

(19)



(11)

EP 4 512 385 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
26.02.2025 Bulletin 2025/09

(51) International Patent Classification (IPC):
A61H 33/00 ^(2006.01)

(21) Application number: **24195471.8**

(52) Cooperative Patent Classification (CPC):
A61H 23/0218; A61H 33/0087; A61H 33/6089;
A61H 33/027

(22) Date of filing: **20.08.2024**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR

Designated Extension States:

BA

Designated Validation States:

GE KH MA MD TN

(30) Priority: **22.08.2023 JP 2023134432**
22.08.2023 JP 2023134433
22.08.2023 JP 2023134434
22.08.2023 JP 2023134435
22.08.2023 JP 2023134436
08.07.2024 JP 2024109444

(71) Applicant: **TOTO LTD.**
Kokurakita-ku
Kitakyushu-shi, Fukuoka 802-8601 (JP)

(72) Inventors:

- **Miyazaki, Toshikuni**
Kitakyushu-shi, 802-8601 (JP)
- **Azuma, Kensuke**
Kitakyushu-shi, 802-8601 (JP)
- **Oketani, Kosuke**
Kitakyushu-shi, 802-8601 (JP)
- **Mori, Kento**
Kitakyushu-shi, 802-8601 (JP)

(74) Representative: **Bandpay & Greuter**
11 rue Christophe Colomb
75008 Paris (FR)

(54) BATHTUB SYSTEM

(57) Problem:

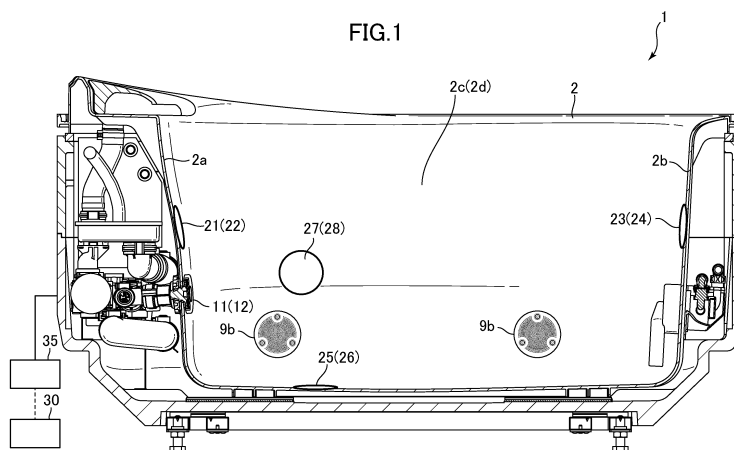
The object of first aspect of the present invention is to provide a finely tuned comfort to a user of a bathtub by combining: a hot/cool water stream generating unit configured to generate a hot or cool water stream inside pooled hot or cool water, which has been already pooled in the bathtub, by supplying hot or cool water into the bathtub; and a vibration generating unit configured to generate a vibration in the pooled hot or cool water without supplying hot or cool water into the bathtub.

Solution:

The first aspect of the present invention is a bathtub

system including: a bathtub in which hot or cool water can be pooled; a hot/cool water stream generating unit provided in the bathtub, the hot/cool water stream generating unit being configured to generate a hot or cool water stream inside pooled hot or cool water, which is to have been already pooled in the bathtub, by supplying hot or cool water into the bathtub; and a vibration generating unit provided in the bathtub, the vibration generating unit being configured to generate a vibration in the pooled hot or cool water without supplying hot or cool water into the bathtub.

FIG.1

**EP 4 512 385 A1**

Description

Technical Field

[0001] The present invention pertains to a bathtub system.

Background Art

[0002] It has been known to install one or more speakers in a bathtub so that a user of the bathtub can enjoy music while taking a bath. For example, JP-A-H3(1991)-15423 (Patent Document 1) has proposed to fix a sound source unit to a back side surface of a bathtub. JP-A-2006-128970 (Patent Document 2) has disclosed that a sound generator (speaker) for a pooled water area in a bathtub and a sound generator (speaker) for a space area above the pooled water area are controlled separately.

[0003] It has also been found that by supplying a flow of hot or cool water into a bathtub (to a certain extent vigorously), a stream of hot or cool water can be generated inside pooled hot or cool water that has been already pooled in the bathtub, and that such a stream of hot or cool water produces hydraulic stimulation which can provide comfort to a user of the bathtub. This has already been marketed ("Koshirakuyu" (which means 'waist comfortable hot water') or "Hydro Hands" by TOTO LTD.).

[0004] The inventor has found that it is possible to provide a finely tuned comfort to a user of a bathtub by combining: a hot/cool water stream generating unit configured to generate a hot or cool water stream inside pooled hot or cool water, which has been already pooled in the bathtub, by supplying hot or cool water into the bathtub; and a vibration generating unit configured to generate a vibration in the pooled hot or cool water without supplying hot or cool water into the bathtub.

Patent Document List

[0005]

Patent Document 1 is JP-A-H3(1991)-15423.

Patent Document 2 is JP-A-2006-128970.

Summary of Invention

Technical Problem

[0006] The present invention has been made based on the above findings by the inventors. The object of first and second aspects of the present invention is to provide a finely tuned comfort to a user of a bathtub by combining: a hot/cool water stream generating unit configured to generate a hot or cool water stream inside pooled hot or cool water, which has been already pooled in the bathtub, by supplying hot or cool water into the bathtub; and a vibration generating unit configured to generate a vibration in

the pooled hot or cool water without supplying hot or cool water into the bathtub.

[0007] In addition, the object of third, fourth and fifth aspects of the present invention is to provide a finely tuned comfort to a user of a bathtub by combining: a discharge water stream generating unit configured to generate a discharge water stream by supplying hot or cool water into the bathtub from above pooled hot or cool water, which has been already pooled in the bathtub; and a vibration generating unit configured to generate a vibration in the pooled hot or cool water without supplying hot or cool water into the bathtub.

Solution to Problem

[0008] First aspect of the present invention is a bathtub system including: a bathtub in which hot or cool water can be pooled; a hot/cool water stream generating unit provided in the bathtub, the hot/cool water stream generating unit being configured to generate a hot or cool water stream inside pooled hot or cool water, which is to have been already pooled in the bathtub, by supplying hot or cool water into the bathtub; and a vibration generating unit provided in the bathtub, the vibration generating unit being configured to generate a vibration in the pooled hot or cool water without supplying hot or cool water into the bathtub.

[0009] According to the first aspect of the invention, by the generated hot or cool water stream, a relatively strong water pressure stimulation can be given to a user of the bathtub, as if it were penetrating into the user's body (e.g. muscles), while a delicate water pressure stimulation caused by the vibration generated by the vibration generating unit can be given mainly to a surface (e.g. skin) of the user's body. This can provide a finely tuned comfort to the user.

[0010] In the first aspect, it is preferable that a maximum value in the bathtub of the water pressure stimulation caused by the vibration generated by the vibration generating unit is smaller than a maximum value in the bathtub of the water pressure stimulation caused by the hot or cool water stream generated by the hot/cool water stream generating unit.

[0011] According to this feature, it is more surely prevented that the vibration generated by the vibration generating unit interferes with action of the hot or cool water stream generated by the hot/cool water stream generating unit.

[0012] In addition, it is preferable that, at a predetermined position in the bathtub (such as a position corresponding to a body surface of a user who is to sit or lie in the bathtub), the water pressure stimulation caused by the vibration generated by the vibration generating unit is smaller than the water pressure stimulation caused by the hot or cool water stream generated by the hot/cool water stream generating unit.

[0013] According to this feature, it is effectively inhibited that a too strong stimulation is given to the user's skin

(which may provide discomfort to the user).

[0014] In addition, it is preferable that the hot/cool water stream generating unit is located on a back side wall surface of the bathtub (a wall surface of the bathtub against which a user's back is to face) and that the vibration generating unit (a vibration generating unit for shoulders in the embodiment described below) is also located on the back side wall surface of the bathtub.

[0015] According to this feature, on the back side of the body where the user is more likely to feel stimulation, the user can perceive comfort effects of both the stimulation by the vibration and the stimulation by the hot or cool water stream.

[0016] In addition, in this case, it is preferable that the vibration generating unit is located above the hot/cool water stream generating unit.

[0017] When the hot/cool water stream generating unit is located on the back side wall surface of the bathtub, it is expected that the momentum of the hot or cool water stream will cause the user's shoulder side to approach the back side wall surface of the bathtub. Therefore, by locating the vibration generating unit on the back side wall surface of the bathtub in an area where the user's shoulder side will approach in the above way, the user can perceive comfort effects of the vibration by the vibration generating unit more easily on the user's shoulder side.

[0018] In addition, in this case, it is preferable that the back side wall surface of the bathtub, where the vibration generating unit is located, is inclined.

[0019] When the user's shoulder side approaches the back side wall surface of the bathtub, if the back side wall surface of the bathtub is inclined, the back side wall surface of the bathtub is more likely to conform to the user's body line. Therefore, if the vibration generating unit is located there, the user can perceive comfort effects of the vibration by the vibration generating unit more easily.

[0020] In addition, in this case, it is preferable that the direction of the vibration generated by the vibration generating unit is in an oblique vertical direction.

[0021] When the user's shoulder side approaches the back side wall surface of the bathtub, if the direction of the vibration is in an oblique vertical direction, the user can perceive comfort effects of the vibration more easily on the user's shoulder side.

[0022] In addition, in the first aspect of the invention, it is preferable that the direction of the vibration generated by the vibration generating unit (a vibration generating unit for buttocks, a left vibration generating unit and a right vibration generating unit in the embodiment described below) and the direction of the hot or cool water stream generated by the hot/cool water stream generating unit form a substantially right angle.

[0023] According to this feature, the user is more likely to perceive the comfort effects of both the stimulation by the vibration and the stimulation by the hot or cool water stream, respectively independently.

[0024] In addition, in the first aspect of the invention, it is preferable that the vibration generating unit (a vibration generating unit for leg in the embodiment described below) is located on a leg side wall surface of the bathtub, and that the vibration generating unit and the hot/cool water stream generating unit are located at positions offset from each other in a height direction and/or in a left and right direction.

[0025] According to this feature, the user is more likely to perceive the comfort effects of both the stimulation by the vibration and the stimulation by the hot or cool water stream, respectively independently.

[0026] Second aspect of the present invention is a bathtub system including: a bathtub in which hot or cool water can be pooled; a hot/cool water stream generating unit provided in the bathtub, the hot/cool water stream generating unit being configured to generate a hot or cool water stream inside pooled hot or cool water, which is to have been already pooled in the bathtub, by supplying hot or cool water into the bathtub, a vibration generating unit provided in the bathtub, the vibration generating unit being configured to generate a vibration in the pooled hot or cool water without supplying hot or cool water into the bathtub; and a controlling unit configured to coordinate an operation of the hot/cool water stream generating unit and an operation of the vibration generating unit.

[0027] According to the second aspect of the invention as well, by the generated hot or cool water stream, a relatively strong water pressure stimulation can be given to a user of the bathtub, as if it were penetrating into the user's body (e.g. muscles), while a delicate water pressure stimulation caused by the vibration generated by the vibration generating unit can be given mainly to a surface (e.g. skin) of the user's body. This can provide a finely tuned comfort to the user. In particular, by coordinating the operation of the hot/cool water stream generating unit and the operation of the vibration generating unit (by correlating them with each other), the finely tuned comfort for the user can be more improved.

[0028] For example, it is preferable that the controlling unit is settable at a simultaneous-operation blocking mode, that the controlling unit in the simultaneous-operation blocking mode is configured not to start the operation of the vibration generating unit during the operation of the hot/cool water stream generating unit and not to start the operation of the hot/cool water stream generating unit during the operation of the vibration generating unit.

[0029] According to this feature, it is surely prevented that the operation of the hot/cool water stream generating unit and the operation of the vibration generating unit interfere with each other.

[0030] Furthermore, in this case, it is preferable that, when the controlling unit in the simultaneous-operation blocking mode receives an instruction for starting an operation of the vibration generating unit during the operation of the hot/cool water stream generating unit, the controlling unit is configured to start the operation of the vibration generating unit after the operation of the hot/-

cool water stream generating unit is completed, and that, when the controlling unit in the simultaneous-operation blocking mode receives an instruction for starting an operation of the hot/cool water stream generating unit during the operation of the vibration generating unit, the controlling unit is configured to start the operation of the hot/cool water stream generating unit after the operation of the vibration generating unit is completed.

[0031] According to this feature, it is possible to achieve an operational control in which operational contents by the user (user's intention to use the hot/cool water stream generating unit or the vibration generating unit) are respected while surely preventing that the operation of the hot/cool water stream generating unit and the operation of the vibration generating unit interfere with each other.

[0032] Herein, in terms of the completion of the operation of the hot/cool water stream generating unit or the vibration generating unit, for example, if an ongoing function is to continue for a preselected period of time, the ongoing function may be completed after the preselected period of time has elapsed. Alternatively, at a timing at which operational contents to use another (not ongoing) function are received, a message such as "The water discharge function will be stopped for starting the vibration function" is issued, and the ongoing function may be completed (stopped) immediately. The message to the user is not limited to an audible one, but can also be a visual one by using a display unit or the like.

[0033] Furthermore, in this case, it is preferable that, when the controlling unit in the simultaneous-operation blocking mode receives an instruction for starting an operation of the vibration generating unit during the operation of the hot/cool water stream generating unit, the controlling unit is configured to start the operation of the vibration generating unit within a predetermined period of time after the operation of the hot/cool water stream generating unit has been completed.

[0034] According to this feature, the vibration is given within the predetermined period of time during which there is still a lingering effect of the hot/cool water stream generated by the hot/cool water stream generating unit, so that the change from the water stream stimulation to the vibration stimulation can be made with less discomfort for the user.

[0035] Furthermore, in this case, it is preferable that, the predetermined period of time corresponds to 0 % to 80 % of a period of time which it takes for the hot/cool water stream remaining in the bathtub after the completion of the operation of the hot/cool water stream generating unit to disappear.

[0036] According to this feature, the change from the water stream stimulation to the vibration stimulation can be made with less discomfort for the user, more effectively.

[0037] Alternatively, in the second aspect of the invention, it is preferable that the controlling unit is settable at a simultaneous-operation acceptable mode, and that,

when the controlling unit in the simultaneous-operation acceptable mode receives an instruction for starting an operation of the vibration generating unit during the operation of the hot/cool water stream generating unit, the controlling unit is configured to start the operation of the vibration generating unit after weakening output strength of the hot/cool water stream generating unit to a predetermined value or lower, and that, when the controlling unit in the simultaneous-operation acceptable mode receives an instruction for starting an operation of the hot/cool water stream generating unit during the operation of the vibration generating unit, the controlling unit is configured to start the operation of the hot/cool water stream generating unit after weakening output strength of the operation of the vibration generating unit to a predetermined value or lower.

[0038] According to this feature, the situation is surely prevented in which the user cannot perceive the comfort effects of the vibration generated by the vibration generating unit because the hot or cool water stream generated by the hot/cool water stream generating unit has too strong effects.

[0039] Third aspect of the present invention is a bathtub system including: a bathtub in which hot or cool water can be pooled; a discharge water stream generating unit provided at an upper part of the bathtub, the discharge water stream generating unit being configured to generate a discharge water stream by supplying hot or cool water into the bathtub from above pooled hot or cool water, which is to have been already pooled in the bathtub; and a vibration generating unit provided in the bathtub, the vibration generating unit being configured to generate a vibration in the pooled hot or cool water without supplying hot or cool water into the bathtub.

[0040] According to the third aspect of the invention, by the generated discharge water stream, a relatively strong water pressure stimulation can be given to a user of the bathtub, as if it were penetrating into the user's body (e.g. muscles, in particular around the user's neck or shoulders), while a delicate water pressure stimulation caused by the vibration generated by the vibration generating unit can be given mainly to a surface (e.g. skin) of the user's body. This can provide a finely tuned comfort to the user.

[0041] In the third aspect of the invention, it is preferable that, in a hypothetical situation in which there is no hot or cool water pooled in the bathtub, the discharge water stream generated by the discharge water stream generating unit is to land at a predetermined bottom landing position on a bottom of the bathtub, and that the vibration generating unit is located on the user's back side in a front and rear direction with respect to the predetermined bottom landing position.

[0042] The discharge water stream generated by the discharge water stream generating unit is generally designed to be targeted around the user's neck or shoulders. After the discharge water stream collides with the user's neck or shoulders or the vicinity thereof and

passes there, the discharge water stream lands on the pooled hot or cool water mainly on the user's leg side and causes a turbulent flow in the pooled hot or cool water in the bathtub. Taking this into consideration, if the vibration generating unit is located on the user's back side in a front and rear direction with respect to the predetermined bottom landing position, the situation is effectively inhibited in which the water pressure stimulation caused by the vibration generated by the vibration generating unit is interfered with the discharge water stream generated by the discharge water stream generating unit.

[0043] Alternatively, in the third aspect of the invention, it is preferable that, in a hypothetical situation in which there is pooled hot or cool water in the bathtub, the discharge water stream generated by the discharge water stream generating unit is to land at a predetermined surface landing position on a surface of the pooled hot or cool water, and that the vibration generating unit is located on the user's back side in a front and rear direction with respect to the predetermined surface landing position.

[0044] As described above, the discharge water stream generated by the discharge water stream generating unit lands on the surface of the pooled hot or cool water mainly on the user's front side (user's leg side) and causes a turbulent flow in the pooled hot or cool water in the bathtub. Taking this into consideration, if the vibration generating unit is located on the user's back side in a front and rear direction with respect to the predetermined surface landing position, the situation is effectively inhibited in which the water pressure stimulation caused by the vibration generated by the vibration generating unit is interfered with the discharge water stream generated by the discharge water stream generating unit.

[0045] Fourth aspect of the present invention is a bathtub system including: a bathtub in which hot or cool water can be pooled; a discharge water stream generating unit provided at an upper part of the bathtub, the discharge water stream generating unit being configured to generate a discharge water stream by supplying hot or cool water into the bathtub from above pooled hot or cool water, which is to have been already pooled in the bathtub; a vibration generating unit provided in the bathtub, the vibration generating unit being configured to generate a vibration in the pooled hot or cool water without supplying hot or cool water into the bathtub; and a controlling unit configured to coordinate an operation of the discharge water stream generating unit and an operation of the vibration generating unit.

[0046] According to the fourth aspect of the invention as well, by the generated discharge water stream, a relatively strong water pressure stimulation can be given to a user of the bathtub, as if it were penetrating into the user's body (e.g. muscles, in particular around the user's neck or shoulders), while a delicate water pressure stimulation caused by the vibration generated by the vibration generating unit can be given mainly to a surface (e.g. skin) of the user's body. This can provide a finely tuned

comfort to the user. In particular, by coordinating the operation of the discharge water stream generating unit and the operation of the vibration generating unit (by correlating them with each other), the finely tuned comfort for the user can be more improved.

[0047] For example, it is preferable that the controlling unit is settable at a simultaneous-operation blocking mode, and that the controlling unit in the simultaneous-operation blocking mode is configured not to start the operation of the vibration generating unit during the operation of the discharge water stream generating unit and not to start the operation of the discharge water stream generating unit during the operation of the vibration generating unit.

[0048] According to this feature, it is surely prevented that the operation of the discharge water stream generating unit and the operation of the vibration generating unit interfere with each other.

[0049] Furthermore, in this case, it is preferable that, when the controlling unit in the simultaneous-operation blocking mode receives an instruction for starting an operation of the vibration generating unit during the operation of the discharge water stream generating unit, the controlling unit is configured to start the operation of the vibration generating unit after the operation of the discharge water stream generating unit is completed, and that, when the controlling unit in the simultaneous-operation blocking mode receives an instruction for starting an operation of the discharge water stream generating unit during the operation of the vibration generating unit, the controlling unit is configured to start the operation of the discharge water stream generating unit after the operation of the vibration generating unit is completed.

[0050] According to this feature, it is possible to achieve an operational control in which operational contents by the user (user's intention to use the discharge water stream generating unit or the vibration generating unit) are respected while surely preventing that the operation of the discharge water stream generating unit and the operation of the vibration generating unit interfere with each other.

[0051] Herein, in terms of the completion of the operation of the discharge water stream generating unit or the vibration generating unit, for example, if an ongoing function is to continue for a preselected period of time, the ongoing function may be completed after the preselected period of time has elapsed. Alternatively, at a timing at which operational contents to use another (not ongoing) function are received, a message such as "The water discharge function will be stopped for starting the vibration function" is issued, and the ongoing function may be completed (stopped) immediately. The message to the user is not limited to an audible one, but can also be a visual one by using a display unit or the like.

[0052] Furthermore, in this case, it is preferable that, when the controlling unit in the simultaneous-operation blocking mode receives an instruction for starting an operation of the vibration generating unit during the op-

eration of the discharge water stream generating unit, the controlling unit is configured to start the operation of the vibration generating unit within a predetermined period of time after the operation of the discharge water stream generating unit has been completed.

[0053] According to this feature, the vibration is given within the predetermined period of time during which there is still a lingering effect of the water stream generated by the discharge water stream generating unit, so that the change from the water stream stimulation to the vibration stimulation can be made with less discomfort for the user.

[0054] Furthermore, in this case, it is preferable that, the predetermined period of time corresponds to 0 % to 80 % of a period of time which it takes for the water stream remaining in the bathtub after the completion of the operation of the discharge water stream generating unit to disappear.

[0055] According to this feature, the change from the water stream stimulation to the vibration stimulation can be made with less discomfort for the user, more effectively.

[0056] Alternatively, in the fourth aspect of the invention, it is preferable that the controlling unit is settable at a simultaneous-operation acceptable mode, and that, when the controlling unit in the simultaneous-operation acceptable mode receives an instruction for starting an operation of the vibration generating unit during the operation of the discharge water stream generating unit, the controlling unit is configured to start the operation of the vibration generating unit after weakening output strength of the discharge water stream generating unit to a predetermined value or lower, and that, when the controlling unit in the simultaneous-operation acceptable mode receives an instruction for starting an operation of the discharge water stream generating unit during the operation of the vibration generating unit, the controlling unit is configured to start the operation of the discharge water stream generating unit after weakening output strength of the operation of the vibration generating unit to a predetermined value or lower.

[0057] According to this feature, the situation is surely prevented in which the user cannot perceive the comfort effects of the vibration generated by the vibration generating unit because the water stream generated by the discharge water stream generating unit has too strong effects.

[0058] Fifth aspect of the present invention is a bathtub system including: a bathtub in which hot or cool water can be pooled; a discharge water stream generating unit provided at an upper part of the bathtub, the discharge water stream generating unit being configured to generate a discharge water stream by supplying hot or cool water into the bathtub from a discharge port provided above pooled hot or cool water, which is to have been already pooled in the bathtub; and a vibration generating unit provided in the bathtub, the vibration generating unit being configured to generate a vibration in the pooled hot

or cool water without supplying hot or cool water into the bathtub; wherein, in a plan view or in a side view, a propagation direction of the vibration generated by the vibration generating unit and a travelling direction of the discharge water stream when it is being discharged from the discharge port intersect each other.

