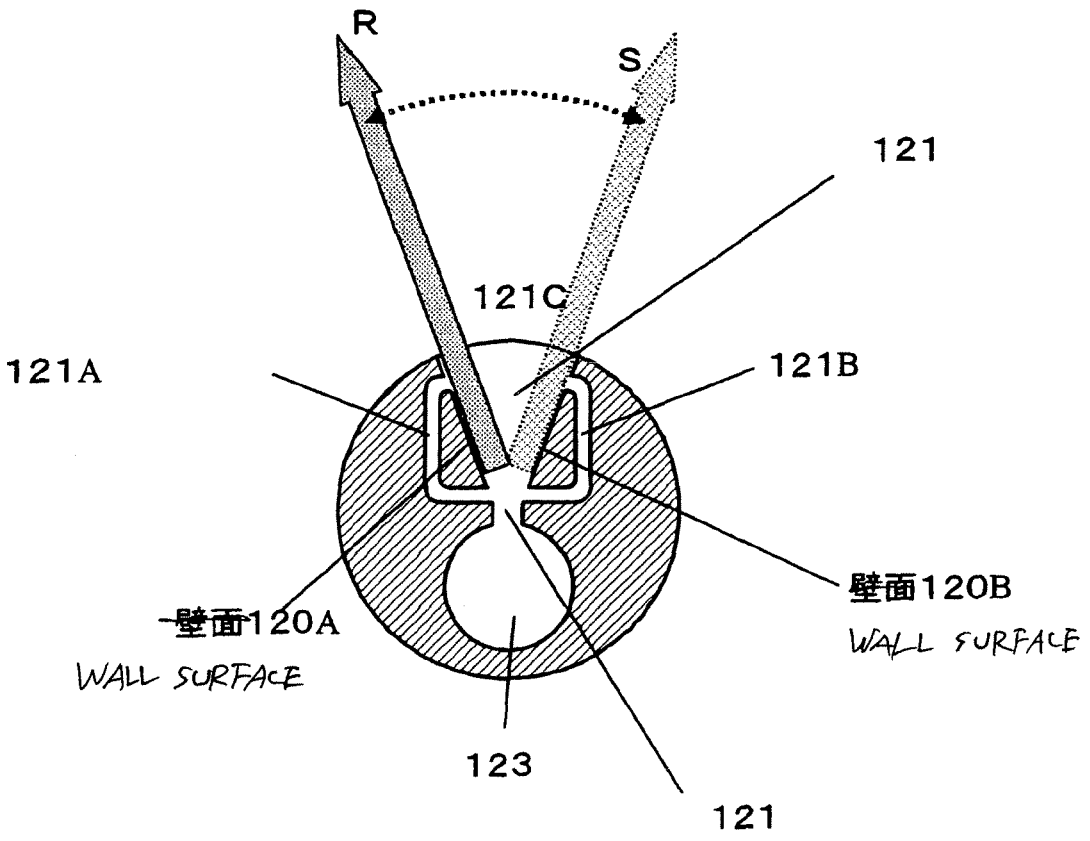


FIG. 19


R
S
121
121C
121A
121B
壁面120B
WALL SURFACE
壁面120A
WALL SURFACE
123
121

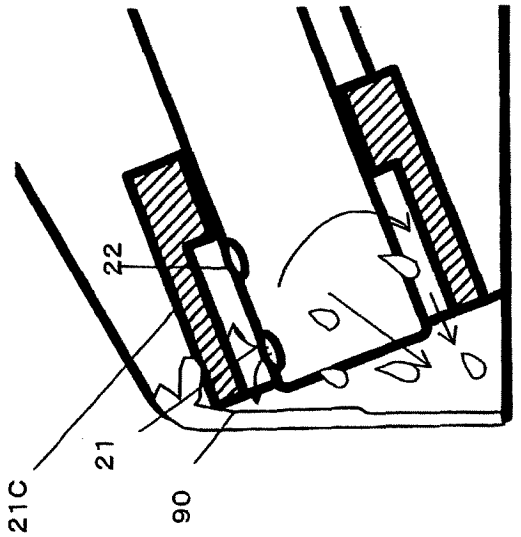


FIG. 20(b)