[0059] According to the fourth aspect of the invention as well, by the generated discharge water stream, a relatively strong water pressure stimulation can be given to a user of the bathtub, as if it were penetrating into the user's body (e.g. muscles, in particular around the user's neck or shoulders), while a delicate water pressure stimulation caused by the vibration generated by the vibration generating unit can be given mainly to a surface (e.g. skin) of the user's body. This can provide a finely tuned comfort to the user. In particular, by the feature wherein, in a plan view or in a side view, a propagation direction of the vibration generated by the vibration generating unit and a travelling direction of the discharge water stream when it is being discharged from the discharge port intersect each other, the situation is effectively inhibited in which the water pressure stimulation caused by the vibration generated by the vibration generating unit is interfered with the discharge water stream generated by the discharge water stream generating unit.

[0060] As used herein, the term "a propagation direction of the vibration" means a direction of a line linking: a central point of a plane whose vibration amplitude is maximum (or a point whose vibration amplitude is maximum) in the vibration generating unit (specifically, an oscillating element thereof), and another point away from the above point by a predetermined distance and at which a maximum sound pressure is measured, when the vibration generating unit (the oscillating element thereof) is oscillated by using an octave band noise signal whose nominal center frequency is defined by ISO 266 (e.g. any of 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, 8000 Hz or 16000 Hz, which belong to 1/1 octave).

[0061] However, as a close approximation, when the vibration generating unit is installed on a wall surface of the bathtub, the direction can be in a direction perpendicular to the wall surface from a portion of the wall surface where the vibration generating unit is installed (including a range of $\pm 10^\circ$ at least at the time of filing the present application), or when the vibration generating unit is installed in a hole provided on the bathtub, the direction can be in a direction extending in an oscillation direction of the oscillating element from the central point of the plane thereof whose vibration amplitude is maximum (or the point thereof whose vibration amplitude is maximum) (including a range of $\pm 10^\circ$ at least at the time of filing the present application).

[0062] On the other hand, as used herein, the term "a travelling direction of the discharge water stream when it is being discharged from the discharge port" means a visually determined direction, if possible. However, as a close approximation, the direction can be in a direction

perpendicular to an opening surface forming the discharge port.

[0063] In addition, it is preferable that, in a stereoscopic view, the propagation direction of the vibration generated by the vibration generating unit and the travelling direction of the discharge water stream when it is being discharged from the discharge port do not intersect each other.

[0064] According to this feature, the situation in which the water pressure stimulation caused by the vibration generated by the vibration generating unit is interfered with the discharge water stream generated by the discharge water stream generating unit is more effectively inhibited.

[0065] Furthermore, it is preferable that, in the plan view or in the side view, the propagation direction of the vibration generated by the vibration generating unit and the travelling direction of the discharge water stream when it is being discharged from the discharge port intersect each other substantially perpendicularly.

[0066] According to this feature, the situation in which the water pressure stimulation caused by the vibration generated by the vibration generating unit is interfered with the discharge water stream generated by the discharge water stream generating unit is more effectively inhibited.

[0067] As used herein, the term "(intersect each other) substantially perpendicularly" means a relationship forming an angle between 80 ° and 100 °, preferably a relationship forming an angle between 85 ° and 95 °.

[0068] The bathtub system according to the first aspect of the present invention may further include a hot/cool water stream generating unit provided in the bathtub, the hot/cool water stream generating unit being configured to generate a hot or cool water stream inside pooled hot or cool water, which is to have been already pooled in the bathtub, by supplying hot or cool water into the bathtub. In this case, it is preferable that, in a plan view or in a side view, the propagation direction of the vibration generated by the vibration generating unit and a travelling direction of the hot or cool water stream intersect each other.

[0069] According to this feature, the situation is effectively inhibited in which the water pressure stimulation caused by the vibration generated by the vibration generating unit is interfered with the hot or cool water stream generated by the hot/cool water stream generating unit.

[0070] As used herein, the term "a travelling direction of the hot or cool water stream" means a visually determined direction, if possible. However, as a close approximation, the direction can be in a direction perpendicular to an opening surface forming a discharge port for the hot or cool water stream.

[0071] In an earlier application on which the priority of the present application is based, the following aspect was described. That is to say, an aspect of the present invention set forth in the earlier application is a bathtub system including: a bathtub in which hot or cool water can be pooled; a discharge water stream generating unit pro-

vided at an upper part of the bathtub, the discharge water stream generating unit being configured to generate a discharge water stream by supplying hot or cool water into the bathtub from above pooled hot or cool water, which is to have been already pooled in the bathtub; and a vibration generating unit provided in the bathtub, the vibration generating unit being configured to generate a vibration in the pooled hot or cool water without supplying hot or cool water into the bathtub; wherein a propagation direction of the vibration generated by the vibration generating unit and a travelling direction of the discharge water stream when it lands on a surface of the pooled hot or cool water are substantially orthogonal to each other.

[0072] According to the above aspect of the invention, by the generated discharge water stream, a relatively strong water pressure stimulation can be given to a user of the bathtub, as if it were penetrating into the user's body (e.g. muscles, in particular around the user's neck or shoulders), while a delicate water pressure stimulation caused by the vibration generated by the vibration generating unit can be given mainly to a surface (e.g. skin) of the user's body. This can provide a finely tuned comfort to the user. In particular, since the propagation direction of the vibration generated by the vibration generating unit and the travelling direction of the discharge water stream when it lands on a surface of the pooled hot or cool water are substantially orthogonal to each other, the situation is effectively inhibited in which the water pressure stimulation caused by the vibration generated by the vibration generating unit is interfered with the discharge water stream generated by the discharge water stream generating unit.

[0073] In the above aspect of the invention, it is preferable that the propagation direction of the vibration generated by the vibration generating unit and a half straight line extending in the travelling direction from a surface landing point on which the discharge water stream lands do not intersect each other.

[0074] According to this feature, the situation is more effectively inhibited in which the water pressure stimulation caused by the vibration generated by the vibration generating unit is interfered with the discharge water stream generated by the discharge water stream generating unit.

[0075] In addition, the bathtub system of the above aspect of the invention may also include a hot/cool water stream generating unit provided in the bathtub, the hot/cool water stream generating unit being configured to generate a hot or cool water stream inside pooled hot or cool water, which is to have been already pooled in the bathtub, by supplying hot or cool water into the bathtub. In this case, it is preferable that the propagation direction of the vibration generated by the vibration generating unit and a travelling direction of the hot or cool water stream are substantially orthogonal to each other.

[0076] According to this feature, the situation is effectively inhibited in which the water pressure stimulation caused by the vibration generated by the vibration gen-

erating unit is interfered with the hot or cool water stream generated by the hot/cool water stream generating unit.

Advantageous Effects of Invention

[0077] The first aspect of the invention makes it possible to provide a finely tuned comfort to a user of a bathtub by combining: a hot/cool water stream generating unit configured to generate a hot or cool water stream inside pooled hot or cool water, which is to have been already pooled in the bathtub, by supplying hot or cool water into the bathtub; and a vibration generating unit configured to generate a vibration in the pooled hot or cool water without supplying hot or cool water into the bathtub.

Brief Description of Drawings

[0078]

Fig. 1 is a schematic sectional view of a bathtub system according to embodiments 1-1, 2-1, 3-1, 4-1 and 5-1 of the present invention,

Fig. 2 is a schematic view of an example of hot/cool water stream generating unit,

Fig. 3 is a view showing an operational image of the example of hot/cool water stream generating unit,

Fig. 4 is a schematic view of a bathtub system in which another example of hot/cool water stream generating unit is installed,

Fig. 5 is a schematic view of an example of vibration generating unit,

Fig. 6 is a view showing an operational image of the example of vibration generating unit,

Fig. 7 is a view showing an operational image of another example of vibration generating unit,

Fig. 8 is a schematic view of an example of sensor for measuring a water pressure stimulation,

Fig. 9 is a schematic sectional view of a bathtub system according to embodiment 1-2 of the present invention,

Fig. 10 is a flow chart of an example of simultaneous operation blocking mode (1),

Fig. 11 is a flow chart of an example of simultaneous operation acceptable mode (1),

Fig. 12 is a supplementary sectional view of a bathtub system according to embodiment 3-1 of the present invention,

Fig. 13 is a supplementary sectional view of a bathtub system according to embodiment 3-2 of the present invention,

Fig. 14 is a flow chart of an example of simultaneous operation blocking mode (2), and

Fig. 15 is a flow chart of an example of simultaneous operation acceptable mode (2).

Description of Embodiments

(Embodiment 1-1: Structure)

[0079] Hereinafter, an embodiment 1-1 of the present invention is explained with reference to the attached drawings. Fig. 1 is a schematic sectional view of a bathtub system 1 according to an embodiment 1-1 of the present invention, through a hot/cool water stream generating unit 11.

[0080] As shown in Fig. 1, the bathtub system 1 of the embodiment 1-1 includes a bathtub 2 in which hot or cool water can be pooled. The bathtub 2 has: a back side wall surface 2a, against which a back of a user of the bathtub 2 is to face; a leg side wall surface 2b, against which legs of the user are to face; a left side wall surface 2c, against which a left side body of the user is to face; and a right side wall surface 2d, against which a right side body of the user is to face.

[0081] With respect to the size of the bathtub 2, for example, the bathtub 2 has a substantially rectangular (substantially oblong) shape of 450 mm x 1,100 mm in a plan view at a bottom thereof, a substantially rectangular (substantially oblong) shape of 600 mm x 1,140 mm in a plan view at a standard height plane (e.g. at a height of 350 mm from the bottom) which corresponds to a water height when hot or cool water has been pooled in the bathtub 2, and a substantially rectangular (substantially oblong) shape of 650 mm x 1,350 mm in a plan view at an upward opening surface (e.g. at a height of 500 mm from the bottom). The right-hand area is not illustrated in the cross-section in Fig. 1, and only numerical signs are shown in brackets for symmetrical right-hand elements.

[0082] A pair of left and right hot/cool water stream generating units 11, 12 are provided in such a manner that respective central axes thereof are positioned at a predetermined height (e.g. at a height of 150 mm from the bottom of the bathtub 2) of the back side wall surface 2a, against which a waist of the user is to face. The back side wall surface 2a is inclined at an angle of approximately 3° to the vertical plane in the area where the pair of left and right hot/cool water stream generating units 11, 12 are installed. The pair of left and right hot/cool water stream generating units 11, 12 are arranged symmetrically in a left and right direction in the bathtub 2, and their respective central axes are separated from each other by 150 mm.

[0083] Each of the pair of left and right hot/cool water stream generating units 11, 12 is a device mechanism configured to generate a hot or cool water stream inside pooled hot or cool water, which is to have been already pooled in the bathtub 2, by vigorously supplying hot or cool water into the bathtub 2. Each of the pair of left and right hot/cool water stream generating units 11, 12 is visible on the back side wall surface 2a as a member formed into a circular ring having an outer diameter of 70 mm, an inner diameter of 26 mm and a projection height (thickness) into the bathtub 2 of 11 mm.

[0084] Specifically, as shown in Figs. 2 and 3, each of the pair of left and right hot/cool water stream generating units 11, 12 is a device mechanism configured to perform a function of giving a comfort stimulation around the waist of the user by jetting a hot or cool water stream in a roughly circular pattern by randomly formed curves. Fig. 2 is a schematic view of an example of each of the hot/cool water stream generating units 11, 12. Fig. 3 is a view showing an operational image of the example of each of the hot/cool water stream generating units 11, 12.

[0085] Returning to Fig. 1, water intake ports 9a, 9b for circulating hot or cool water to the hot/cool water stream generating units 11, 12 are provided on the left side wall surface 2c of the bathtub 2 at predetermined two locations (e.g. at positions of 170 mm and 780 mm from a lower end of the back side wall surface 2a toward the leg side, at a height of 90 mm from the bottom of the bathtub 2). In the example shown in Fig. 1, each of the water intake ports 9a, 9b is a member formed into a circular disk having an outer diameter of 82 mm and a projection height (thickness) into the bathtub 2 of 14 mm.

[0086] In the example of each of the hot/cool water stream generating units 11, 12 shown in Figs. 2 and 3, no air is mixed into the hot or cool water stream. Herein, Fig. 4 is a schematic view of a bathtub system in which another example of each of the hot/cool water stream generating units 11, 12 is installed. As shown in Fig. 4, it is possible to adopt a device mechanism configured to generate a hot or cool water stream inside pooled hot or cool water, which is to have been already pooled in the bathtub 2, by vigorously supplying air-mixed hot or cool water into the bathtub 2.

[0087] On the other hand, a pair of left and right vibration generating units for shoulders 21, 22 are provided in such a manner that respective central axes thereof are positioned at a predetermined height (e.g. at a height of 400 mm from the bottom of the bathtub 2) of the back side wall surface 2a, against which shoulders of the user are to face. The back side wall surface 2a is inclined at an angle of approximately 20° to the vertical plane in the area where the pair of left and right vibration generating units for shoulders 21, 22 are installed. The pair of left and right vibration generating units for shoulders 21, 22 are arranged symmetrically in a left and right direction in the bathtub 2, and their respective central axes are separated from each other by 250 mm. A direction of vibration generated by each of the vibration generating units for shoulders 21, 22 is adjusted in a direction perpendicular to the back side wall surface 2a. As a result, the direction of vibration generated by each of the vibration generating units for shoulders 21, 22 is in an oblique vertical direction inclined at an angle of approximately 20° to the horizontal plane.

[0088] In addition, a pair of left and right vibration generating units for legs 23, 24 are provided in such a manner that respective central axes thereof are positioned at a predetermined height (e.g. at a height of 200 mm from the bottom of the bathtub 2) of the leg side

wall surface 2b. The pair of left and right vibration generating units for legs 23, 24 are arranged symmetrically in a left and right direction in the bathtub 2, and their respective central axes are separated from each other by 250 mm.

[0089] In addition, a pair of left and right vibration generating units for buttocks 25, 26 are provided in such a manner that respective central axes thereof are positioned at a predetermined location (e.g. at a position of 350 mm from a lower end of the back side wall surface 2a toward the leg side) of the bottom of the bathtub 2, against which buttocks of the user are to face. The pair of left and right vibration generating units for buttocks 25, 26 are arranged symmetrically in a left and right direction in the bathtub 2, and their respective central axes are separated from each other by 250 mm.

[0090] Furthermore, a left side vibration generating unit 27 and a right side vibration generating unit 28 are provided in such a manner that respective central axes thereof are positioned at a predetermined location (e.g. at a position of 250 mm from a lower end of the back side wall surface 2a toward the leg side at a height of 200 mm from the bottom of the bathtub 2) of the left side wall surface 2c and the right side wall surface 2d of the bathtub 2, respectively.

[0091] The vibration generating units for shoulders 21, 22, the vibration generating units for legs 23, 24, the vibration generating units for buttocks 25, 26, the left side vibration generating unit 27 and the right side vibration generating unit 28 may have a common configuration. For example, a common speaker or the like may be adopted for them.

[0092] Fig. 5 is a schematic view of an example of each of the vibration generating units 21-28. In the example shown in Fig. 5, the magnitude of a vibration force is expressed as a Lorentz force ($F = IBL$). Herein, F is the magnitude of a vibration force, I is a value of an electric current flowing in the coil, B is a flux density generated at this time, and L is a length of the iron core. When the vibration generating units 21-28 are directly attached to their corresponding wall surfaces of the bathtub 2, these wall surfaces of the bathtub 2 themselves are directly vibrated so that the water pooled in the bathtub 2 is vibrated.

[0093] Fig. 6 is a view showing an operational image of the example of each of the vibration generating units 21-28. As shown in Fig. 6, when the vibration generating units 21-28 are directly attached to their corresponding wall surfaces of the bathtub 2, these wall surfaces of the bathtub 2 themselves are directly vibrated so that the water pooled in the bathtub 2 is vibrated. Alternatively, Fig. 7 is a view showing an operational image of another example of each of the vibration generating units 21-28. As shown in Fig. 7, each of the vibration generating units 21-28 may be manufactured as a dedicated unit, a hole may be provided on the corresponding wall surface of the bathtub 2, and the dedicated unit may be fitted into the hole.

(Embodiment 1-1: Control Configuration)

[0094] In the present embodiment, a maximum value in the bathtub 2 of the water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-28 (usually, the water pressure stimulation in an area in the immediate vicinity of each of the vibration generating units 21-28) is set to be smaller than a maximum value in the bathtub 2 of the water pressure stimulation caused by the hot or cool water stream generated by each of the hot/cool water stream generating units 11-12 (usually, the water pressure stimulation in an area in the immediate vicinity of each of the hot/cool water stream generating units 11-12).

[0095] Furthermore, in the present embodiment, at a predetermined position in the bathtub 2 (such as a position corresponding to a body surface of a user who is to sit or lie in the bathtub 2), the water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-28 is set to be smaller than the water pressure stimulation caused by the hot or cool water stream generated by each of the hot/cool water stream generating units 11-12.

[0096] These settings can be achieved by adjusting an electrical signal for driving each of the vibration generating units 21-28 and an electrical signal for driving each of the hot/cool water stream generating units 11-12 (in particular, an electrical signal supplied to a built-in motor for jetting the hot or cool water).

[0097] The "water pressure stimulation" used as an indicator for the adjustment of these electrical signals is evaluated (measured), for example, according to the following "water pressure stimulation measurement method". Based on "JIS 5532:2014", measurements were made with a 50 Hz sine wave and pink noise input for the vibration generating units for shoulders 21, 22, the vibration generating units for legs 23, 24, the left side vibration generating unit 27 and the right side vibration generating unit 28.

(Water Pressure Stimulation Measurement Method)

[0098] A new type of sensor is formed by a transparent cylinder and a sphere inserted into the transparent cylinder, and the new type of sensor is installed at a predetermined position inside the pooled hot or cool water in the bathtub 2. Then, a distance by which the sphere moves inside the transparent cylinder is measured as a "water pressure stimulation". Fig. 8 is a schematic view of an example of the new type of sensor. For example, the transparent cylinder is made of polypropylene, with an outer diameter of 50 mm, an inner diameter of 40 mm and a length of 500 mm, and the sphere is made of Styrofoam, with a diameter of 30 mm. The cylinder is installed parallel to the direction of the water stream generated by the hot/cool water stream generating unit 11 or 12, the direction of the vibration generated by the vibration generating unit for shoulders 21 or 22, the direction of the vibration

generated by the vibration generating unit for legs 23 or 24, the direction of the vibration generated by the left side vibration generating unit 27, or the direction of the vibration generated by the right side vibration generating unit 28.

[0099] First, one end of the cylinder shown in Fig. 8 was positioned 1 mm away from one (each) of the hot/cool water stream generating units 11-12, the vibration generating units for shoulders 21-22, the vibration generating units for legs 23-24, the left side vibration generating unit 27 and the right side vibration generating unit 28 (in turn). Then, the sphere inserted in the cylinder shown in Fig. 8 was brought in contact with the corresponding one of the hot/cool water stream generating units 11-12, the vibration generating units for shoulders 21-22, the vibration generating units for legs 23-24, the left side vibration generating unit 27 and the right side vibration generating unit 28. Then, the cylinder was held in parallel to the corresponding one direction among the direction of the water stream generated by the hot/cool water stream generating unit 11 or 12, the direction of the vibration generated by the vibration generating unit for shoulders 21 or 22, the direction of the vibration generated by the vibration generating unit for legs 23 or 24, the direction of the vibration generated by the left side vibration generating unit 27, or the direction of the vibration generated by the right side vibration generating unit 28. In the above state, the corresponding one of the hot/cool water stream generating units 11-12, the vibration generating units for shoulders 21-22, the vibration generating units for legs 23-24, the left side vibration generating unit 27 and the right side vibration generating unit 28 was operated as follows, and the distance of movement of the sphere was measured after a predetermined period of time (e.g. 5 seconds) had elapsed since the start of the operation.

[0100] First, each of the hot/cool water stream generating units 11-12 was driven at "strong output strength", "medium output strength" and "weak output strength", respectively. The distance of movement of the sphere was approximately 500 mm or more in each case.

[0101] Herein, at the "strong output strength" of each of the hot/cool water stream generating units 11-12, the hot or cool water is supplied at a flow rate of 70 little per 1 minute. At the "medium output strength" of each of the hot/cool water stream generating units 11-12, the hot or cool water is supplied at a flow rate of 60 little per 1 minute. At the "weak output strength" of each of the hot/cool water stream generating units 11-12, the hot or cool water is supplied at a flow rate of 50 little per 1 minute

[0102] Next, each of the vibration generating units for shoulders 21-22 was driven with an input of either a 50 Hz sine wave or a pink noise. The distance of movement of the sphere was approximately 15 mm in each case.

[0103] Next, each of the vibration generating units for legs 23-24 was driven with an input of either a 50 Hz sine wave or a pink noise. The distance of movement of the sphere was approximately 15 mm in each case.

[0104] Next, each of the left side vibration generating unit 27 and the right side vibration generating unit 28 was driven with an input of either a 50 Hz sine wave or a pink noise. The distance of movement of the sphere was approximately 15 mm in each case.

[0105] As seen in the above result of the present embodiment, the distance of movement of the sphere in an area in the immediate vicinity of each of the hot/cool water stream generating units 11-12 when each of the hot/cool water stream generating units 11-12 was driven at the "strong output strength", the "medium output strength" and the "weak output strength", respectively, was greater than:

the distance of movement of the sphere in an area in the immediate vicinity of each of the vibration generating units for shoulders 21-22 when each of the vibration generating units for shoulders 21-22 was driven with an input of either a 50 Hz sine wave or a pink noise;

the distance of movement of the sphere in an area in the immediate vicinity of each of the vibration generating units for legs 23-24 when each of the vibration generating units for legs 23-24 was driven with an input of either a 50 Hz sine wave or a pink noise; and/or

the distance of movement of the sphere in an area in the immediate vicinity of each of the left side vibration generating unit 27 and the right side vibration generating unit 28 when each of the left side vibration generating unit 27 and the right side vibration generating unit 28 was driven with an input of either a 50 Hz sine wave or a pink noise.

[0106] Such conditions satisfy the feature of "a maximum value in the bathtub of the water pressure stimulation caused by the vibration generated by the vibration generating unit is smaller than a maximum value in the bathtub of the water pressure stimulation caused by the hot or cool water stream generated by the hot/cool water stream generating unit" and the feature of "at a predetermined position in the bathtub, the water pressure stimulation caused by the vibration generated by the vibration generating unit is smaller than the water pressure stimulation caused by the hot or cool water stream generated by the hot/cool water stream generating unit".

[0107] In the present embodiment, the sphere is made of Styrofoam. However, the sphere may be made of or filled with another material whose specific gravity is approximately the same (e.g. within $\pm 5\%$) with respect to the specific gravity of water, such as nylon. By using such a sphere, it is possible to accurately measure a vibration having a vertical component, for example a vibration generated by each of the vibration generating units for buttocks 25-26.

[0108] The operation (driving) of the hot/cool water stream generating units 11-12, the selection of the output strength of the hot/cool water stream generating units

11-12 (strong, medium or weak), the operation (driving) of each of the vibration generating units 21-28, and the like are controlled by a controlling unit 35, for example on the basis of an input operation from the user via a remote controller 30.

(Embodiment 1-1: Effects)

[0109] According to the bathtub system 1 of the present embodiment as structured above, by the hot or cool water streams generated by the hot/cool water stream generating units 11-12, a relatively strong water pressure stimulation can be given to the user of the bathtub 2, as if it were penetrating into the user's body (e.g. muscles), while a delicate water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-28 can be given mainly to a surface (e.g. skin) of the user's body. This can provide a finely tuned comfort to the user.

[0110] In addition, according to the bathtub system 1 of the present embodiment, a maximum value in the bathtub 2 of the water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-28 is adjusted to be smaller than a maximum value in the bathtub 2 of the water pressure stimulation caused by the hot or cool water stream generated by each of the hot/cool water stream generating units 11-12.

[0111] According to this feature, it is more surely prevented that the vibration generated by each of the vibration generating units 21-28 interferes with action of the hot or cool water stream generated by each of the hot/cool water stream generating units 11-12.

[0112] In addition, according to the bathtub system 1 of the present embodiment, at a predetermined position in the bathtub 2 (such as a position corresponding to a body surface of a user who is to sit or lie in the bathtub 2), the water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-28 is adjusted to be smaller than the water pressure stimulation caused by the hot or cool water stream generated by each of the hot/cool water stream generating units 11-12.

[0113] According to this feature, it is effectively inhibited that a too strong stimulation is given to the user's skin (which may provide discomfort to the user).

[0114] In addition, according to the bathtub system 1 of the present embodiment, the hot/cool water stream generating units 11-12 are located on the back side wall surface 2a of the bathtub 2, and the vibration generating units for shoulders 21-22 are also located on the back side wall surface 2a of the bathtub 2.

[0115] According to this feature, on the back side of the body where the user is more likely to feel stimulation, the user can perceive comfort effects of both the stimulation by the vibration(s) and the stimulation by the hot or cool water stream(s).

[0116] In addition, according to the bathtub system 1 of the present embodiment, the vibration generating units for shoulders 21-22 are located above the hot/cool water

stream generating units 11-12.

[0117] As the hot/cool water stream generating units 11-12 are located on the back side wall surface 2a of the bathtub 2, it is expected that the momentum of the hot or cool water streams from the hot/cool water stream generating units 11-12 will cause the user's shoulder side to approach the back side wall surface 2a of the bathtub 2. Therefore, by locating the vibration generating units for shoulders 21-22 on the back side wall surface 2a of the bathtub 2 in an area where the user's shoulder side will approach in the above way, the user can perceive comfort effects of the vibration by the vibration generating units for shoulders 21-22 more easily on the user's shoulder side.

[0118] Furthermore, according to the bathtub system 1 of the present embodiment, the back side wall surface 2a of the bathtub 2, where the vibration generating units for shoulders 21-22 are located, is inclined.

[0119] When the user's shoulder side approaches the back side wall surface 2a of the bathtub 2, as the back side wall surface 2a of the bathtub 2 is inclined, the back side wall surface 2a of the bathtub 2 is more likely to conform to the user's body line. Herein, as the vibration generating units for shoulders 21-22 are located there, the user can perceive comfort effects of the vibration by the vibration generating units for shoulders 21-22 more easily.

[0120] Furthermore, according to the bathtub system 1 of the present embodiment, the direction of the vibration generated by each of the vibration generating units for shoulders 21-22 is in an oblique vertical direction.

[0121] When the user's shoulder side approaches the back side wall surface 2a of the bathtub 2, as the direction of the vibration generated by each of the vibration generating units for shoulders 21-22 is in an oblique vertical direction, the user can perceive comfort effects of the vibration more easily on the user's shoulder side.

[0122] In addition, according to the bathtub system 1 of the present embodiment, the direction of the vibration generated by the vibration generating units for buttocks 25-26, the direction of the vibration generated by the left vibration generating unit 27 and the direction of the vibration generated by the right vibration generating unit 28 form a substantially right angle with the direction of the hot or cool water streams generated by the hot/cool water stream generating units 11-12, respectively. In the present invention, the term "a substantially right angle" is defined to include not only 90°, but also any angle between 70° and 110°.

[0123] According to this feature, the user is more likely to perceive the comfort effects of both the stimulation by the vibration generated by each of the vibration generating units 21-28 and the stimulation by the hot or cool water stream from each of the hot/cool water stream generating units 11-12, respectively independently.

[0124] In addition, according to the bathtub system 1 of the present embodiment, the vibration generating units for legs 23-24 are located on the leg side wall surface 2b

of the bathtub 2, and the vibration generating units for legs 23-24 and the hot/cool water stream generating units 11-12 are located at positions offset from each other in a height direction.

[0125] According to this feature, the user is more likely to perceive the comfort effects of both the stimulation by the vibration from the vibration generating units for legs 23-24 and the stimulation by the hot or cool water stream from each of the hot/cool water stream generating units 11-12, respectively independently.

[0126] Herein, as an alternative or in addition to the feature wherein the vibration generating units for legs 23-24 and the hot/cool water stream generating units 11-12 are offset from each other in a height direction, the vibration generating units for legs 23-24 and the hot/cool water stream generating units 11-12 may preferably be offset from each other in a left and right direction (for example, the pair of left and right vibration generating units for legs 23-24 may be arranged symmetrically in a left and right direction in the bathtub 2, and their respective central axes may be separated from each other by 250 mm).

(Embodiment 1-2: Structure)

[0127] Hereinafter, an embodiment 1-2 of the present invention is explained with reference to the attached drawings. Unless otherwise explained, the structure (arrangement configuration) of a bathtub system 101 of the embodiment 1-2 of the present invention is similar to that of the bathtub system 1 of the embodiment 1-1 of the present invention described with reference to Figs. 1 to 7. Fig. 9 is an irregular schematic sectional view of the bathtub system 101 of the embodiment 1-2 of the invention, through a hot/cool water stream generating unit 111 (located closer to the left side in a left and right direction) and a water intake inlet 109 (located in the center in a left and right direction).

[0128] A bathtub 102 has a bottom, a portion of which is a more recessed area against which buttocks of a user is to face. The bathtub 102 has a substantially rectangular (substantially oblong) shape of 900 mm x 1,690 mm in a plan view at a standard height plane (e.g. at a height of 210 mm from the deepest bottom of the more recessed area against which buttocks of a user is to face) which corresponds to a water height when hot or cool water has been pooled in the bathtub 2. The right-hand area is not illustrated in the cross-section in Fig. 9, and only numerical signs are shown in brackets for symmetrical right-hand elements.

[0129] A pair of left and right hot/cool water stream generating units 111, 112 are provided in such a manner that respective central axes thereof are positioned at a predetermined height (e.g. at a height of 45 mm from the bottom of the bathtub 102) of the back side wall surface 102a, against which a waist of the user is to face. The back side wall surface 102a is inclined at an angle of approximately 50° to the vertical plane in the area where

the pair of left and right hot/cool water stream generating units 111, 112 are installed. The pair of left and right hot/cool water stream generating units 111, 112 are arranged symmetrically in a left and right direction in the bathtub 102, and their respective central axes are separated from each other by 140 mm.

[0130] Each of the pair of left and right hot/cool water stream generating units 111, 112 is a device mechanism configured to generate a hot or cool water stream inside pooled hot or cool water, which is to have been already pooled in the bathtub 102, by vigorously supplying hot or cool water into the bathtub 102. Each of the pair of left and right hot/cool water stream generating units 111, 112 is visible on the back side wall surface 102a as a member formed into a circular ring having an outer diameter of 70 mm, an inner diameter of 28 mm and a projection height (thickness) into the bathtub 102 of 9 mm.

[0131] Returning to Fig. 9, a water intake port 109 for circulating hot or cool water to the hot/cool water stream generating units 111, 112 is provided on the leg side wall surface 102b of the bathtub 102 at a predetermined location (e.g. at a position in the center in a left and right direction, at a height of 180 mm from the bottom of the bathtub 102). In the example shown in Fig. 9, the water intake port 109 is a member formed into a circular disk having an outer diameter of 90 mm and a projection height (thickness) into the bathtub 102 of 12 mm.

[0132] In the example of each of the hot/cool water stream generating units 111, 112 shown in Figs. 2 and 3, no air is mixed into the hot or cool water stream. Herein, Fig. 4 is a schematic view of a bathtub system in which another example of each of the hot/cool water stream generating units 111, 112 is installed. As shown in Fig. 4, it is possible to adopt a device mechanism configured to generate a hot or cool water stream inside pooled hot or cool water, which is to have been already pooled in the bathtub 102, by vigorously supplying air-mixed hot or cool water into the bathtub 102 (such as a device mechanism manufactured and marketed by TOTO LTD. under the name of "Blow Bath").

[0133] On the other hand, a pair of left and right vibration generating units for shoulders 121, 122 are provided in such a manner that respective central axes thereof are positioned at a predetermined height (e.g. at a height of 250 mm from the deepest bottom of the bathtub 102) of the back side wall surface 102a, against which shoulders of the user are to face. The back side wall surface 102a is inclined at an angle of approximately 50° to the vertical plane in the area where the pair of left and right vibration generating units for shoulders 121, 122 are installed. The pair of left and right vibration generating units for shoulders 121, 122 are arranged symmetrically in a left and right direction in the bathtub 102, and their respective central axes are separated from each other by 250 mm. A direction of vibration generated by each of the vibration generating units for shoulders 121, 122 is adjusted in a direction perpendicular to the back side wall surface 102a. As a result, the direction of vibration generated

by each of the vibration generating units for shoulders 121, 122 is in an oblique vertical direction inclined at an angle of approximately 50° to the horizontal plane.

[0134] In addition, a pair of left and right vibration generating units for legs 123, 124 are provided in such a manner that respective central axes thereof are positioned at a predetermined height (e.g. at a height of 300 mm from the deepest bottom of the bathtub 102) of the leg side wall surface 102b. The pair of left and right vibration generating units for legs 123, 124 are arranged symmetrically in a left and right direction in the bathtub 102, and their respective central axes are separated from each other by 250 mm.

[0135] In addition, a pair of left and right vibration generating units for buttocks 125, 126 are provided in such a manner that respective central axes thereof are positioned at a predetermined location (e.g. at a position of 150 mm from a lower end of the back side wall surface 102a toward the leg side) of the bottom of the bathtub 102, against which buttocks of the user are to face. The pair of left and right vibration generating units for buttocks 125, 126 are arranged symmetrically in a left and right direction in the bathtub 102, and their respective central axes are separated from each other by 250 mm.

[0136] Furthermore, a left side vibration generating unit 127 and a right side vibration generating unit 128 are provided in such a manner that respective central axes thereof are positioned at a predetermined location (e.g. at a position of 50 mm from a lower end of the back side wall surface 102a toward the shoulder side at a height of 200 mm from the deepest bottom of the bathtub 102) of the left side wall surface 102c and the right side wall surface 102d of the bathtub 102, respectively.

[0137] The vibration generating units for shoulders 121, 122, the vibration generating units for legs 123, 124, the vibration generating units for buttocks 125, 126, the left side vibration generating unit 127 and the right side vibration generating unit 128 may have a common configuration. For example, a common speaker or the like may be adopted for them. The description of the vibration generating units 21-28 with reference to Figs. 5 to 9 can also be applied to the vibration generating units 121-128.

(Embodiment 1-2: Control Configuration)

[0138] In the present embodiment as well, a maximum value in the bathtub 102 of the water pressure stimulation caused by the vibration generated by each of the vibration generating units 121-128 (usually, the water pressure stimulation in an area in the immediate vicinity of each of the vibration generating units 121-128) is set to be smaller than a maximum value in the bathtub 102 of the water pressure stimulation caused by the hot or cool water stream generated by each of the hot/cool water stream generating units 111-112 (usually, the water pressure stimulation in an area in the immediate vicinity of each of the hot/cool water stream generating units

111-112).

[0139] Furthermore, in the present embodiment as well, at a predetermined position in the bathtub 102 (such as a position corresponding to a body surface of a user who is to sit or lie in the bathtub 102), the water pressure stimulation caused by the vibration generated by each of the vibration generating units 121-128 is set to be smaller than the water pressure stimulation caused by the hot or cool water stream generated by each of the hot/cool water stream generating units 111-112.

[0140] These settings can be achieved by adjusting an electrical signal for driving each of the vibration generating units 121-128 and an electrical signal for driving each of the hot/cool water stream generating units 111-112 (in particular, an electrical signal supplied to a built-in motor for jetting the hot or cool water).

[0141] The "water pressure stimulation" used as an indicator for the adjustment of these electrical signals can be evaluated (measured), for example, according to the "water pressure stimulation measurement method" described above. Then, the strength of each vibration can be pre-adjusted, for example, as described in paragraphs 0098 to 0106.

[0142] The operation (driving) of the hot/cool water stream generating units 111-112, the selection of the output strength of the hot/cool water stream generating units 111-112 (strong, medium or weak), the operation (driving) of each of the vibration generating units 121-128, and the like are controlled by a controlling unit 135, for example on the basis of an input operation from the user via a remote controller 130.

(Embodiment 1-2: Effects)

[0143] According to the bathtub system 101 of the present embodiment as well, by the hot or cool water streams generated by the hot/cool water stream generating units 111-112, a relatively strong water pressure stimulation can be given to the user of the bathtub 102, as if it were penetrating into the user's body (e.g. muscles), while a delicate water pressure stimulation caused by the vibration generated by each of the vibration generating units 121-128 can be given mainly to a surface (e.g. skin) of the user's body. This can provide a finely tuned comfort to the user.

[0144] In addition, according to the bathtub system 101 of the present embodiment as well, a maximum value in the bathtub 102 of the water pressure stimulation caused by the vibration generated by each of the vibration generating units 121-128 is adjusted to be smaller than a maximum value in the bathtub 102 of the water pressure stimulation caused by the hot or cool water stream generated by each of the hot/cool water stream generating units 111-112.

[0145] According to this feature, it is more surely prevented that the vibration generated by each of the vibration generating units 121-128 interferes with action of the hot or cool water stream generated by each of the hot/-

cool water stream generating units 111-112.

[0146] In addition, according to the bathtub system 101 of the present embodiment as well, at a predetermined position in the bathtub 102 (such as a position corresponding to a body surface of a user who is to sit or lie in the bathtub 102), the water pressure stimulation caused by the vibration generated by each of the vibration generating units 121-128 is adjusted to be smaller than the water pressure stimulation caused by the hot or cool water stream generated by each of the hot/cool water stream generating units 111-112.

[0147] According to this feature, it is effectively inhibited that a too strong stimulation is given to the user's skin (which may provide discomfort to the user).

[0148] In addition, according to the bathtub system 101 of the present embodiment as well, the hot/cool water stream generating units 111-112 are located on the back side wall surface 102a of the bathtub 102, and the vibration generating units for shoulders 121-122 are also located on the back side wall surface 102a of the bathtub 102.

[0149] According to this feature, on the back side of the body where the user is more likely to feel stimulation, the user can perceive comfort effects of both the stimulation by the vibration(s) and the stimulation by the hot or cool water stream(s).

[0150] In addition, according to the bathtub system 101 of the present embodiment as well, the vibration generating units for shoulders 121-122 are located above the hot/cool water stream generating units 111-112.

[0151] As the hot/cool water stream generating units 111-112 are located on the back side wall surface 102a of the bathtub 102, it is expected that the momentum of the hot or cool water streams from the hot/cool water stream generating units 111-112 will cause the user's shoulder side to approach the back side wall surface 102a of the bathtub 102. Therefore, by locating the vibration generating units for shoulders 121-122 on the back side wall surface 102a of the bathtub 102 in an area where the user's shoulder side will approach in the above way, the user can perceive comfort effects of the vibration by the vibration generating units for shoulders 121-122 more easily on the user's shoulder side.

[0152] Furthermore, according to the bathtub system 101 of the present embodiment as well, the back side wall surface 102a of the bathtub 102, where the vibration generating units for shoulders 121-122 are located, is inclined.

[0153] When the user's shoulder side approaches the back side wall surface 102a of the bathtub 102, as the back side wall surface 102a of the bathtub 102 is inclined, the back side wall surface 102a of the bathtub 102 is more likely to conform to the user's body line. Herein, as the vibration generating units for shoulders 121-122 are located there, the user can perceive comfort effects of the vibration by the vibration generating units for shoulders 121-122 more easily.

[0154] Furthermore, according to the bathtub system

101 of the present embodiment as well, the direction of the vibration generated by each of the vibration generating units for shoulders 121-122 is in an oblique vertical direction.

[0155] When the user's shoulder side approaches the back side wall surface 102a of the bathtub 102, as the direction of the vibration generated by each of the vibration generating units for shoulders 121-122 is in an oblique vertical direction, the user can perceive comfort effects of the vibration more easily on the user's shoulder side.

[0156] In addition, according to the bathtub system 101 of the present embodiment as well, the direction of the vibration generated by the vibration generating units for buttocks 125-126, the direction of the vibration generated by the left vibration generating unit 127 and the direction of the vibration generated by the right vibration generating unit 128 form a substantially right angle with the direction of the hot or cool water streams generated by the hot/cool water stream generating units 111-112, respectively.

[0157] According to this feature, the user is more likely to perceive the comfort effects of both the stimulation by the vibration generated by each of the vibration generating units 121-128 and the stimulation by the hot or cool water stream from each of the hot/cool water stream generating units 111-112, respectively independently.

[0158] In addition, according to the bathtub system 101 of the present embodiment as well, the vibration generating units for legs 123-124 are located on the leg side wall surface 102b of the bathtub 102, and the vibration generating units for legs 123-124 and the hot/cool water stream generating units 111-112 are located at positions offset from each other in a height direction.

[0159] According to this feature, the user is more likely to perceive the comfort effects of both the stimulation by the vibration from the vibration generating units for legs 123-124 and the stimulation by the hot or cool water stream from each of the hot/cool water stream generating units 111-112, respectively independently.

(Embodiment 2-1: Structure)

[0160] Hereinafter, an embodiment 2-1 of the present invention is explained with reference to the attached drawings. The structure (arrangement configuration) of a bathtub system of the embodiment 2-1 of the present invention is the same as that of the bathtub system 1 of the embodiment 1-1 of the present invention described with reference to Figs. 1 to 7.

(Embodiment 2-1: Control Configuration)

[0161] In the present embodiment, the water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-28 and the water pressure stimulation caused by the hot or cool water stream generated by each of the hot/cool water stream generat-

ing units 11-12 are adapted not to interfere with each other.

[0162] These settings can be achieved by adjusting respective supply timings or the like of an electrical signal for driving each of the vibration generating units 21-28 and an electrical signal for driving each of the hot/cool water stream generating units 11-12 (in particular, an electrical signal supplied to a built-in motor for jetting the hot or cool water).

[0163] The "water pressure stimulation" used as an indicator for the adjustment of these electrical signals can be evaluated (measured), for example, according to the "water pressure stimulation measurement method" described above. Then, the strength of each vibration can be pre-adjusted, for example, as described in paragraphs 0098 to 0106.

[0164] The operation (driving) of the hot/cool water stream generating units 11-12, the selection of the output strength of the hot/cool water stream generating units 11-12 (strong, medium or weak), the operation (driving) of each of the vibration generating units 21-28, and the like are controlled by the controlling unit 35, for example on the basis of an input operation from the user via the remote controller 30.

[0165] Herein, the controlling unit 35 of the present embodiment is configured to coordinate operations of the hot/cool water stream generating units 11-12 and operations of the vibration generating units 21-28 (i.e., configured to correlate them with each other).

[0166] Specifically, the controlling unit 35 is settable at a simultaneous-operation blocking mode (1), for example on the basis of an input operation from the user via the remote controller 30. As shown in Fig. 10, in the simultaneous-operation blocking mode (1), the controlling unit 35 is configured not to start an operation of any of the vibration generating units 21-28 during an operation of one or more of the hot/cool water stream generating units 11-12 and not to start an operation of any of the hot/cool water stream generating units 11-12 during an operation of one or more of the vibration generating units 21-28. More specifically, when the controlling unit 35 in the simultaneous-operation blocking mode (1) receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of one or more of the hot/cool water stream generating units 11-12, the controlling unit 35 is configured to start the operation of the one or more of the vibration generating units 21-28 after the operation of the one or more of the hot/cool water stream generating units 11-12 is completed, and when the controlling unit 35 in the simultaneous-operation blocking mode (1) receives an instruction for starting an operation of any one or more of the hot/cool water stream generating units 11-12 during an operation of one or more of the vibration generating units 21-28, the controlling unit 35 is configured to start the operation of the one or more of the hot/cool water stream generating units 11-12 after the operation of the one or more of the vibration generating units 21-28 is com-

pleted.

[0167] According to this feature, it is possible to achieve an operational control in which operational contents by the user (user's intention to use the hot/cool water stream generating units 11-12 or the vibration generating units 21-28) are respected, while surely preventing that the operation of any of the hot/cool water stream generating units 11-12 and the operation of any of the vibration generating units 21-28 interfere with each other.

[0168] Herein, in terms of the completion of the operation of the one or more of the hot/cool water stream generating units 11-12 or the one or more of the vibration generating units 21-28, for example, if an ongoing function is to continue for a preselected period of time, the ongoing function may be completed after the preselected period of time has elapsed. Alternatively, at a timing at which operational contents to use another (not ongoing) function are received, a message such as "The water discharge function will be stopped for starting the vibration function" is issued, and the ongoing function may be completed (stopped) immediately. The message to the user is not limited to an audible one, but can also be a visual one by using a display unit or the like.

[0169] Furthermore, as shown in Fig. 10, when the controlling unit 35 in the simultaneous-operation blocking mode (1) receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of one or more of the hot/cool water stream generating units 11-12, the controlling unit 35 is configured to start the operation of the one or more of the vibration generating units 21-28 within a predetermined period of time after the operation of the one or more of the hot/cool water stream generating units 11-12 has been completed.

[0170] According to this feature, the vibration(s) is given within the predetermined period of time during which there is still a lingering effect of the hot/cool water stream(s) generated by the one or more of the hot/cool water stream generating units 11-12, so that the change from the water stream stimulation to the vibration stimulation can be made with less discomfort for the user.

[0171] In the present embodiment, the predetermined period of time is set to correspond to 70 % of a period of time which it takes for the hot/cool water stream remaining in the bathtub 2 after the completion of the operation of the one or more of the hot/cool water stream generating units 11-12 to disappear.

[0172] According to this feature, the change from the water stream stimulation to the vibration stimulation can be made with less discomfort for the user, more effectively.

[0173] In the present embodiment, the period of time which it takes for the hot/cool water stream remaining in the bathtub 2 after the completion of the operation of the one or more of the hot/cool water stream generating units 11-12 to disappear is: about 25 seconds when the one or more of the hot/cool water stream generating units 11-12

is driven at the "strong output strength", about 20 seconds when the one or more of the hot/cool water stream generating units 11-12 is driven at the "medium output strength", and about 15 seconds when the one or more of the hot/cool water stream generating units 11-12 is driven at the "weak output strength". Herein, in the present embodiment, the state in which the hot/cool water stream remaining in the bathtub 2 has disappeared is, for example, a state in which no wave (no oscillation) is found on the surface of the hot or cool water pooled in the bathtub 2.