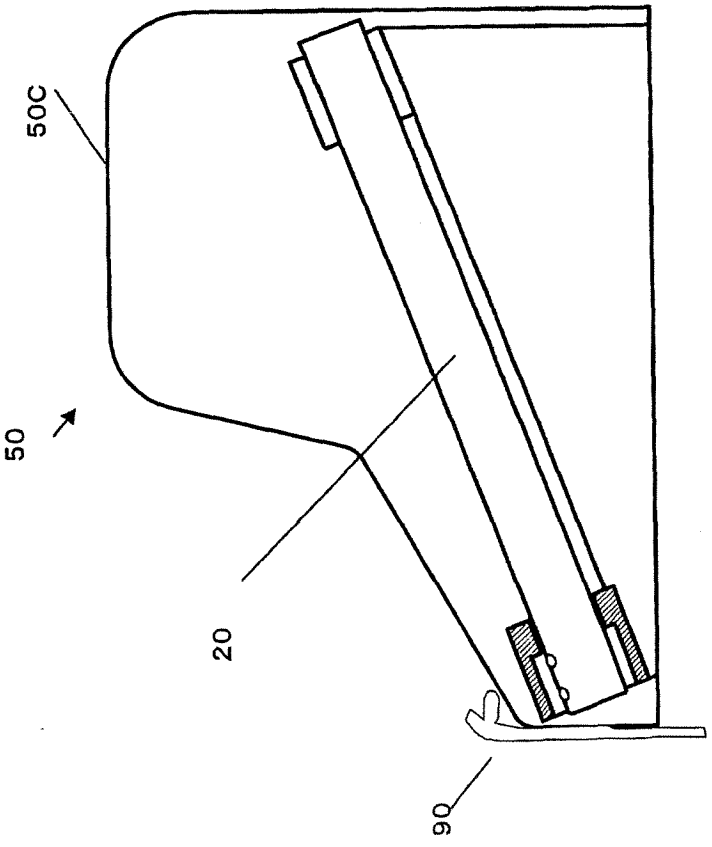


FIG. 20(a)

FIG. 21

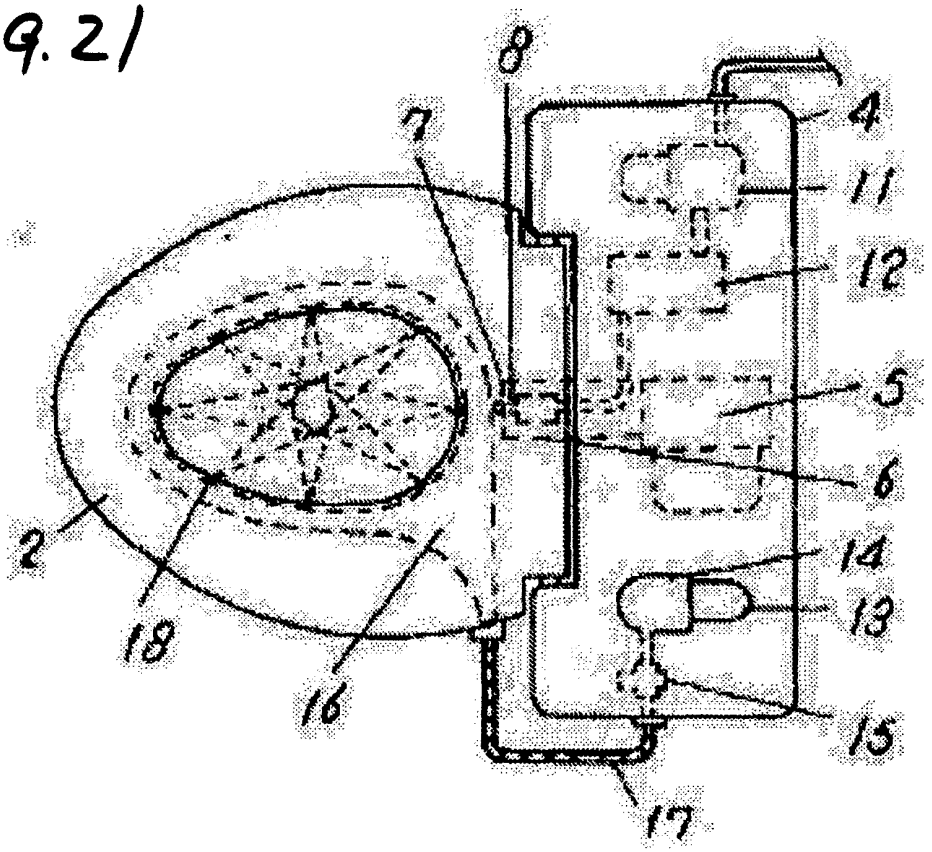
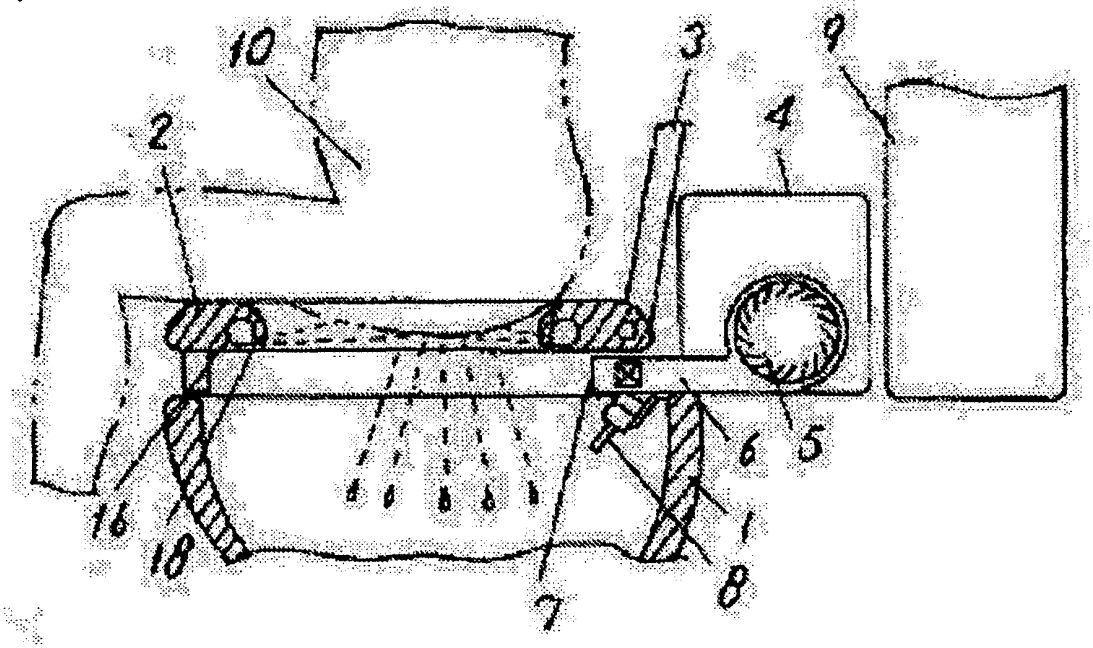