[0174] Fig. 10 is explained in detail. When an instruction (a command) for starting an operation of any one or more of the vibration generating units 21-28 is received (YES in STEP 11), it is judged whether or not it is during an operation of any one or more of the hot/cool water stream generating units 11-12 (STEP 12). When it is during an operation of any one or more of the hot/cool water stream generating units 11-12 (YES in STEP 12), the next step waits until the operation of the one or more of the hot/cool water stream generating units 11-12 is completed (STEP 13). Then, the operation of the one or more of the vibration generating units 21-28 is started within the predetermined period of time after the operation of the one or more of the hot/cool water stream generating units 11-12 has been completed (STEP 14). When it is not during an operation of any one or more of the hot/cool water stream generating units 11-12 (NO in STEP 12), the operation of the one or more of the vibration generating units 21-28 is started immediately (STEP 15).

[0175] Roughly symmetrically, when an instruction (a command) for starting an operation of any one or more of the hot/cool water stream generating units 11-12 is received (YES in STEP 21), it is judged whether or not it is during an operation of any one or more of the vibration generating units 21-28 (STEP 22). When it is during an operation of any one or more of the vibration generating units 21-28 (YES in STEP 22), the next step waits until the operation of the one or more of the vibration generating units 21-28 is completed (STEP 23). Then, the operation of the one or more of the hot/cool water stream generating units 11-12 is started (STEP 24). When it is not during an operation of any one or more of the vibration generating units 21-28 (NO in STEP 22), the operation of the one or more of the hot/cool water stream generating units 11-12 is started immediately (STEP 24).

[0176] Furthermore, the controlling unit 35 of the present embodiment is settable at a simultaneous-operation acceptable mode, for example on the basis of an input operation from the user via the remote controller 30. As shown in Fig. 11, when the controlling unit 35 in the simultaneous-operation acceptable mode receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of one or more of the hot/cool water stream generating units 11-12, the controlling unit 35 is configured to forcibly switch the ongoing output strength of the one or more of the hot/cool water stream generating units 11-12

into "weak output strength" and then to start the operation of the one or more of the vibration generating units 21-28, and when the controlling unit 35 in the simultaneous-operation acceptable mode receives an instruction for starting an operation of any one or more of the hot/cool water stream generating units 11-12 during an operation of one or more of the vibration generating units 21-28, the controlling unit 35 is configured to forcibly switch the pre-set output strength of the one or more of the hot/cool water stream generating units 11-12 into "weak output strength" and then to start the operation of the one or more of the hot/cool water stream generating units 11-12.

[0177] According to this feature, the situation is surely prevented in which the user cannot perceive the comfort effects of the vibration generated by any of the vibration generating units 21-28 because the hot or cool water stream generated by any of the hot/cool water stream generating units 11-12 has too strong effects.

[0178] Fig. 11 is explained in detail. When an instruction (a command) for starting an operation of any one or more of the vibration generating units 21-28 is received (YES in STEP 31), it is judged whether or not it is during an operation of any one or more of the hot/cool water stream generating units 11-12 (STEP 32). When it is during an operation of any one or more of the hot/cool water stream generating units 11-12 (YES in STEP 32), it is judged whether the one or more of the hot/cool water stream generating units 11-12 is not driven at the "weak output strength" (STEP 33). When any of the one or more of the hot/cool water stream generating units 11-12 during the operation is not driven at the "weak output strength" (YES in STEP 33), the ongoing output strength of the one or more of the hot/cool water stream generating units 11-12 is forcibly switched into the "weak output strength" (STEP 34). Then, the operation of the one or more of the vibration generating units 21-28 is started (STEP 35). When it is not during an operation of any one or more of the hot/cool water stream generating units 11-12 (NO in STEP 32), the operation of the one or more of the vibration generating units 21-28 is started immediately (STEP 35). When all of the one or more of the hot/cool water stream generating units 11-12 during the operation is driven at the "weak output strength" (NO in STEP 33), the operation of the one or more of the vibration generating units 21-28 is started immediately (STEP 35).

[0179] Roughly symmetrically, when an instruction (a command) for starting an operation of any one or more of the hot/cool water stream generating units 11-12 is received (YES in STEP 41), it is judged whether or not it is during an operation of any one or more of the vibration generating units 21-28 (STEP 42). When it is during an operation of any one or more of the vibration generating units 21-28 (YES in STEP 42), it is judged whether the one or more of the hot/cool water stream generating units 11-12 is not pre-set (selected) at the "weak output strength" (STEP 43). When any of the one or more of the hot/cool water stream generating units 11-12 is not

pre-set (selected) at the "weak output strength" (YES in STEP 43), the pre-set (selected) output strength of the one or more of the hot/cool water stream generating units 11-12 is forcibly switched into the "weak output strength" (STEP 44). Then, the operation of the one or more of the hot/cool water stream generating units 11-12 is started (STEP 45). When it is not during an operation of any one or more of the vibration generating units 21-28 (NO in STEP 42), the operation of the one or more of the hot/cool water stream generating units 11-12 is started immediately (STEP 45). When all of the one or more of the hot/cool water stream generating units 11-12 is pre-set (selected) at the "weak output strength" (NO in STEP 43), the operation of the one or more of the hot/cool water stream generating units 11-12 is started immediately (STEP 45).

(Embodiment 2-1: Effects)

[0180] According to the bathtub system 1 of the present embodiment as structured above, by the hot or cool water streams generated by the hot/cool water stream generating units 11-12, a relatively strong water pressure stimulation can be given to the user of the bathtub 2, as if it were penetrating into the user's body (e.g. muscles), while a delicate water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-28 can be given mainly to a surface (e.g. skin) of the user's body. This can provide a finely tuned comfort to the user. In particular, by coordinating the operations of the hot/cool water stream generating units 11-12 and the operations of the vibration generating units 21-28 (by correlating them with each other), the finely tuned comfort for the user can be more improved.

[0181] In addition, according to the bathtub system 1 of the present embodiment, the controlling unit 35 is settable at the simultaneous-operation blocking mode (1), the controlling unit 35 in the simultaneous-operation blocking mode (1) is configured not to start an operation of any one or more of the vibration generating units 11-12 during an operation of one or more of the hot/cool water stream generating units 11-12 and not to start an operation of any one or more of the hot/cool water stream generating units 11-12 during an operation of one or more of the vibration generating units 21-28.

[0182] According to this feature, it is surely prevented that the operation of any of the hot/cool water stream generating units 11-12 and the operation of any of the vibration generating units 21-28 interfere with each other.

[0183] Furthermore, according to the bathtub system 1 of the present embodiment, when the controlling unit 35 in the simultaneous-operation blocking mode (1) receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of one or more of the hot/cool water stream generating units 11-12, the controlling unit 35 is configured to start the operation of the one or more of the vibration generating units 21-28 after the operation of

the one or more of the hot/cool water stream generating units 11-12 is completed, and when the controlling unit 35 in the simultaneous-operation blocking mode (1) receives an instruction for starting an operation of any one or more of the hot/cool water stream generating units 11-12 during an operation of one or more of the vibration generating units 21-28, the controlling unit 35 is configured to start the operation of the one or more of the hot/cool water stream generating units 11-12 after the operation of the one or more of the vibration generating units 21-28 is completed.

[0184] According to this feature, it is possible to achieve an operational control in which operational contents by the user (user's intention to use the hot/cool water stream generating units 11-12 or the vibration generating units 21-28) are respected, while surely preventing that the operation of any of the hot/cool water stream generating units 11-12 and the operation of any of the vibration generating units 11-12 interfere with each other.

[0185] Furthermore, according to the bathtub system 1 of the present embodiment, when the controlling unit 35 in the simultaneous-operation blocking mode (1) receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of one or more of the hot/cool water stream generating units 11-12, the controlling unit 35 is configured to start the operation of the one or more of the vibration generating units 21-28 within a predetermined period of time after the operation of the one or more of the hot/cool water stream generating units 11-12 has been completed.

[0186] According to this feature, the vibration(s) is given within the predetermined period of time during which there is still a lingering effect of the hot/cool water stream(s) generated by the one or more of the hot/cool water stream generating units 11-12, so that the change from the water stream stimulation to the vibration stimulation can be made with less discomfort for the user.

[0187] Furthermore, according to the bathtub system 1 of the present embodiment, the controlling unit 35 is settable at the simultaneous-operation acceptable mode, when the controlling unit 35 in the simultaneous-operation acceptable mode receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of one or more of the hot/cool water stream generating units 11-12, the controlling unit 35 is configured to forcibly switch the ongoing output strength of the one or more of the hot/cool water stream generating units 11-12 into "weak output strength" and then to start the operation of the one or more of the vibration generating units 21-28, and when the controlling unit 35 in the simultaneous-operation acceptable mode receives an instruction for starting an operation of any one or more of the hot/cool water stream generating units 11-12 during an operation of one or more of the vibration generating units 21-28, the controlling unit 35 is configured to forcibly switch the pre-

set output strength of the one or more of the hot/cool water stream generating units 11-12 into "weak output strength" and then to start the operation of the one or more of the hot/cool water stream generating units 11-12.

[0188] According to this feature, the situation is surely prevented in which the user cannot perceive the comfort effects of the vibration generated by any of the vibration generating units 21-28 because the hot or cool water stream generated by any of the hot/cool water stream generating units 11-12 has too strong effects.

[0189] In the present embodiment, as described above, when the controlling unit 35 in the simultaneous-operation acceptable mode receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of one or more of the hot/cool water stream generating units 11-12, the controlling unit 35 is configured to forcibly switch the ongoing output strength of the one or more of the hot/cool water stream generating units 11-12 into the "weak output strength" and then to start the operation of the one or more of the vibration generating units 21-28, and when the controlling unit 35 in the simultaneous-operation acceptable mode receives an instruction for starting an operation of any one or more of the hot/cool water stream generating units 11-12 during an operation of one or more of the vibration generating units 21-28, the controlling unit 35 is configured to forcibly switch the preset output strength of the one or more of the hot/cool water stream generating units 11-12 into the "weak output strength" and then to start the operation of the one or more of the hot/cool water stream generating units 11-12. However, the present invention is not limited to this manner. For example, when the controlling unit 35 in the simultaneous-operation acceptable mode receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of one or more of the hot/cool water stream generating units 11-12, the controlling unit 35 may be configured to forcibly switch the ongoing output strength of the one or more of the hot/cool water stream generating units 11-12 into output strength further weaker than the "weak output strength" and then to start the operation of the one or more of the vibration generating units 21-28, and when the controlling unit 35 in the simultaneous-operation acceptable mode receives an instruction for starting an operation of any one or more of the hot/cool water stream generating units 11-12 during an operation of one or more of the vibration generating units 21-28, the controlling unit 35 may be configured to forcibly switch the pre-set output strength of the one or more of the hot/cool water stream generating units 11-12 into output strength further weaker than the "weak output strength" and then to start the operation of the one or more of the hot/cool water stream generating units 11-12.

(Embodiment 3-1: Structure)

[0190] Hereinafter, an embodiment 3-1 of the present

invention is explained with reference to the attached drawings. Unless otherwise explained, the structure (arrangement configuration) of a bathtub system of the embodiment 3-1 of the present invention is similar to that of the bathtub system 1 of the embodiment 1-1 of the present invention described with reference to Figs. 1 to 7 and that of the bathtub system 1 of the embodiment 2-1 of the present invention.

[0191] In the present embodiment, as shown in Fig. 12, a discharge water stream generating unit 13 is provided. The discharge water stream generating unit 13 has a slit-like shape extending in a left and right direction. A bottom of the discharge water stream generating unit 13 is positioned at a predetermined height (e.g. at a height of 500 mm from the bottom of the bathtub 2) on the back side wall surface 2a, corresponding to an area above shoulders of a user of the bathtub 2 (which area may cover the back side of a neck of the user).

[0192] The discharge water stream generating unit 13 is a device mechanism manufactured and marketed by TOTO LTD. under the name of "Katarakuyu" (which means 'shoulder comfortable hot water') and is configured to generate a discharge water stream above a surface of pooled hot or cool water, which is to have been already pooled in the bathtub 2, by vigorously supplying hot or cool water into the bathtub 2. The discharge water stream generating unit 13 is visible on the back side wall surface 2a as a slit-like area, whose length in a left and right direction is 440 mm and whose height is 2 mm.

[0193] The water intake ports 9a, 9b serve for circulating hot or cool water to the hot/cool water stream generating units 11, 12 and the discharge water stream generating unit 13. The water intake ports 9a, 9b are provided on the left side wall surface 2c of the bathtub 2 at the predetermined two locations (e.g. at positions of 170 mm and 780 mm from a lower end of the back side wall surface 2a toward the leg side, at a height of 90 mm from the bottom of the bathtub 2). Each of the water intake ports 9a, 9b is a member formed into a circular disk having an outer diameter of 82 mm and a projection height (thickness) into the bathtub 2 of 14 mm.

[0194] Furthermore, Fig. 12 shows a bottom landing position on the bottom of the bathtub 2, at which the discharge water stream generated by the discharge water stream generating unit 13 is to land, in a hypothetical situation in which there is no hot or cool water pooled in the bathtub 2.

(Embodiment 3-1: Control Configuration)

[0195] The control configuration of the bathtub system of the embodiment 3-1 of the present invention is the same as that of the bathtub system 1 of the embodiment 1-1 of the present invention described with reference to Fig. 8.

(Embodiment 3-1: Control Configuration (2))

[0196] Furthermore, in the present embodiment, in a hypothetical situation in which there is no hot or cool water pooled in the bathtub 2, when the discharge water stream generating unit 13 is driven at "strong output strength", the discharge water stream generated by the discharge water stream generating unit 13 is to land at a predetermined bottom landing position (e.g. at a position of 400 mm from a lower end of the back side wall surface 2a toward the leg side) on the bottom of the bathtub 2. Therefore, in the present embodiment, the vibration generating units 21-22 and 25-28 are located on the user's back side in a front and rear direction with respect to the predetermined bottom landing position when the discharge water stream generating unit 13 is driven at the "strong output strength".

[0197] Furthermore, in the present embodiment, in a hypothetical situation in which there is pooled hot or cool water in the bathtub 2 (whose recommendable standard water height is e.g. 350 mm), when the discharge water stream generating unit 13 is driven at the "strong output strength", the discharge water stream generated by the discharge water stream generating unit 13 is to land at a predetermined surface landing position (e.g. whose drooping point onto the bottom of the bathtub 2 corresponds to a position of 200 mm from a lower end of the back side wall surface 2a toward the leg side) on a surface of the pooled hot or cool water. Therefore, in the present embodiment, the vibration generating units 21-22 and 25-28 are located on the user's back side in the front and rear direction with respect to the predetermined surface landing position when the discharge water stream generating unit 13 is driven at the "strong output strength".

[0198] Substantially similarly, in the present embodiment, in a hypothetical situation in which there is no hot or cool water pooled in the bathtub 2, when the discharge water stream generating unit 13 is driven at "medium output strength", the discharge water stream generated by the discharge water stream generating unit 13 is to land at another predetermined bottom landing position (e.g. at a position of 300 mm from a lower end of the back side wall surface 2a toward the leg side) on the bottom of the bathtub 2. Therefore, in the present embodiment, the vibration generating units 21-22 and 25-28 are located on the user's back side in the front and rear direction with respect to the predetermined bottom landing position when the discharge water stream generating unit 13 is driven at the "medium output strength".

[0199] Furthermore, in the present embodiment, in a hypothetical situation in which there is pooled hot or cool water in the bathtub 2, when the discharge water stream generating unit 13 is driven at the "medium output strength", the discharge water stream generated by the discharge water stream generating unit 13 is to land at another predetermined surface landing position (e.g. whose drooping point onto the bottom of the bathtub 2

corresponds to a position of 150 mm from a lower end of the back side wall surface 2a toward the leg side) on a surface of the pooled hot or cool water. Therefore, in the present embodiment, the vibration generating units 21-22 and 25-28 are located on the user's back side in the front and rear direction with respect to the predetermined surface landing position when the discharge water stream generating unit 13 is driven at the "medium output strength".

[0200] On the other hand, in the present embodiment, in a hypothetical situation in which there is no hot or cool water pooled in the bathtub 2, when the discharge water stream generating unit 13 is driven at "weak output strength", the discharge water stream generated by the discharge water stream generating unit 13 is to land at further another predetermined bottom landing position (e.g. at a position of 250 mm from a lower end of the back side wall surface 2a toward the leg side) on the bottom of the bathtub 2. (Therefore, in the present embodiment, the vibration generating units 25-28 cannot be said to be located on the user's back side in the front and rear direction with respect to the predetermined bottom landing position when the discharge water stream generating unit 13 is driven at the "weak output strength").

[0201] Furthermore, in the present embodiment, in a hypothetical situation in which there is pooled hot or cool water in the bathtub 2, when the discharge water stream generating unit 13 is driven at the "weak output strength", the discharge water stream generated by the discharge water stream generating unit 13 is to land at further another predetermined surface landing position (e.g. whose drooping point onto the bottom of the bathtub 2 corresponds to a position of 100 mm from a lower end of the back side wall surface 2a toward the leg side) on a surface of the pooled hot or cool water. (Therefore, in the present embodiment, the vibration generating units 25-28 cannot be said to be located on the user's back side in the front and rear direction with respect to the predetermined surface landing position when the discharge water stream generating unit 13 is driven at the "weak output strength").

[0202] Herein, at the "strong output strength" of the discharge water stream generating unit 13, the hot or cool water is discharged at a flow rate of 65 little per 1 minute. At the "medium output strength" of the discharge water stream generating unit 13, the hot or cool water is discharged at a flow rate of 55 little per 1 minute. At the "weak output strength" of the discharge water stream generating unit 13, the hot or cool water is discharged at a flow rate of 49 little per 1 minute.

(Embodiment 3-1: Effects)

[0203] According to the bathtub system 1 of the present embodiment as structured above, by the discharge water stream from the discharge water stream generating unit 13, a relatively strong water pressure stimulation can be given to a user of the bathtub, as if it were penetrating into

the user's body (e.g. muscles, in particular around the user's neck or shoulders), while a delicate water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-28 can be given mainly to a surface (e.g. skin) of the user's body. This can provide a finely tuned comfort to the user.

[0204] In addition, according to the bathtub system 1 of the present embodiment, in a hypothetical situation in which there is no hot or cool water pooled in the bathtub 2, when the discharge water stream generating unit 13 is driven at the "strong output strength" or the "medium output strength", the discharge water stream generated by the discharge water stream generating unit 13 is to land at the above predetermined bottom landing position on the bottom of the bathtub 2, and the vibration generating units 21-22 and 25-28 are located on the user's back side in the front and rear direction with respect to the above predetermined bottom landing position.

[0205] According to this feature, the situation is effectively inhibited in which the water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-22 and 25-28 is interfered with the discharge water stream generated by the discharge water stream generating unit 13.

[0206] Furthermore, according to the bathtub system 1 of the present embodiment, in a hypothetical situation in which there is pooled hot or cool water in the bathtub 2, when the discharge water stream generating unit 13 is driven at the "strong output strength" or the "medium output strength", the discharge water stream generated by the discharge water stream generating unit 13 is to land at the above predetermined surface landing position on the surface of the pooled hot or cool water, and the vibration generating units 21-22 and 25-28 are located on the user's back side in the front and rear direction with respect to the above predetermined surface landing position.

[0207] According to this feature, the situation is more effectively inhibited in which the water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-22 and 25-28 is interfered with the discharge water stream generated by the discharge water stream generating unit 13.

[0208] Herein, in the present embodiment, the vibration generating units 25-28 cannot be said to be located on the user's back side in the front and rear direction both with respect to the predetermined bottom landing position when the discharge water stream generating unit 13 is driven at the "weak output strength" and with respect to the predetermined surface landing position when the discharge water stream generating unit 13 is driven at the "weak output strength". However, when the discharge water stream generating unit 13 is driven at the "weak output strength", the extent to which the discharge water stream generated by the discharge water stream generating unit 13 lands on the surface of the pooled hot or cool water at the front side (leg side) of the user and causes turbulence inside the pooled hot or cool water in the

bathtub 2 is relatively small. Therefore, when the discharge water stream generating unit 13 is driven at the "weak output strength", the user can perceive the vibration generated by each of the vibration generating units 21-22 and 25-28 sufficiently.

[0209] Furthermore, in the present embodiment, the vibration generating units for legs 23-24 are not located on the user's back side in the front and rear direction both with respect to the above predetermined bottom landing positions and with respect to the above predetermined surface landing positions. However, the vibration generated by each of the vibration generating units for legs 23-24 acts on the user's legs sufficiently away from the above predetermined bottom landing positions and the above predetermined surface landing positions, and thus the user can perceive the vibration generated by each of the vibration generating units for legs 23-24 sufficiently.

[0210] In addition to the above, according to the bathtub system 1 of the present embodiment as well as the bathtub system 1 of the embodiment 1-1, a maximum value in the bathtub 2 of the water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-28 is adjusted to be smaller than a maximum value in the bathtub 2 of the water pressure stimulation caused by the hot or cool water stream generated by each of the hot/cool water stream generating units 11-12.

[0211] According to this feature, it is more surely prevented that the vibration generated by each of the vibration generating units 21-28 is interfered with action of the hot or cool water stream generated by each of the hot/cool water stream generating units 11-12.

[0212] In addition, according to the bathtub system 1 of the present embodiment, at a predetermined position in the bathtub 2 (such as a position corresponding to a body surface of a user who is to sit or lie in the bathtub 2), the water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-28 is adjusted to be smaller than the water pressure stimulation caused by the hot or cool water stream generated by each of the hot/cool water stream generating units 11-12.

[0213] According to this feature, it is effectively inhibited that a too strong stimulation is given to the user's skin (which may provide discomfort to the user).

[0214] In addition, according to the bathtub system 1 of the present embodiment, the hot/cool water stream generating units 11-12 are located on the back side wall surface 2a of the bathtub 2, and the vibration generating units for shoulders 21-22 are also located on the back side wall surface 2a of the bathtub 2.

[0215] According to this feature, on the back side of the body where the user is more likely to feel stimulation, the user can perceive comfort effects of both the stimulation by the vibration(s) and the stimulation by the hot or cool water stream(s).

[0216] In addition, according to the bathtub system 1 of the present embodiment, the vibration generating units for shoulders 21-22 are located above the hot/cool water

stream generating units 11-12.

[0217] As the hot/cool water stream generating units 11-12 are located on the back side wall surface 2a of the bathtub 2, it is expected that the momentum of the hot or cool water streams from the hot/cool water stream generating units 11-12 will cause the user's shoulder side to approach the back side wall surface 2a of the bathtub 2. Therefore, by locating the vibration generating units for shoulders 21-22 on the back side wall surface 2a of the bathtub 2 in an area where the user's shoulder side will approach in the above way, the user can perceive comfort effects of the vibration by the vibration generating units for shoulders 21-22 more easily on the user's shoulder side.

[0218] Furthermore, according to the bathtub system 1 of the present embodiment, the back side wall surface 2a of the bathtub 2, where the vibration generating units for shoulders 21-22 are located, is inclined.

[0219] When the user's shoulder side approaches the back side wall surface 2a of the bathtub 2, as the back side wall surface 2a of the bathtub 2 is inclined, the back side wall surface 2a of the bathtub 2 is more likely to conform to the user's body line. Herein, as the vibration generating units for shoulders 21-22 are located there, the user can perceive comfort effects of the vibration by the vibration generating units for shoulders 21-22 more easily.

[0220] Furthermore, according to the bathtub system 1 of the present embodiment, the direction of the vibration generated by each of the vibration generating units for shoulders 21-22 is in an oblique vertical direction.

[0221] When the user's shoulder side approaches the back side wall surface 2a of the bathtub 2, as the direction of the vibration generated by each of the vibration generating units for shoulders 21-22 is in an oblique vertical direction, the user can perceive comfort effects of the vibration more easily on the user's shoulder side.

[0222] In addition, according to the bathtub system 1 of the present embodiment, the direction of the vibration generated by the vibration generating units for buttocks 25-26, the direction of the vibration generated by the left vibration generating unit 27 and the direction of the vibration generated by the right vibration generating unit 28 form a substantially right angle with the direction of the hot or cool water streams generated by the hot/cool water stream generating units 11-12, respectively.

[0223] According to this feature, the user is more likely to perceive the comfort effects of both the stimulation by the vibration generated by each of the vibration generating units 21-28 and the stimulation by the hot or cool water stream from each of the hot/cool water stream generating units 11-12, respectively independently.

[0224] In addition, according to the bathtub system 1 of the present embodiment, the vibration generating units for legs 23-24 are located on the leg side wall surface 2b of the bathtub 2, and the vibration generating units for legs 23-24 and the hot/cool water stream generating units 11-12 are located at positions offset from each other

in a height direction.

[0225] According to this feature, the user is more likely to perceive the comfort effects of both the stimulation by the vibration from the vibration generating units for legs 23-24 and the stimulation by the hot or cool water stream from each of the hot/cool water stream generating units 11-12, respectively independently.

[0226] Herein, as an alternative or in addition to the feature wherein the vibration generating units for legs 23-24 and the hot/cool water stream generating units 11-12 are offset from each other in a height direction, the vibration generating units for legs 23-24 and the hot/cool water stream generating units 11-12 may preferably be offset from each other in a left and right direction (for example, the pair of left and right vibration generating units for legs 23-24 may be arranged symmetrically in a left and right direction in the bathtub 2, and their respective central axes may be separated from each other by 250 mm).

(Embodiment 3-2: Structure)

[0227] Hereinafter, an embodiment 3-2 of the present invention is explained with reference to the attached drawings. Unless otherwise explained, the structure (arrangement configuration) of a bathtub system of the embodiment 3-2 of the present invention is similar to that of the bathtub system 101 of the embodiment 1-2 of the present invention described with reference to Fig. 9..

[0228] In the present embodiment, as shown in Fig. 13, a discharge water stream generating unit 113 is provided. The discharge water stream generating unit 113 has a slit-like shape extending in a left and right direction. A bottom of the discharge water stream generating unit 113 is positioned in a pillow-like raised portion on the back side wall surface 102a at a predetermined height (e.g. at a height of 500 mm from the bottom of the bathtub 102), corresponding to an area above shoulders of a user of the bathtub 102 (which area may cover the back side of a neck of the user).

[0229] The discharge water stream generating unit 113 is a device mechanism configured to generate a discharge water stream above a surface of pooled hot or cool water, which is to have been already pooled in the bathtub 102, by vigorously supplying hot or cool water into the bathtub 102. The discharge water stream generating unit 113 is visible on the back side wall surface 102a as a slit-like area, whose slightly curved length in a left and right direction is 250 mm and whose height is 2 mm.

[0230] A water intake port 109 for circulating hot or cool water to the hot/cool water stream generating units 111, 112 and the discharge water stream generating unit 113 is provided on the leg side wall surface 102b of the bathtub 102 at a predetermined location (e.g. at a position in the center in a left and right direction, at a height of 180 mm from the bottom of the bathtub 102). The water intake port 109 is a member formed into a circular disk having an

outer diameter of 90 mm and a projection height (thickness) into the bathtub 102 of 12 mm.

[0231] Furthermore, Fig. 13 shows a bottom landing position on the bottom of the bathtub 102, at which the discharge water stream generated by the discharge water stream generating unit 113 is to land, in a hypothetical situation in which there is no hot or cool water pooled in the bathtub 102.

(Embodiment 3-2: Control Configuration)

[0232] The control configuration of the bathtub system of the embodiment 3-2 of the present invention is the same as that of the bathtub system 101 of the embodiment 1-2 of the present invention.

(Embodiment 3-2: Control Configuration (2))

[0233] Furthermore, in the present embodiment, in a hypothetical situation in which there is no hot or cool water pooled in the bathtub 102, when the discharge water stream generating unit 113 is driven at "strong output strength", the discharge water stream generated by the discharge water stream generating unit 113 is to land at a predetermined bottom landing position (e.g. at a position of 300 mm from a lower end of the back side wall surface 102a toward the leg side) on the bottom of the bathtub 102. Therefore, in the present embodiment, the vibration generating units 121-122 and 125-128 are located on the user's back side in a front and rear direction with respect to the predetermined bottom landing position when the discharge water stream generating unit 113 is driven at the "strong output strength".

[0234] Furthermore, in the present embodiment, in a hypothetical situation in which there is pooled hot or cool water in the bathtub 102 (whose recommendable standard water height is e.g. 210 mm), when the discharge water stream generating unit 113 is driven at the "strong output strength", the discharge water stream generated by the discharge water stream generating unit 113 is to land at a predetermined surface landing position (e.g. whose drooping point onto the bottom of the bathtub 102 corresponds to a position of 150 mm from a lower end of the back side wall surface 102a toward the leg side) on a surface of the pooled hot or cool water. Therefore, in the present embodiment, the vibration generating units 121-122 and 125-128 are located on the user's back side in the front and rear direction with respect to the predetermined surface landing position when the discharge water stream generating unit 113 is driven at the "strong output strength".

[0235] Substantially similarly, in the present embodiment, in a hypothetical situation in which there is no hot or cool water pooled in the bathtub 102, when the discharge water stream generating unit 113 is driven at "medium output strength", the discharge water stream generated by the discharge water stream generating unit 113 is to land at another predetermined bottom landing position

(e.g. at a position of 240 mm from a lower end of the back side wall surface 102a toward the leg side) on the bottom of the bathtub 102. Therefore, in the present embodiment, the vibration generating units 121-122 and 125-128 are located on the user's back side in the front and rear direction with respect to the predetermined bottom landing position when the discharge water stream generating unit 113 is driven at the "medium output strength".

[0236] Furthermore, in the present embodiment, in a hypothetical situation in which there is pooled hot or cool water in the bathtub 102, when the discharge water stream generating unit 113 is driven at the "medium output strength", the discharge water stream generated by the discharge water stream generating unit 113 is to land at another predetermined surface landing position (e.g. whose drooping point onto the bottom of the bathtub 102 corresponds to a position of 120 mm from a lower end of the back side wall surface 102a toward the leg side) on a surface of the pooled hot or cool water. Therefore, in the present embodiment, the vibration generating units 121-122 and 127-128 are located on the user's back side in the front and rear direction with respect to the predetermined surface landing position when the discharge water stream generating unit 113 is driven at the "medium output strength". (In the present embodiment, the vibration generating units 125-126 cannot be said to be located on the user's back side in the front and rear direction with respect to the predetermined surface landing position when the discharge water stream generating unit 113 is driven at the "medium output strength").

[0237] On the other hand, in the present embodiment, in a hypothetical situation in which there is no hot or cool water pooled in the bathtub 102, when the discharge water stream generating unit 113 is driven at "weak output strength", the discharge water stream generated by the discharge water stream generating unit 113 is to land at further another predetermined bottom landing position (e.g. at a position of 180 mm from a lower end of the back side wall surface 102a toward the leg side) on the bottom of the bathtub 102. (Therefore, in the present embodiment, the vibration generating units 125-128 cannot be said to be located on the user's back side in the front and rear direction with respect to the predetermined bottom landing position when the discharge water stream generating unit 113 is driven at the "weak output strength").

[0238] Furthermore, in the present embodiment, in a hypothetical situation in which there is pooled hot or cool water in the bathtub 102, when the discharge water stream generating unit 113 is driven at the "weak output strength", the discharge water stream generated by the discharge water stream generating unit 113 is to land at further another predetermined surface landing position (e.g. whose drooping point onto the bottom of the bathtub 102 corresponds to a position of 90 mm from a lower end of the back side wall surface 102a toward the leg side) on a surface of the pooled hot or cool water. (Therefore, in the present embodiment, the vibration generating units

125-128 cannot be said to be located on the user's back side in the front and rear direction with respect to the predetermined surface landing position when the discharge water stream generating unit 113 is driven at the "weak output strength").

(Embodiment 3-2: Effects)

[0239] According to the bathtub system 101 of the present embodiment as structured above, by the discharge water stream from the discharge water stream generating unit 113, a relatively strong water pressure stimulation can be given to a user of the bathtub, as if it were penetrating into the user's body (e.g. muscles, in particular around the user's neck or shoulders), while a delicate water pressure stimulation caused by the vibration generated by each of the vibration generating units 121-128 can be given mainly to a surface (e.g. skin) of the user's body. This can provide a finely tuned comfort to the user.

[0240] In addition, according to the bathtub system 101 of the present embodiment, in a hypothetical situation in which there is no hot or cool water pooled in the bathtub 102, when the discharge water stream generating unit 113 is driven at the "strong output strength" or the "medium output strength", the discharge water stream generated by the discharge water stream generating unit 113 is to land at the above predetermined bottom landing position on the bottom of the bathtub 102, and the vibration generating units 121-122 and 125-128 are located on the user's back side in the front and rear direction with respect to the above predetermined bottom landing position.

[0241] According to this feature, the situation is effectively inhibited in which the water pressure stimulation caused by the vibration generated by each of the vibration generating units 121-122 and 125-128 is interfered with the discharge water stream generated by the discharge water stream generating unit 113.

[0242] Furthermore, according to the bathtub system 101 of the present embodiment, in a hypothetical situation in which there is pooled hot or cool water in the bathtub 102, when the discharge water stream generating unit 113 is driven at the "strong output strength", the discharge water stream generated by the discharge water stream generating unit 113 is to land at the above predetermined surface landing position on the surface of the pooled hot or cool water, and the vibration generating units 121-122 and 125-128 are located on the user's back side in the front and rear direction with respect to the above predetermined surface landing position.

[0243] According to this feature, the situation is more effectively inhibited in which the water pressure stimulation caused by the vibration generated by each of the vibration generating units 121-122 and 125-128 is interfered with the discharge water stream generated by the discharge water stream generating unit 113.

[0244] Herein, in the present embodiment, the vibra-

tion generating units 125-128 cannot be said to be located on the user's back side in the front and rear direction both with respect to the predetermined bottom landing position when the discharge water stream generating unit 113 is driven at the "weak output strength" and with respect to the predetermined surface landing position when the discharge water stream generating unit 113 is driven at the "weak output strength". However, when the discharge water stream generating unit 113 is driven at the "weak output strength", the extent to which the discharge water stream generated by the discharge water stream generating unit 113 lands on the surface of the pooled hot or cool water at the front side (leg side) of the user and causes turbulence inside the pooled hot or cool water in the bathtub 102 is relatively small. Therefore, when the discharge water stream generating unit 113 is driven at the "weak output strength", the user can perceive the vibration generated by each of the vibration generating units 121-122 and 125-128 sufficiently.

[0245] Furthermore, in the present embodiment, the vibration generating units for legs 123-124 are not located on the user's back side in the front and rear direction both with respect to the above predetermined bottom landing positions and with respect to the above predetermined surface landing positions. However, the vibration generated by each of the vibration generating units for legs 123-124 acts on the user's legs sufficiently away from the above predetermined bottom landing positions and the above predetermined surface landing positions, and thus the user can perceive the vibration generated by each of the vibration generating units for legs 123-124 sufficiently.

[0246] In addition to the above, according to the bathtub system 101 of the present embodiment as well as the bathtub system 1 of the embodiment 3-1, a maximum value in the bathtub 102 of the water pressure stimulation caused by the vibration generated by each of the vibration generating units 121-128 is adjusted to be smaller than a maximum value in the bathtub 102 of the water pressure stimulation caused by the hot or cool water stream generated by each of the hot/cool water stream generating units 111-112.

[0247] According to this feature, it is more surely prevented that the vibration generated by each of the vibration generating units 121-128 is interfered with action of the hot or cool water stream generated by each of the hot/cool water stream generating units 111-112.

[0248] In addition, according to the bathtub system 101 of the present embodiment as well, at a predetermined position in the bathtub 102 (such as a position corresponding to a body surface of a user who is to sit or lie in the bathtub 102), the water pressure stimulation caused by the vibration generated by each of the vibration generating units 121-128 is adjusted to be smaller than the water pressure stimulation caused by the hot or cool water stream generated by each of the hot/cool water stream generating units 111-112.

[0249] According to this feature, it is effectively inhibited

that a too strong stimulation is given to the user's skin (which may provide discomfort to the user).

[0250] In addition, according to the bathtub system 101 of the present embodiment as well, the hot/cool water stream generating units 111-112 are located on the back side wall surface 102a of the bathtub 102, and the vibration generating units for shoulders 121-122 are also located on the back side wall surface 102a of the bathtub 102.

[0251] According to this feature, on the back side of the body where the user is more likely to feel stimulation, the user can perceive comfort effects of both the stimulation by the vibration(s) and the stimulation by the hot or cool water stream(s).

[0252] In addition, according to the bathtub system 101 of the present embodiment as well, the vibration generating units for shoulders 121-122 are located above the hot/cool water stream generating units 111-112.

[0253] As the hot/cool water stream generating units 111-112 are located on the back side wall surface 102a of the bathtub 102, it is expected that the momentum of the hot or cool water streams from the hot/cool water stream generating units 111-112 will cause the user's shoulder side to approach the back side wall surface 102a of the bathtub 102. Therefore, by locating the vibration generating units for shoulders 121-122 on the back side wall surface 2a of the bathtub 102 in an area where the user's shoulder side will approach in the above way, the user can perceive comfort effects of the vibration by the vibration generating units for shoulders 121-122 more easily on the user's shoulder side.

[0254] Furthermore, according to the bathtub system 101 of the present embodiment as well, the back side wall surface 102a of the bathtub 102, where the vibration generating units for shoulders 121-122 are located, is inclined.

[0255] When the user's shoulder side approaches the back side wall surface 102a of the bathtub 102, as the back side wall surface 102a of the bathtub 102 is inclined, the back side wall surface 102a of the bathtub 102 is more likely to conform to the user's body line. Herein, as the vibration generating units for shoulders 121-122 are located there, the user can perceive comfort effects of the vibration by the vibration generating units for shoulders 121-122 more easily.

[0256] Furthermore, according to the bathtub system 101 of the present embodiment as well, the direction of the vibration generated by each of the vibration generating units for shoulders 121-122 is in an oblique vertical direction.

[0257] When the user's shoulder side approaches the back side wall surface 102a of the bathtub 102, as the direction of the vibration generated by each of the vibration generating units for shoulders 121-122 is in an oblique vertical direction, the user can perceive comfort effects of the vibration more easily on the user's shoulder side.

[0258] In addition, according to the bathtub system 101

of the present embodiment as well, the direction of the vibration generated by the vibration generating units for buttocks 125-126, the direction of the vibration generated by the left vibration generating unit 127 and the direction of the vibration generated by the right vibration generating unit 128 form a substantially right angle with the direction of the hot or cool water streams generated by the hot/cool water stream generating units 111-112, respectively.

[0259] According to this feature, the user is more likely to perceive the comfort effects of both the stimulation by the vibration generated by each of the vibration generating units 121-128 and the stimulation by the hot or cool water stream from each of the hot/cool water stream generating units 111-112, respectively independently.

[0260] In addition, according to the bathtub system 101 of the present embodiment as well, the vibration generating units for legs 123-124 are located on the leg side wall surface 102b of the bathtub 102, and the vibration generating units for legs 123-124 and the hot/cool water stream generating units 111-112 are located at positions offset from each other in a height direction.

[0261] According to this feature, the user is more likely to perceive the comfort effects of both the stimulation by the vibration from the vibration generating units for legs 123-124 and the stimulation by the hot or cool water stream from each of the hot/cool water stream generating units 111-112, respectively independently.

[0262] Herein, as an alternative or in addition to the feature wherein the vibration generating units for legs 123-124 and the hot/cool water stream generating units 111-112 are offset from each other in a height direction, the vibration generating units for legs 123-124 and the hot/cool water stream generating units 111-112 may preferably be offset from each other in a left and right direction (for example, the pair of left and right vibration generating units for legs 123-124 may be arranged symmetrically in a left and right direction in the bathtub 102, and their respective central axes may be separated from each other by 250 mm).

(Embodiment 4-1: Structure)

[0263] Hereinafter, an embodiment 4-1 of the present invention is explained with reference to the attached drawings. The structure (arrangement configuration) of a bathtub system of the embodiment 4-1 of the present invention is the same as that of the bathtub system 1 of the embodiment 1-1 of the present invention, that of the bathtub system 1 of the embodiment 2-1 of the present invention or that of the bathtub system 1 of the embodiment 3-1 of the present invention.

(Embodiment 4-1: Control Configuration)

[0264] The control configuration of the bathtub system of the embodiment 4-1 of the present invention is the same as that of the bathtub system 1 of the embodiment

2-1 of the present invention or that of the bathtub system 1 of the embodiment 3-1 of the present invention.

(Embodiment 4-1: Control Configuration (3))

[0265] Furthermore, in the present embodiment, the water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-28 and the water pressure stimulation caused by the hot or cool water stream generated by the discharge water stream generating unit 13 are adapted not to interfere with each other.

[0266] These settings can be achieved by adjusting respective supply timings or the like of an electrical signal for driving each of the vibration generating units 21-28 and an electrical signal for driving the discharge water stream generating unit 13 (in particular, an electrical signal supplied to a built-in motor for discharging the hot or cool water).

[0267] In detail, the operation (driving) of the discharge water stream generating unit 13, the selection of the output strength of the discharge water stream generating unit 13 (strong, medium or weak), the operation (driving) of each of the vibration generating units 21-28, and the like are controlled by the controlling unit 35, for example on the basis of an input operation from the user via the remote controller 30. Herein, the controlling unit 35 of the present embodiment is configured to coordinate an operation of the discharge water stream generating unit 13 and operations of the vibration generating units 21-28 (i.e., configured to correlate them with each other).

[0268] Specifically, the controlling unit 35 is settable at a simultaneous-operation blocking mode (2), for example on the basis of an input operation from the user via the remote controller 30. As shown in Fig. 14, in the simultaneous-operation blocking mode (2), the controlling unit 35 is configured not to start an operation of any of the vibration generating units 21-28 during an operation of the discharge water stream generating unit 13 and not to start an operation of the discharge water stream generating unit 13 during an operation of one or more of the vibration generating units 21-28. More specifically, when the controlling unit 35 in the simultaneous-operation blocking mode (2) receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of the discharge water stream generating unit 13, the controlling unit 35 is configured to start the operation of the one or more of the vibration generating units 21-28 after the operation of the discharge water stream generating unit 13 is completed, and when the controlling unit 35 in the simultaneous-operation blocking mode (2) receives an instruction for starting an operation of the discharge water stream generating unit 13 during an operation of one or more of the vibration generating units 21-28, the controlling unit 35 is configured to start the operation of the discharge water stream generating unit 13 after the operation of the one or more of the vibration generating units 21-28 is com-

pleted.

[0269] According to this feature, it is possible to achieve an operational control in which operational contents by the user (user's intention to use the discharge water stream generating unit 13 or the vibration generating units 21-28) are respected, while surely preventing that the operation of the discharge water stream generating unit 13 and the operation of any of the vibration generating units 21-28 interfere with each other.

[0270] Herein, in terms of the completion of the operation of the discharge water stream generating unit 13 or the one or more of the vibration generating units 21-28, for example, if an ongoing function is to continue for a preselected period of time, the ongoing function may be completed after the preselected period of time has elapsed. Alternatively, at a timing at which operational contents to use another (not ongoing) function are received, a message such as ""The water discharge function will be stopped for starting the vibration function" is issued, and the ongoing function may be completed (stopped) immediately. The message to the user is not limited to an audible one, but can also be a visual one by using a display unit or the like.

[0271] Furthermore, as shown in Fig. 14, when the controlling unit 35 in the simultaneous-operation blocking mode (2) receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of the discharge water stream generating unit 13, the controlling unit 35 is configured to start the operation of the one or more of the vibration generating units 21-28 within a predetermined period of time after the operation of the discharge water stream generating unit 13 has been completed.

[0272] According to this feature, the vibration(s) is given within the predetermined period of time during which there is still a lingering effect of the discharge water stream generated by the discharge water stream generating unit 13, so that the change from the water stream stimulation to the vibration stimulation can be made with less discomfort for the user.

[0273] In the present embodiment, the predetermined period of time is set to correspond to 70 % of a period of time which it takes for the hot/cool water stream remaining in the bathtub 2 after the completion of the operation of the discharge water stream generating unit 13 to disappear.

[0274] According to this feature, the change from the water stream stimulation to the vibration stimulation can be made with less discomfort for the user, more effectively.

[0275] In the present embodiment, the period of time which it takes for the hot/cool water stream remaining in the bathtub 2 after the completion of the operation of the discharge water stream generating unit 13 to disappear is: about 25 seconds when the discharge water stream generating unit 13 is driven at the "strong output strength", about 20 seconds when the discharge water stream generating unit 13 is driven at the "medium output

strength", and about 15 seconds when the discharge water stream generating unit 13 is driven at the "weak output strength".

[0276] Fig. 14 is explained in detail. When an instruction (a command) for starting an operation of any one or more of the vibration generating units 21-28 is received (YES in STEP 51), it is judged whether or not it is during an operation of the discharge water stream generating unit 13 (STEP 52). When it is during an operation of the discharge water stream generating unit 13 (YES in STEP 52), the next step waits until the operation of the discharge water stream generating unit 13 is completed (STEP 53). Then, the operation of the one or more of the vibration generating units 21-28 is started within the predetermined period of time after the operation of the discharge water stream generating unit 13 has been completed (STEP 54). When it is not during an operation of the discharge water stream generating unit 13 (NO in STEP 52), the operation of the one or more of the vibration generating units 21-28 is started immediately (STEP 55).

[0277] Roughly symmetrically, when an instruction (a command) for starting an operation of the discharge water stream generating unit 13 is received (YES in STEP 61), it is judged whether or not it is during an operation of any one or more of the vibration generating units 21-28 (STEP 62). When it is during an operation of any one or more of the vibration generating units 21-28 (YES in STEP 62), the next step waits until the operation of the one or more of the vibration generating units 21-28 is completed (STEP 63). Then, the operation of the discharge water stream generating unit 13 is started (STEP 64). When it is not during an operation of any one or more of the vibration generating units 21-28 (NO in STEP 62), the operation of the discharge water stream generating unit 13 is started immediately (STEP 64).