FIG. 22



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/061021

A. CLASSIFICATION OF SUBJECT MATTER
E03D9/08(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

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 1996-2007
Kokai Jitsuyo Shinan Koho 1971-2007 Toroku Jitsuyo Shinan Koho 1994-2007

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	JP 9-309414 A (Nissei Build Kogyo Kabushiki Kaisha), 02 December, 1997 (02.12.97), Par. Nos. [0015] to [0042]; Figs. 1, 2, 4, 5 & SG 55215 A	1,2
X	JP 2002-309653 A (Matsushita Electric Industrial Co., Ltd.), 23 October, 2002 (23.10.02), Par. Nos. [0021], [0024] to [0026]; Figs. 1, 2, 5, 6 (Family: none)	1,2

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 August, 2007 (14.08.07)	28 August, 2007 (28.08.07)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/061021

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The invention of claim 1, which is the matter common to the inventions of claims 1 and 2, claims 3, 5 and 6, claims 4, 7 and 8, claim 9, claims 10, 12 and 18 - 21, claims 11 and 13 - 17, claim 22 and claim 23, neither explicitly specifies any contribution over the prior art nor is a special technical feature, since that invention is disclosed in the following document 1 or 2.

(continued to extra sheet)

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
Claims 1 and 2.

Remark on Protest

the

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, payment of a protest fee..

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

Form PCT/ISA/210 (continuation of first sheet (2)) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/061021

Continuation of Box No.III of continuation of first sheet(2)

Document 1: JP 9-309414 A (Nissei Build Kogyo Kabushiki Kaisha), 2 December, 1997 (02.12.97), Par. Nos. [0015] - [0042], Figs. 1, 2, 4 and 5

Document 2: JP 2002-309653 A (Matsushita Electric Industrial Co., Ltd.), 23 October, 2002 (23.10.02), Par. Nos. [0021] and [0024] - [0026], and Figs. 1, 2, 5 and 6.

Form PCT/ISA/210 (extra sheet) (April 2005)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 58218531 A **[0013]**
- JP 3799850 B **[0013]**