[0278] Furthermore, the controlling unit 35 of the present embodiment is settable at a simultaneous-operation acceptable mode (2), for example on the basis of an input operation from the user via the remote controller 30. As shown in Fig. 15, when the controlling unit 35 in the simultaneous-operation acceptable mode (2) receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of the discharge water stream generating unit 13, the controlling unit 35 is configured to forcibly switch the ongoing output strength of the discharge water stream generating unit 13 into "weak output strength" and then to start the operation of the one or more of the vibration generating units 21-28, and when the controlling unit 35 in the simultaneous-operation acceptable mode (2) receives an instruction for starting an operation of the discharge water stream generating unit 13 during an operation of one or more of the vibration generating units 21-28, the controlling unit 35 is configured to forcibly switch the pre-set output strength of the discharge water stream generating unit 13 into "weak output strength" and then to start the operation of the discharge water stream

generating unit 13.

[0279] According to this feature, the situation is surely prevented in which the user cannot perceive the comfort effects of the vibration generated by any of the vibration generating units 21-28 because the hot or cool water stream generated by the discharge water stream generating unit 13 has too strong effects.

[0280] Fig. 15 is explained in detail. When an instruction (a command) for starting an operation of any one or more of the vibration generating units 21-28 is received (YES in STEP 71), it is judged whether or not it is during an operation of the discharge water stream generating unit 13 (STEP 72). When it is during an operation of the discharge water stream generating unit 13 (YES in STEP 72), it is judged whether the discharge water stream generating unit 13 is not driven at the "weak output strength" (STEP 73). When the discharge water stream generating unit 13 during the operation is not driven at the "weak output strength" (YES in STEP 73), the ongoing output strength of the discharge water stream generating unit 13 is forcibly switched into the "weak output strength" (STEP 74). Then, the operation of the one or more of the vibration generating units 21-28 is started (STEP 75). When it is not during an operation of the discharge water stream generating unit 13 (NO in STEP 72), the operation of the one or more of the vibration generating units 21-28 is started immediately (STEP 75). When the discharge water stream generating unit 13 during the operation is driven at the "weak output strength" (NO in STEP 73), the operation of the one or more of the vibration generating units 21-28 is started immediately (STEP 75).

[0281] Roughly symmetrically, when an instruction (a command) for starting an operation of the discharge water stream generating unit 13 is received (YES in STEP 81), it is judged whether or not it is during an operation of any one or more of the vibration generating units 21-28 (STEP 82). When it is during an operation of any one or more of the vibration generating units 21-28 (YES in STEP 82), it is judged whether the discharge water stream generating unit 13 is not pre-set (selected) at the "weak output strength" (STEP 83). When the discharge water stream generating unit 13 is not pre-set (selected) at the "weak output strength" (YES in STEP 83), the pre-set (selected) output strength of the discharge water stream generating unit 13 is forcibly switched into the "weak output strength" (STEP 84). Then, the operation of the discharge water stream generating unit 13 is started (STEP 85). When it is not during an operation of any one or more of the vibration generating units 21-28 (NO in STEP 82), the operation of the discharge water stream generating unit 13 is started immediately (STEP 85). When the discharge water stream generating unit 13 is pre-set (selected) at the "weak output strength" (NO in STEP 83), the operation of the discharge water stream generating unit 13 is started immediately (STEP 85).

(Embodiment 4-1: Effects (1))

[0282] According to the bathtub system 1 of the present embodiment as structured above, as well as the bathtub system 1 of the present embodiment 2-1, by the hot or cool water streams generated by the hot/cool water stream generating units 11-12, a relatively strong water pressure stimulation can be given to the user of the bathtub 2, as if it were penetrating into the user's body (e.g. muscles), while a delicate water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-28 can be given mainly to a surface (e.g. skin) of the user's body. This can provide a finely tuned comfort to the user. In particular, by coordinating the operations of the hot/cool water stream generating units 11-12 and the operations of the vibration generating units 21-28 (by correlating them with each other), the finely tuned comfort for the user can be more improved.

[0283] In addition, according to the bathtub system 1 of the present embodiment, the controlling unit 35 is settable at the simultaneous-operation blocking mode (1), the controlling unit 35 in the simultaneous-operation blocking mode (1) is configured not to start an operation of any one or more of the vibration generating units 11-12 during an operation of one or more of the hot/cool water stream generating units 11-12 and not to start an operation of any one or more of the hot/cool water stream generating units 11-12 during an operation of one or more of the vibration generating units 21-28.

[0284] According to this feature, it is surely prevented that the operation of any of the hot/cool water stream generating units 11-12 and the operation of any of the vibration generating units 21-28 interfere with each other.

[0285] Furthermore, according to the bathtub system 1 of the present embodiment, when the controlling unit 35 in the simultaneous-operation blocking mode (1) receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of one or more of the hot/cool water stream generating units 11-12, the controlling unit 35 is configured to start the operation of the one or more of the vibration generating units 21-28 after the operation of the one or more of the hot/cool water stream generating units 11-12 is completed, and when the controlling unit 35 in the simultaneous-operation blocking mode (1) receives an instruction for starting an operation of any one or more of the hot/cool water stream generating units 11-12 during an operation of one or more of the vibration generating units 21-28, the controlling unit 35 is configured to start the operation of the one or more of the hot/cool water stream generating units 11-12 after the operation of the one or more of the vibration generating units 21-28 is completed.

[0286] According to this feature, it is possible to achieve an operational control in which operational contents by the user (user's intention to use the hot/cool water stream generating units 11-12 or the vibration

generating units 21-28) are respected, while surely preventing that the operation of any of the hot/cool water stream generating units 11-12 and the operation of any of the vibration generating units 11-12 interfere with each other.

[0287] Furthermore, according to the bathtub system 1 of the present embodiment, when the controlling unit 35 in the simultaneous-operation blocking mode (1) receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of one or more of the hot/cool water stream generating units 11-12, the controlling unit 35 is configured to start the operation of the one or more of the vibration generating units 21-28 within a predetermined period of time after the operation of the one or more of the hot/cool water stream generating units 11-12 has been completed.

[0288] According to this feature, the vibration(s) is given within the predetermined period of time during which there is still a lingering effect of the hot/cool water stream(s) generated by the one or more of the hot/cool water stream generating units 11-12, so that the change from the water stream stimulation to the vibration stimulation can be made with less discomfort for the user.

[0289] Furthermore, according to the bathtub system 1 of the present embodiment, the controlling unit 35 is settable at the simultaneous-operation acceptable mode (1), when the controlling unit 35 in the simultaneous-operation acceptable mode (1) receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of one or more of the hot/cool water stream generating units 11-12, the controlling unit 35 is configured to forcibly switch the ongoing output strength of the one or more of the hot/cool water stream generating units 11-12 into "weak output strength" and then to start the operation of the one or more of the vibration generating units 21-28, and when the controlling unit 35 in the simultaneous-operation acceptable mode receives an instruction for starting an operation of any one or more of the hot/cool water stream generating units 11-12 during an operation of one or more of the vibration generating units 21-28, the controlling unit 35 is configured to forcibly switch the pre-set output strength of the one or more of the hot/cool water stream generating units 11-12 into "weak output strength" and then to start the operation of the one or more of the hot/cool water stream generating units 11-12.

[0290] According to this feature, the situation is surely prevented in which the user cannot perceive the comfort effects of the vibration generated by any of the vibration generating units 21-28 because the hot or cool water stream generated by any of the hot/cool water stream generating units 11-12 has too strong effects.

[0291] In the present embodiment, as described above, when the controlling unit 35 in the simultaneous-operation acceptable mode receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of

one or more of the hot/cool water stream generating units 11-12, the controlling unit 35 is configured to forcibly switch the ongoing output strength of the one or more of the hot/cool water stream generating units 11-12 into the "weak output strength" and then to start the operation of the one or more of the vibration generating units 21-28, and when the controlling unit 35 in the simultaneous-operation acceptable mode receives an instruction for starting an operation of any one or more of the hot/cool water stream generating units 11-12 during an operation of one or more of the vibration generating units 21-28, the controlling unit 35 is configured to forcibly switch the pre-set output strength of the one or more of the hot/cool water stream generating units 11-12 into the "weak output strength" and then to start the operation of the one or more of the hot/cool water stream generating units 11-12. However, the present invention is not limited to this manner. For example, when the controlling unit 35 in the simultaneous-operation acceptable mode receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of one or more of the hot/cool water stream generating units 11-12, the controlling unit 35 may be configured to forcibly switch the ongoing output strength of the one or more of the hot/cool water stream generating units 11-12 into output strength further weaker than the "weak output strength" and then to start the operation of the one or more of the vibration generating units 21-28, and when the controlling unit 35 in the simultaneous-operation acceptable mode receives an instruction for starting an operation of any one or more of the hot/cool water stream generating units 11-12 during an operation of one or more of the vibration generating units 21-28, the controlling unit 35 may be configured to forcibly switch the pre-set output strength of the one or more of the hot/cool water stream generating units 11-12 into output strength further weaker than the "weak output strength" and then to start the operation of the one or more of the hot/cool water stream generating units 11-12.

(Embodiment 4-1: Effects (2))

[0292] In addition to the above, according to the bathtub system 1 of the present embodiment as structured above, by the discharge water stream from the discharge water stream generating unit 13, a relatively strong water pressure stimulation can be given to a user of the bathtub, as if it were penetrating into the user's body (e.g. muscles, in particular around the user's neck or shoulders), while a delicate water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-28 can be given mainly to a surface (e.g. skin) of the user's body. This can provide a finely tuned comfort to the user. In particular, by coordinating the operation of the discharge water stream generating unit 13 and the operations of the vibration generating units 21-28 (by correlating them with each other), the finely tuned comfort for the user can be more improved.

[0293] In addition, according to the bathtub system 1 of the present embodiment, the controlling unit 35 is settable at a simultaneous-operation blocking mode (2), and the controlling unit 35 in the simultaneous-operation blocking mode (2) is configured not to start an operation of any of the vibration generating units 21-28 during an operation of the discharge water stream generating unit 13 and not to start an operation of the discharge water stream generating unit 13 during an operation of one or more of the vibration generating units 21-28.

[0294] According to this feature, it is surely prevented that the operation of the discharge water stream generating unit 13 and the operation of any of the vibration generating units 21-28 interfere with each other.

[0295] Furthermore, according to the bathtub system 1 of the present embodiment, when the controlling unit 35 in the simultaneous-operation blocking mode (2) receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of the discharge water stream generating unit 13, the controlling unit 35 is configured to start the operation of the one or more of the vibration generating units 21-28 after the operation of the discharge water stream generating unit 13 is completed, and when the controlling unit 35 in the simultaneous-operation blocking mode (2) receives an instruction for starting an operation of the discharge water stream generating unit 13 during an operation of one or more of the vibration generating units 21-28, the controlling unit 35 is configured to start the operation of the discharge water stream generating unit 13 after the operation of the one or more of the vibration generating units 21-28 is completed.

[0296] According to this feature, it is possible to achieve an operational control in which operational contents by the user (user's intention to use the discharge water stream generating unit 13 or the vibration generating units 21-28) are respected, while surely preventing that the operation of the discharge water stream generating unit 13 and the operation of any of the vibration generating units 21-28 interfere with each other.

[0297] Furthermore, according to the bathtub system 1 of the present embodiment, when the controlling unit 35 in the simultaneous-operation blocking mode (2) receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of the discharge water stream generating unit 13, the controlling unit 35 is configured to start the operation of the one or more of the vibration generating units 21-28 within a predetermined period of time after the operation of the discharge water stream generating unit 13 has been completed.

[0298] According to this feature, the vibration(s) is given within the predetermined period of time during which there is still a lingering effect of the discharge water stream generated by the discharge water stream generating unit 13, so that the change from the water stream stimulation to the vibration stimulation can be made with less discomfort for the user.

[0299] Furthermore, according to the bathtub system 1 of the present embodiment, the controlling unit 35 is settable at a simultaneous-operation acceptable mode (2), and when the controlling unit 35 in the simultaneous-operation acceptable mode (2) receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of the discharge water stream generating unit 13, the controlling unit 35 is configured to forcibly switch the ongoing output strength of the discharge water stream generating unit 13 into "weak output strength" and then to start the operation of the one or more of the vibration generating units 21-28, and when the controlling unit 35 in the simultaneous-operation acceptable mode (2) receives an instruction for starting an operation of the discharge water stream generating unit 13 during an operation of one or more of the vibration generating units 21-28, the controlling unit 35 is configured to forcibly switch the pre-set output strength of the discharge water stream generating unit 13 into "weak output strength" and then to start the operation of the discharge water stream generating unit 13.

[0300] According to this feature, the situation is surely prevented in which the user cannot perceive the comfort effects of the vibration generated by any of the vibration generating units 21-28 because the hot or cool water stream generated by the discharge water stream generating unit 13 has too strong effects.

[0301] In the present embodiment, as described above, when the controlling unit 35 in the simultaneous-operation acceptable mode (2) receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of the discharge water stream generating unit 13, the controlling unit 35 is configured to forcibly switch the ongoing output strength of the discharge water stream generating unit 13 into the "weak output strength" and then to start the operation of the one or more of the vibration generating units 21-28, and when the controlling unit 35 in the simultaneous-operation acceptable mode (2) receives an instruction for starting an operation of the discharge water stream generating unit 13 during an operation of one or more of the vibration generating units 21-28, the controlling unit 35 is configured to forcibly switch the pre-set output strength of the discharge water stream generating unit 13 into the "weak output strength" and then to start the operation of the discharge water stream generating unit 13. However, the present invention is not limited to this manner. For example, when the controlling unit 35 in the simultaneous-operation acceptable mode receives an instruction for starting an operation of any one or more of the vibration generating units 21-28 during an operation of the discharge water stream generating unit 13, the controlling unit 35 may be configured to forcibly switch the ongoing output strength of the discharge water stream generating unit 13 into output strength further weaker than the "weak output strength" and then to start the operation of the one or more of the vibration generating units 21-28, and when the control-

ling unit 35 in the simultaneous-operation acceptable mode (2) receives an instruction for starting an operation of the discharge water stream generating unit 13 during an operation of one or more of the vibration generating units 21-28, the controlling unit 35 may be configured to forcibly switch the pre-set output strength of the discharge water stream generating unit 13 into output strength further weaker than the "weak output strength" and then to start the operation of the discharge water stream generating unit 13.

(Embodiment 5-1: Structure)

[0302] Hereinafter, an embodiment 5-1 of the present invention is explained with reference to the attached drawings. The structure (arrangement configuration) of a bathtub system of the embodiment 5-1 of the present invention is the same as that of the bathtub system 1 of the embodiment 1-1 of the present invention, that of the bathtub system 1 of the embodiment 2-1 of the present invention, that of the bathtub system 1 of the embodiment 3-1 of the present invention or that of the bathtub system 1 of the embodiment 4-1 of the present invention..

(Embodiment 5-1: Control Configuration)

[0303] The control configuration of the bathtub system of the embodiment 5-1 of the present invention is the same as that of the bathtub system 1 of the embodiment 1-1 of the present invention or that of the bathtub system 1 of the embodiment 3-1 of the present invention.

[0304] In the present embodiment, a propagation direction(s) of the vibration(s) generated by at least a part of the vibration generating units 21-28 and a travelling direction of the water or cool water (see Figs. 2 and 3) are substantially orthogonal to each other.

[0305] In addition, in the present embodiment, both in a plan view and in a side view, a propagation direction of the vibration generated by each of the vibration generating units 21-24 and 27-28 and a travelling direction of the discharge water stream when it is being discharged from a discharge port of the discharge water stream generating unit 13 are substantially orthogonal (an example of "intersect each other"). According to this feature, the situation is effectively inhibited in which the water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-24 and 27-28 is interfered with the discharge water stream generated by the discharge water stream generating unit 13.

[0306] Furthermore, the bathtub system 1 of the present embodiment can be also assessed as follows. That is to say, as the propagation direction of the vibration generated by each of the vibration generating units 21-24 and 27-28 and a travelling direction of the discharge water stream when it lands on a surface of the pooled hot or cool water are substantially orthogonal to each other, the situation is effectively inhibited in which the water pressure stimulation caused by the vibration gen-

erated by each of the vibration generating units 21-24 and 27-28 is interfered with the discharge water stream generated by the discharge water stream generating unit 13.

[0307] Herein, a propagation direction of the vibration generated by each of the vibration generating units for buttocks 25-26 and the travelling direction of the discharge water stream when it lands on a surface of the pooled hot or cool water form only an angle of approximately 40°. However, the vibration generated by each of the vibration generating units for buttocks 25-26 acts on the user's buttocks sufficiently away from a surface landing point on which the discharge water stream lands, and thus the user can perceive the vibration generated by each of the vibration generating units for buttocks 25-26 sufficiently.

[0308] In addition, in the present embodiment, a propagation direction of the vibration generated by each of the vibration generating units 21-28 and the travelling direction of the water or cool water form an angle of 45° or more. According to this feature, the situation is effectively inhibited in which the water pressure stimulation caused by the vibration generated by each of the vibration generating units 21-28 is interfered with the hot or cool water stream generated by each of the hot/cool water stream generating units 11-12.

Description of Reference Signs

[0309]

30	1	Bathtub System (Embodiments 1-1, 2-1, 3-1, 4-1 and 5-1)
	2	Bathtub
	2a	Back Side Wall Surface
35	2b	Leg Side Wall Surface
	2c	Left Side Wall Surface
	2d	Right Side Wall Surface
	9a, 9b	Water Intake Port
	11, 12	Hot/Cool Water Stream Generating Unit
40	21, 22	Vibration Generating Unit for Shoulders
	23, 24	Vibration Generating Unit for Legs
	25, 26	Vibration Generating Unit for Buttocks
	27	Left Side Vibration Generating Unit
	28	Right Side Vibration Generating Unit
45	30	Remote Controller
	35	Controlling Unit
	101	Bathtub System (Embodiments 1-2 and 3-2)
	102	Bathtub
50	102a	Back Side Wall Surface
	102b	Leg Side Wall Surface
	102c	Left Side Wall Surface
	102d	Right Side Wall Surface
	109	Water Intake Port
55	111, 112	Hot/Cool Water Stream Generating Unit
	121, 122	Vibration Generating Unit for Shoulders
	123, 124	Vibration Generating Unit for Legs
	125, 126	Vibration Generating Unit for Buttocks

- 127 Left Side Vibration Generating Unit
- 128 Right Side Vibration Generating Unit
- 130 Remote Controller
- 135 Controlling Unit

Claims

1. A bathtub system comprising:

a bathtub in which hot or cool water can be pooled,
 a hot/cool water stream generating unit provided in the bathtub, the hot/cool water stream generating unit being configured to generate a hot or cool water stream inside pooled hot or cool water, which is to have been already pooled in the bathtub, by supplying hot or cool water into the bathtub, and
 a vibration generating unit provided in the bathtub, the vibration generating unit being configured to generate a vibration in the pooled hot or cool water without supplying hot or cool water into the bathtub.

2. The bathtub system according to claim 1, wherein a maximum value in the bathtub of a water pressure stimulation caused by the vibration generated by the vibration generating unit is smaller than a maximum value in the bathtub of a water pressure stimulation caused by the hot or cool water stream generated by the hot/cool water stream generating unit.

3. The bathtub system according to claim 1 or 2, wherein at a predetermined position in the bathtub, a water pressure stimulation caused by the vibration generated by the vibration generating unit is smaller than a water pressure stimulation caused by the hot or cool water stream generated by the hot/cool water stream generating unit.

4. The bathtub system according to any of claims 1 to 3, wherein

the hot/cool water stream generating unit is located on a back side wall surface of the bathtub, and
 the vibration generating unit is also located on the back side wall surface of the bathtub.

5. The bathtub system according to any of claims 1 to 4, wherein
 a direction of the vibration generated by the vibration generating unit and a direction of the hot or cool water stream generated by the hot/cool water stream generating unit form a substantially right angle.

6. The bathtub system according to any of claims 1 to 5,

wherein

the vibration generating unit is located on a leg side wall surface of the bathtub, and
 the vibration generating unit and the hot/cool water stream generating unit are located at positions offset from each other in a height direction and/or in a left and right direction.

7. The bathtub system according to any of claims 1 to 6, further comprising
 a controlling unit configured to coordinate an operation of the hot/cool water stream generating unit and an operation of the vibration generating unit.

8. The bathtub system according to any of claims 1 to 7, further comprising
 a discharge water stream generating unit provided at an upper part of the bathtub, the discharge water stream generating unit being configured to generate a discharge water stream by supplying hot or cool water into the bathtub from above pooled hot or cool water, which is to have been already pooled in the bathtub.

9. The bathtub system according to claim 8, further comprising
 a controlling unit configured to coordinate an operation of the discharge water stream generating unit and an operation of the vibration generating unit.

10. The bathtub system according to claim 8 or 9, wherein

the discharge water stream generating unit is configured to generate the discharge water stream by supplying the hot or cool water into the bathtub from a discharge port provided above the pooled hot or cool water, and
 in a plan view or in a side view, a propagation direction of the vibration generated by the vibration generating unit and a travelling direction of the discharge water stream when it is being discharged from the discharge port intersect each other.

11. The bathtub system according to any of claims 1 to 10, wherein
 in a plan view or in a side view, a propagation direction of the vibration generated by the vibration generating unit and a travelling direction of the hot or cool water stream intersect each other.

FIG.1

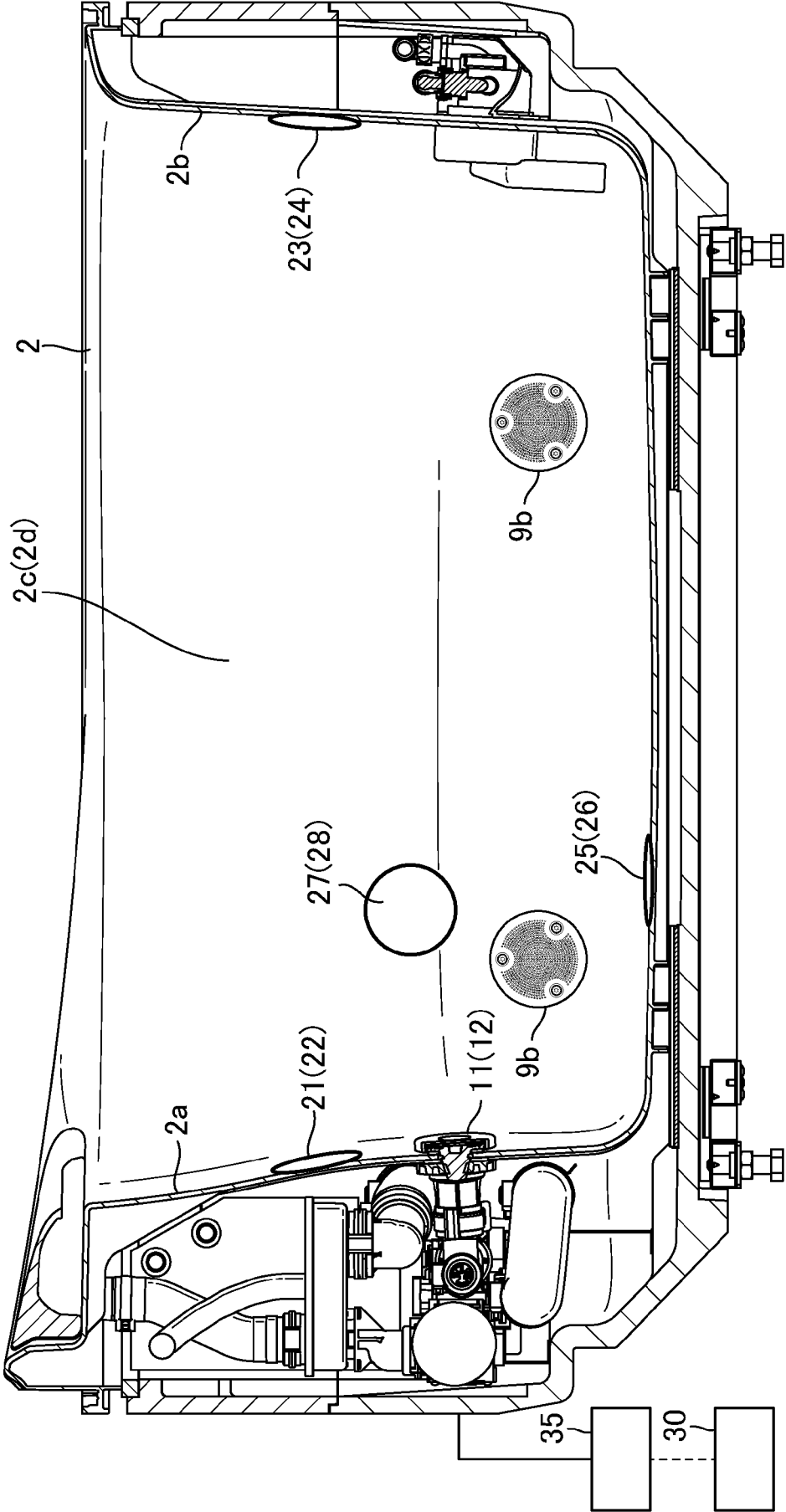


FIG.2

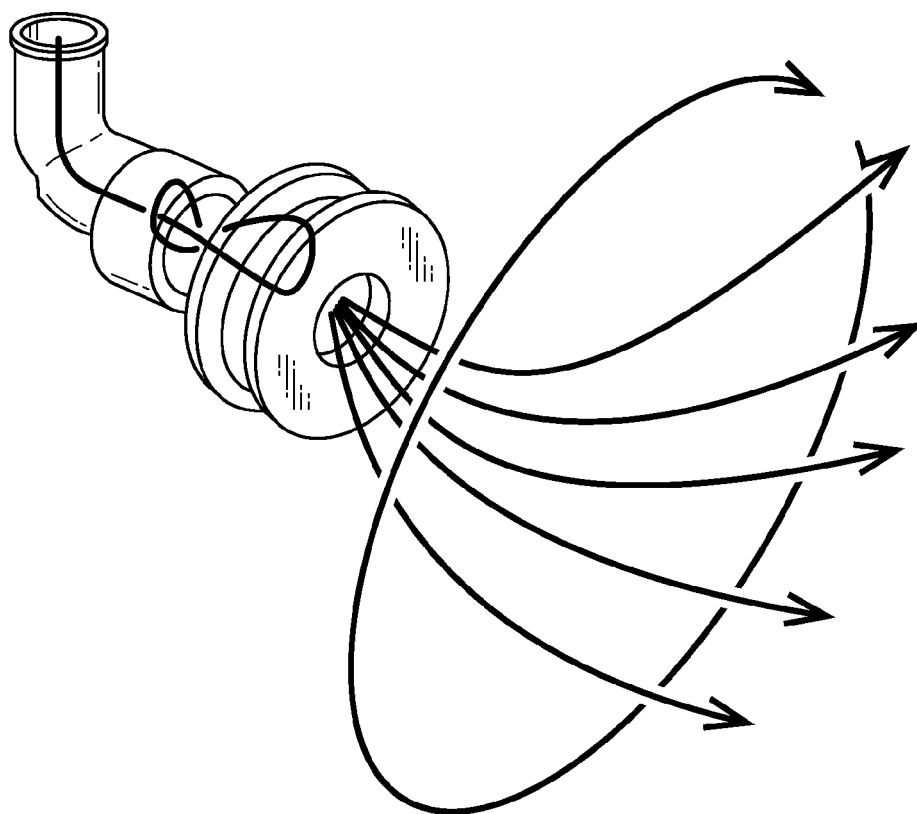


FIG.3

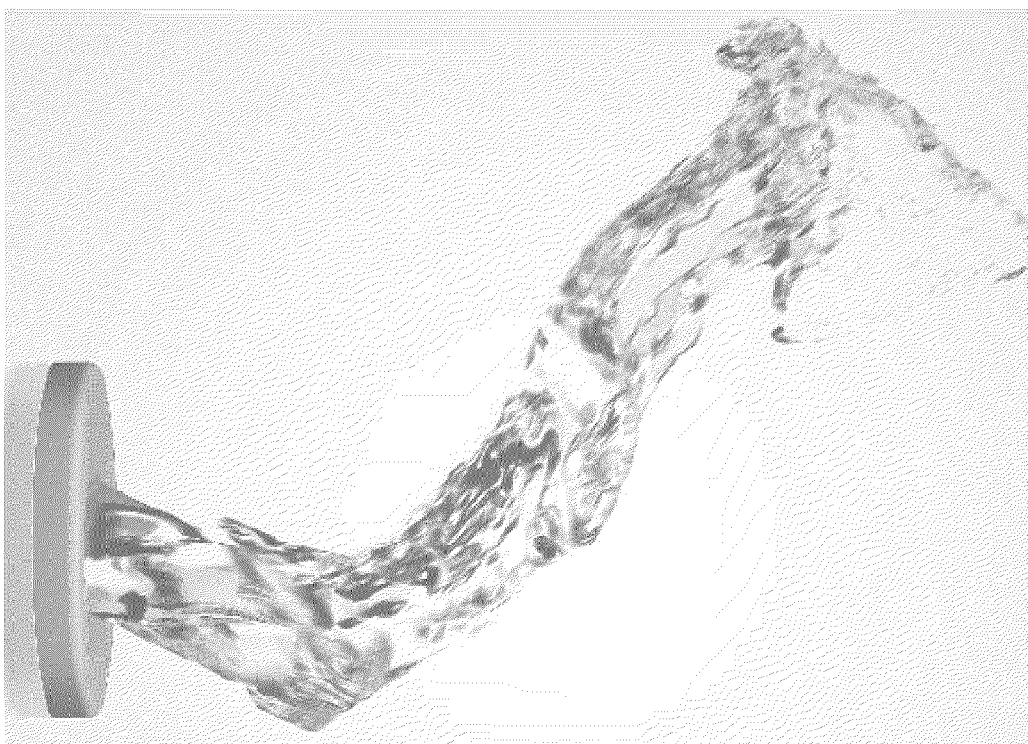


FIG.4

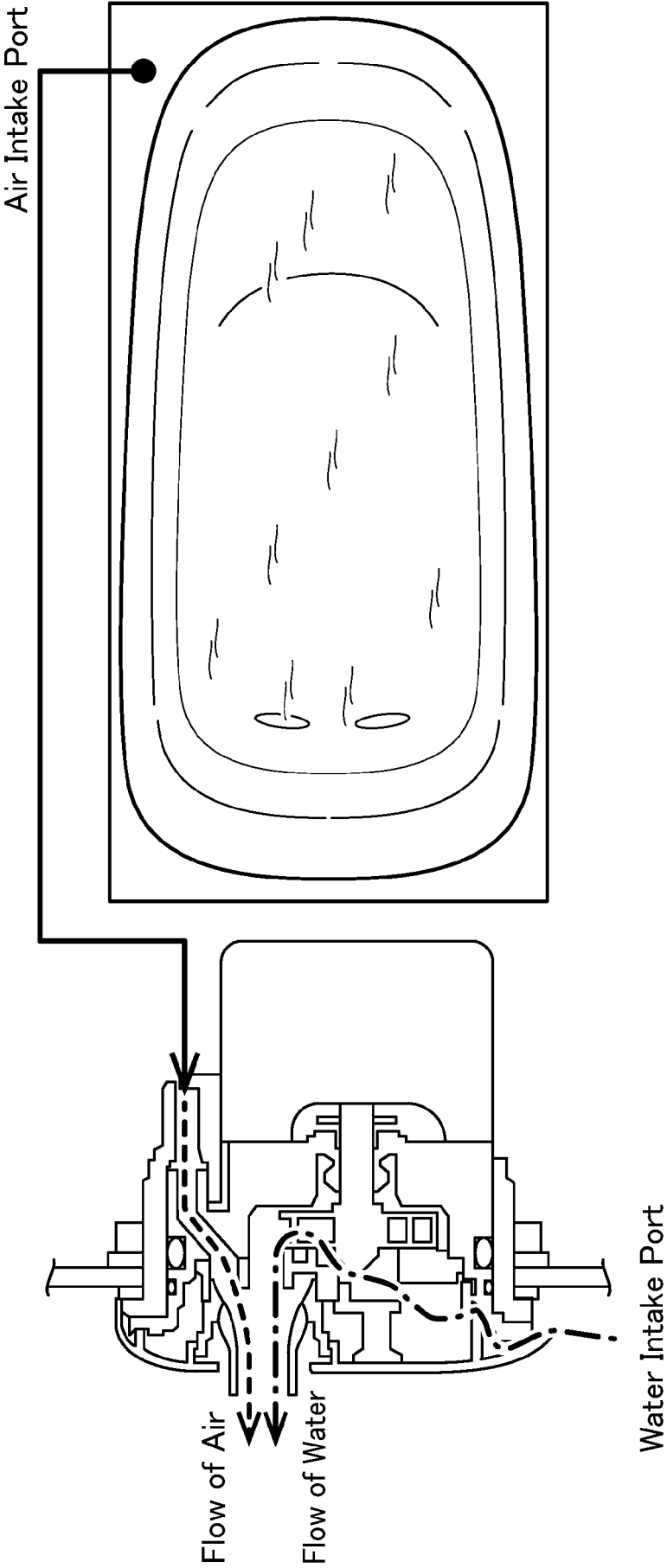


FIG.5

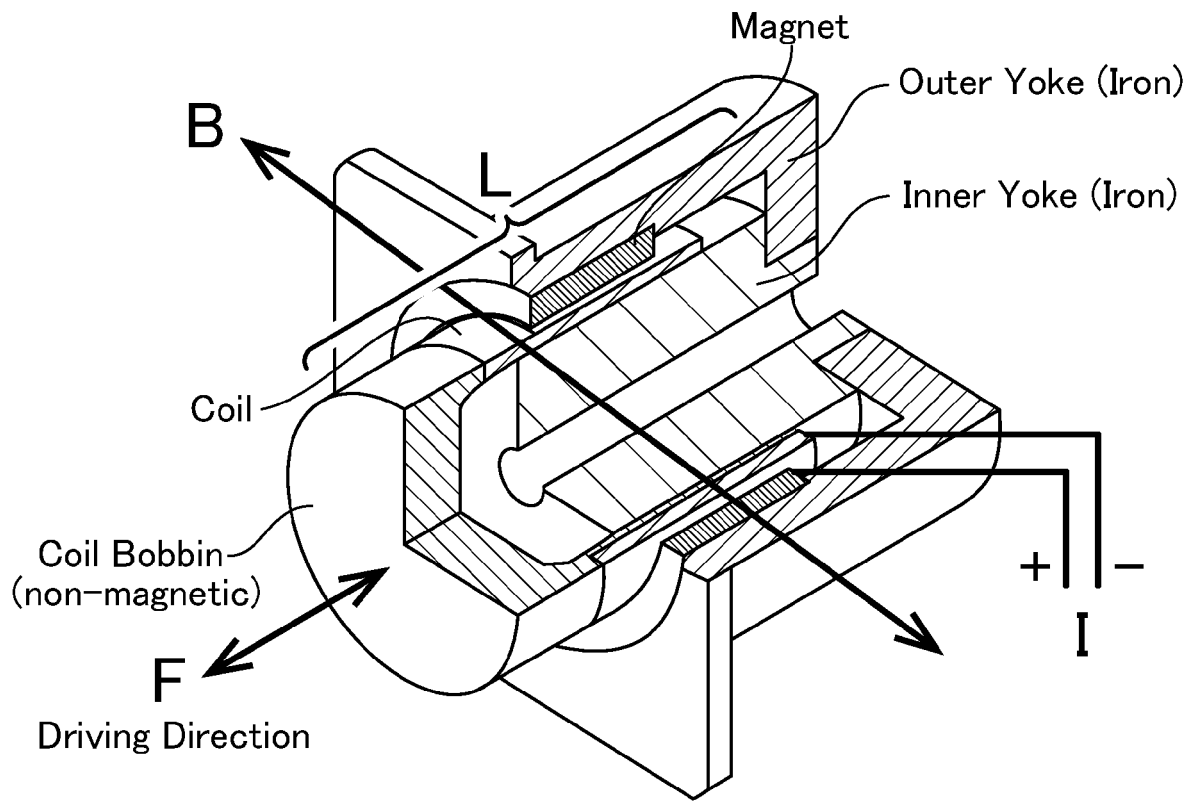


FIG.6

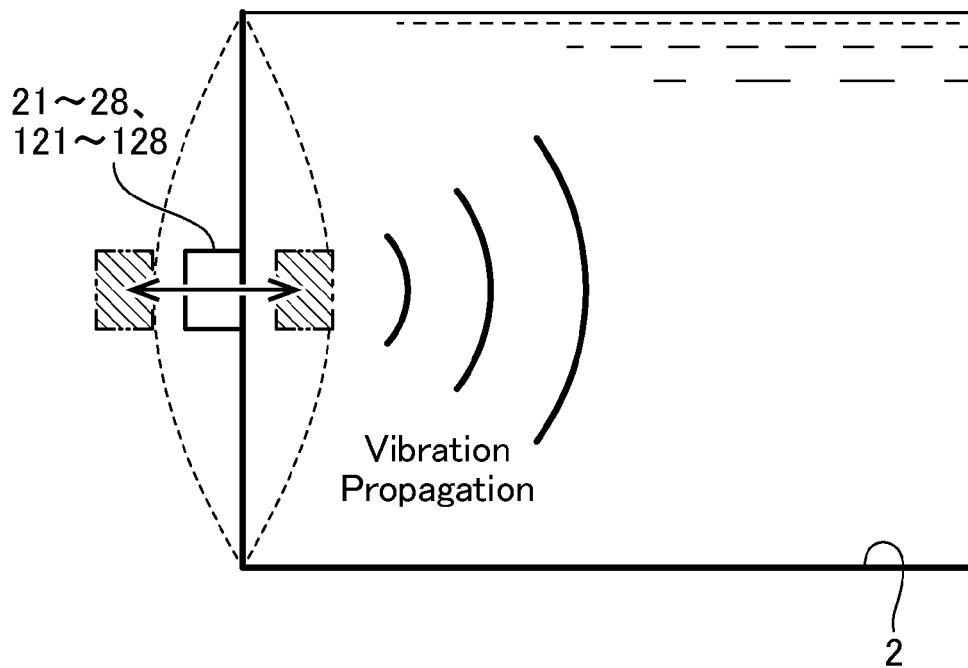


FIG.7

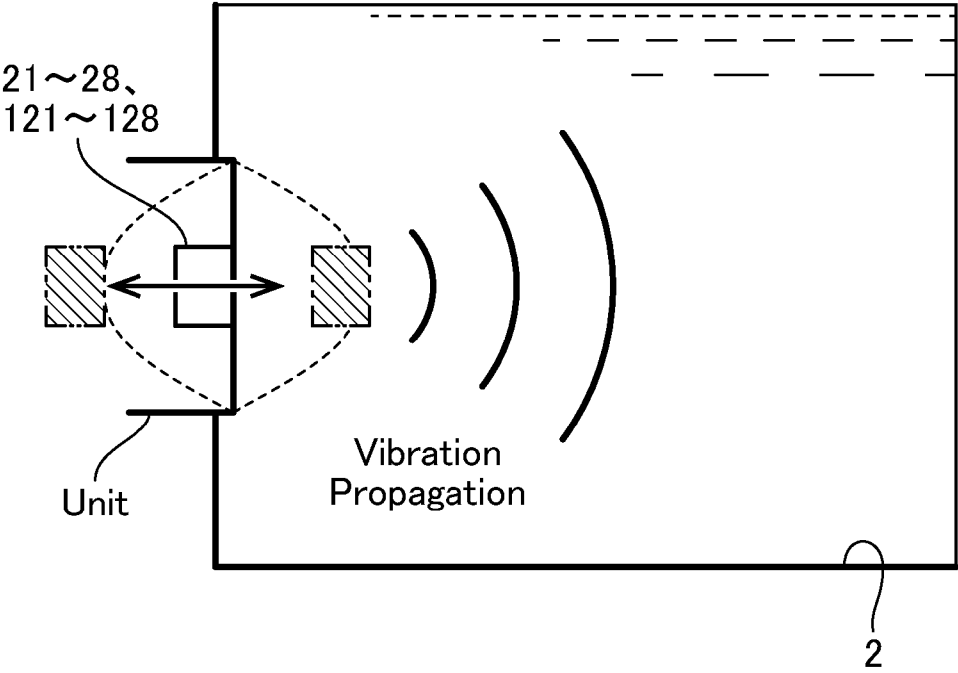


FIG.8

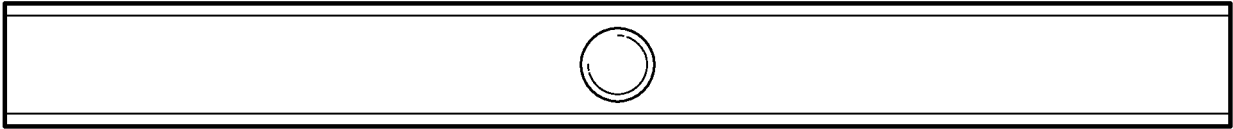


FIG. 9

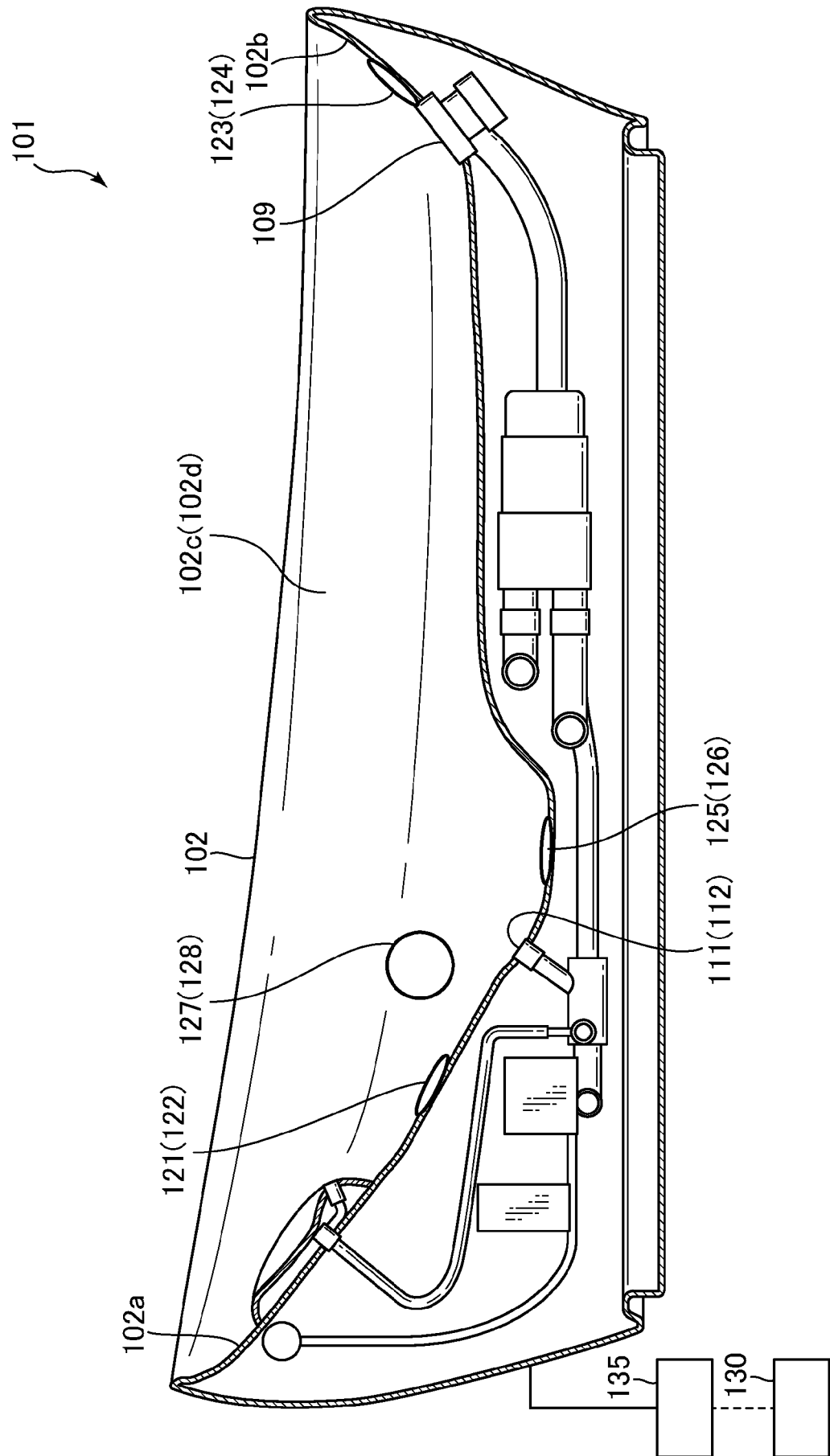


FIG.10

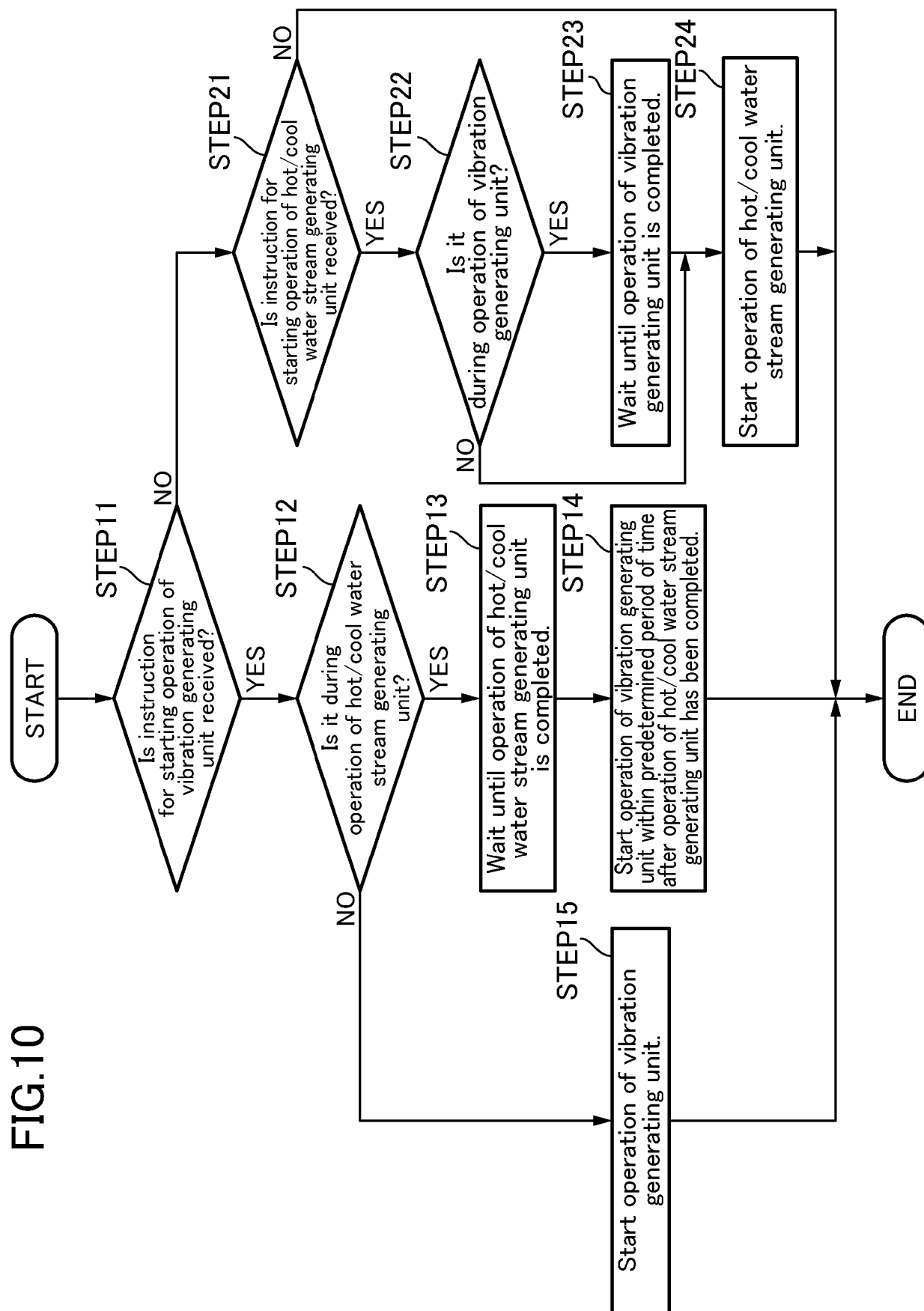


FIG.11

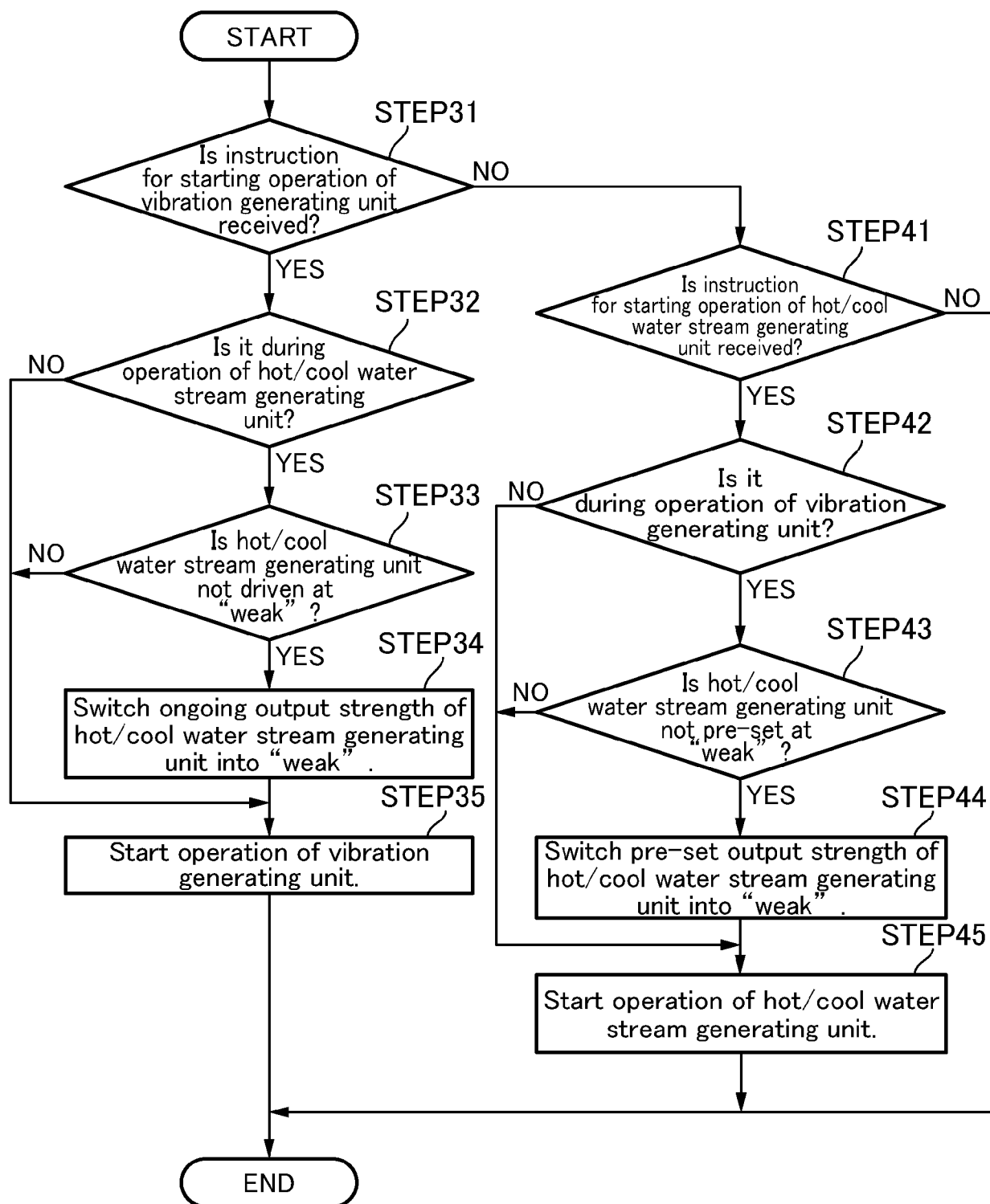


FIG.12

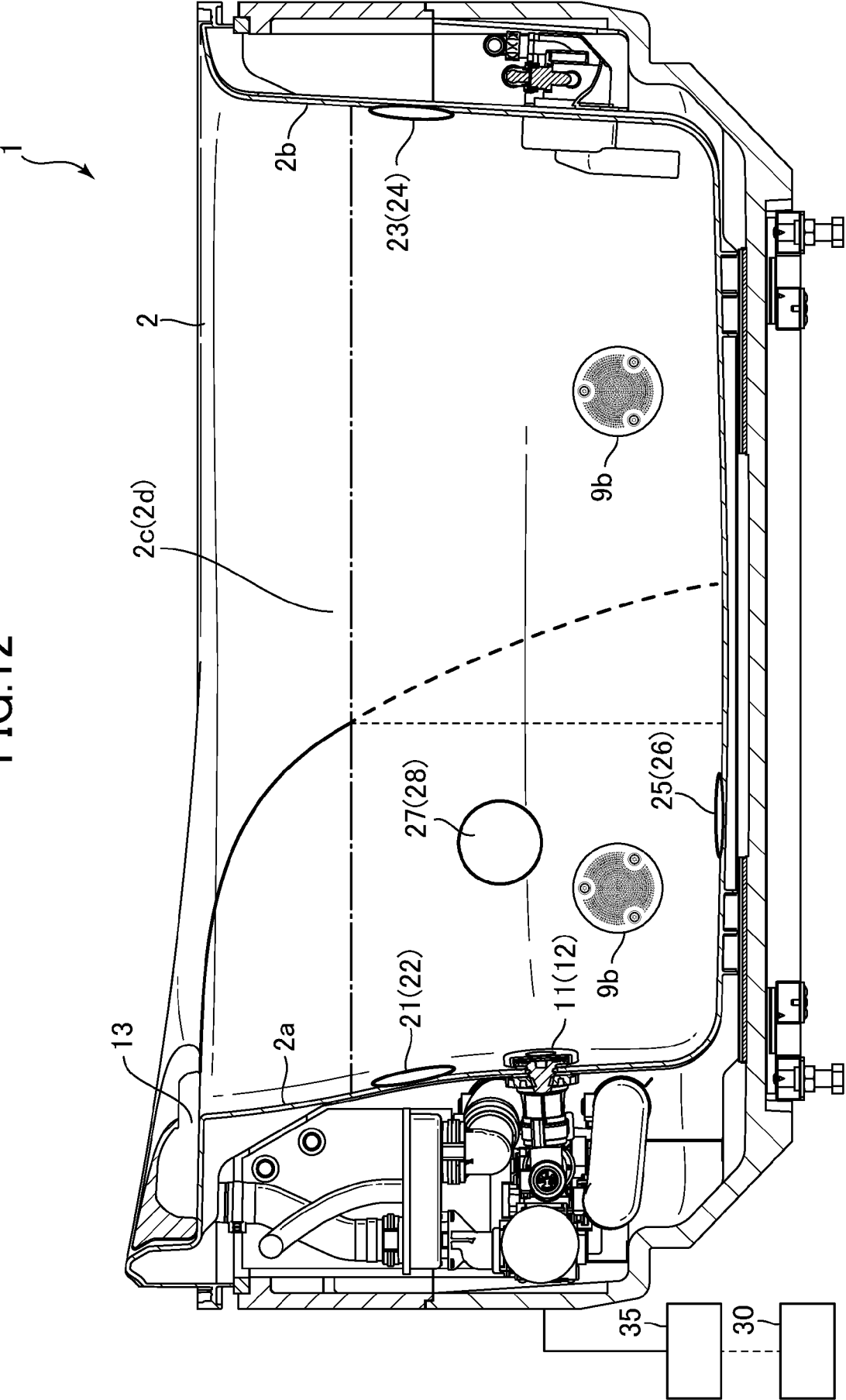
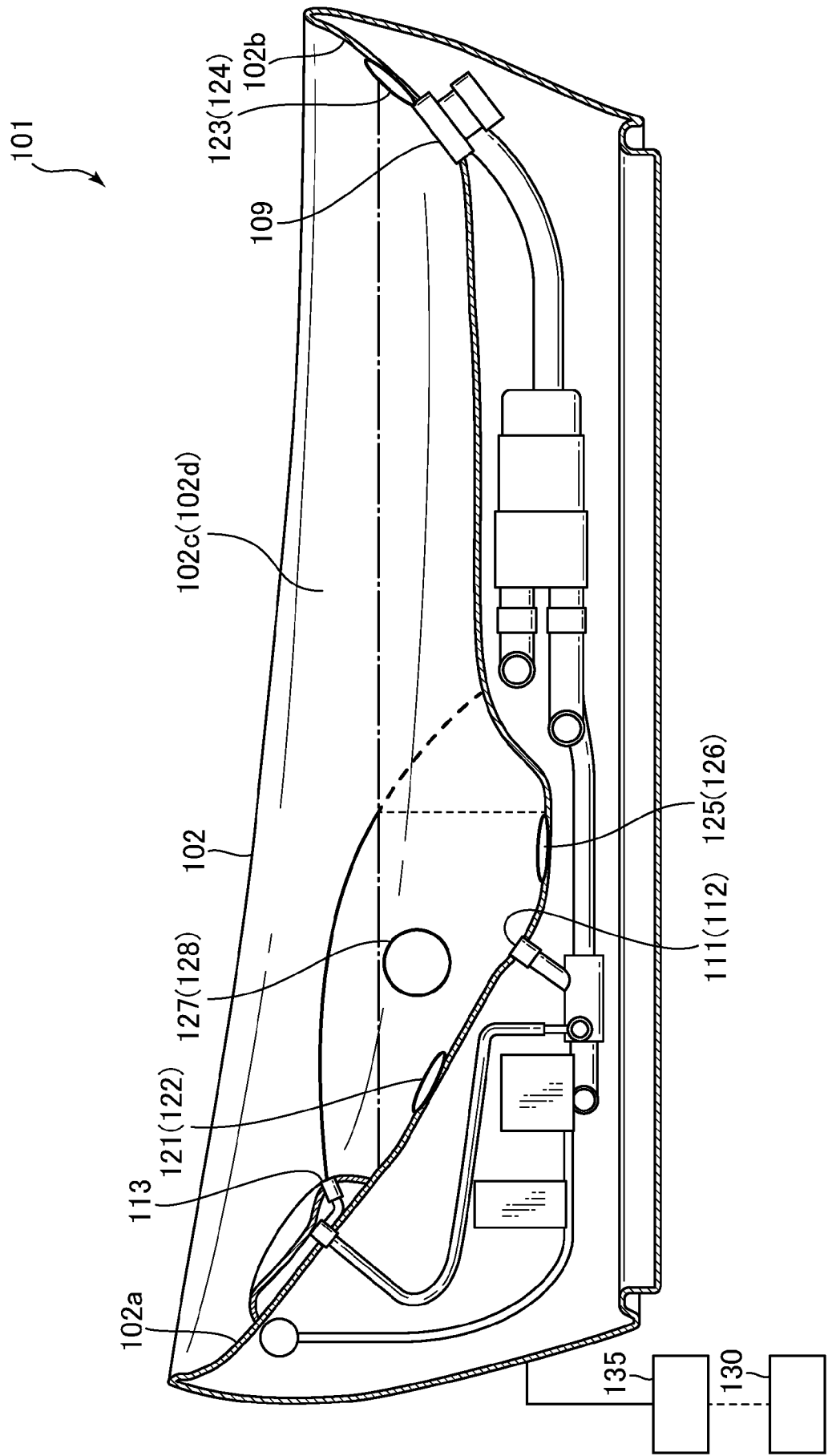


FIG.13



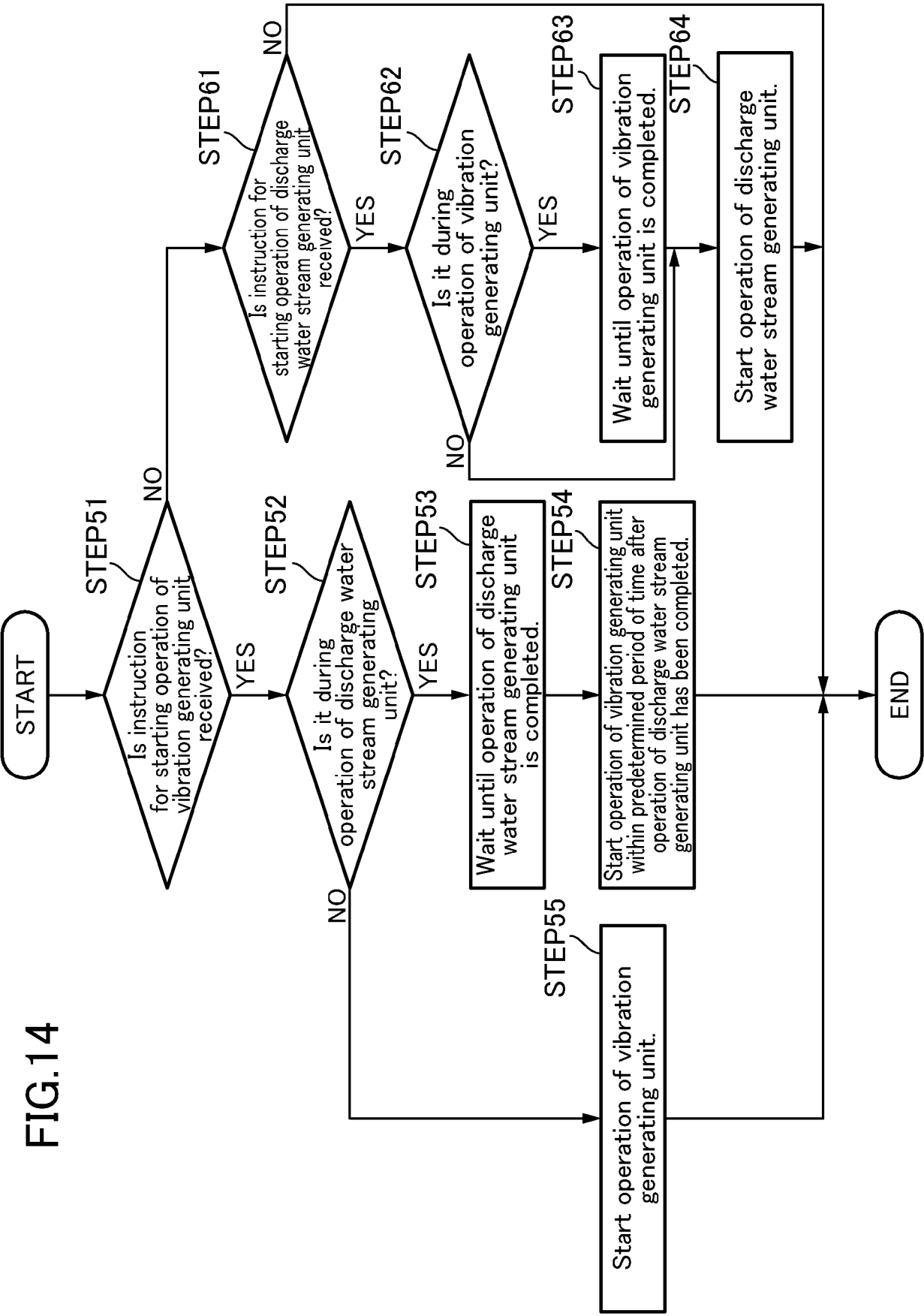
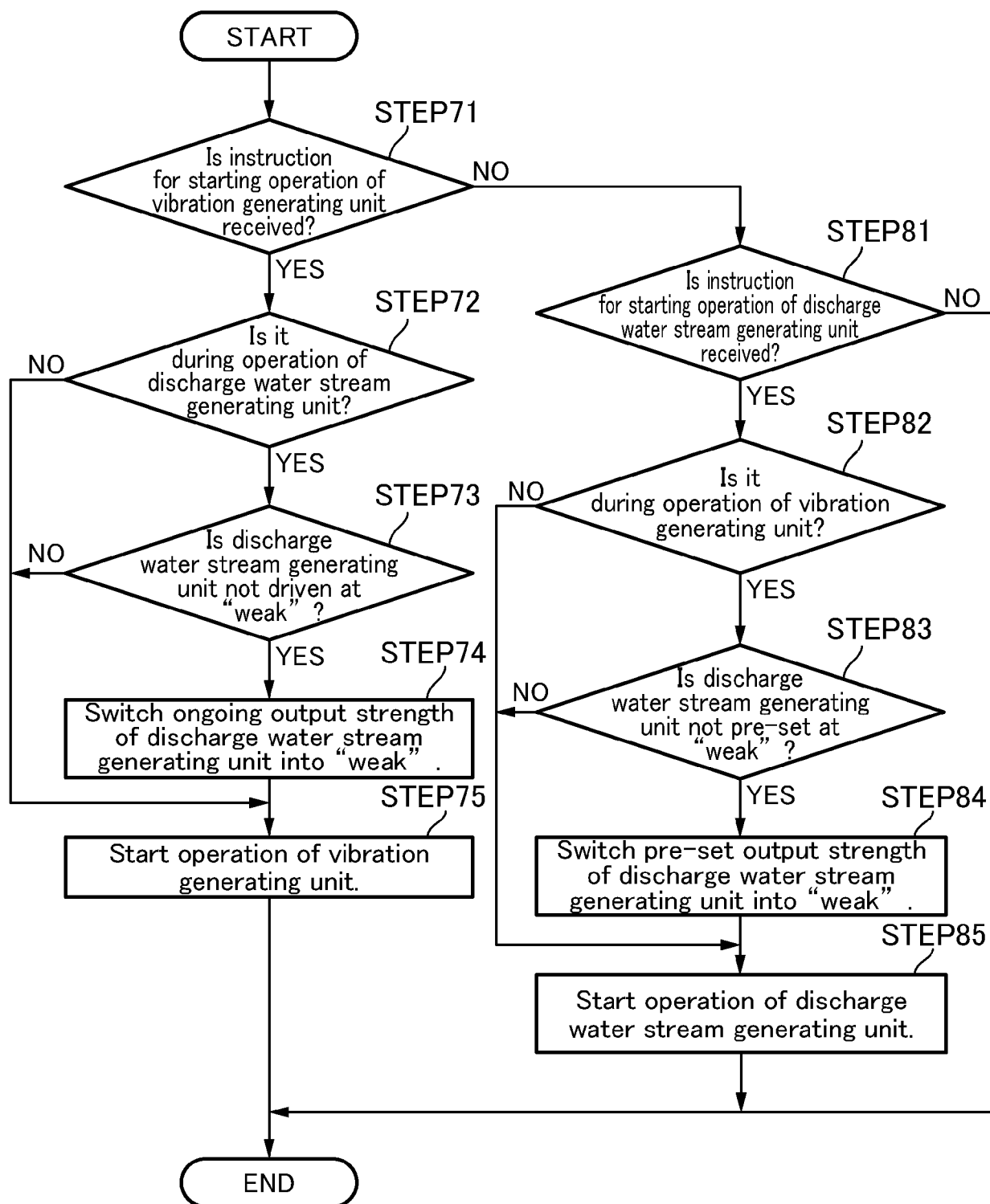


FIG.15





EUROPEAN SEARCH REPORT

Application Number

EP 24 19 5471

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 7 900 296 B2 (FKA DISTRIBUTING CO [US]) 8 March 2011 (2011-03-08) * column 6, line 12 - column 6, line 67 * * the whole document *	1-11	INV. A61H33/00
X	US 5 898 957 A (HANSEN BORG [US] ET AL) 4 May 1999 (1999-05-04) * paragraph [0001]; figures 2,3 * * the whole document *	1-7,11	
Y	----- US 4 620 529 A (KUROSAWA TADASHI [JP]) 4 November 1986 (1986-11-04) * the whole document *	8-10	
A	----- DE 10 2011 052812 B3 (KALDEWEI FRANZ GMBH & CO [DE]) 23 August 2012 (2012-08-23) * figure 1 *	1-11	
Y	-----	8-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			A61H
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		17 December 2024	Schindler-Bauer, P
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 24 19 5471

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

17-12-2024

10

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7900296 B2	08-03-2011	CN 101141905 A	12-03-2008
		US 2006207016 A1	21-09-2006
		US 2008301870 A1	11-12-2008

US 5898957 A	04-05-1999	NONE	

US 4620529 A	04-11-1986	NONE	

DE 102011052812 B3	23-08-2012	NONE	

15

20

25

30

35

40

45

50

55

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP H3199115423 A [0002] [0005]
- JP 2006128970 A [0002] [0005]