



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
31.12.2014 Bulletin 2015/01

(51) Int Cl.:
F24H 1/00 (2006.01)

(21) Application number: **13752411.2**

(86) International application number:
PCT/JP2013/052021

(22) Date of filing: **30.01.2013**

(87) International publication number:
WO 2013/125310 (29.08.2013 Gazette 2013/35)

(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 MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(72) Inventors:
• **HOSHIZAKI, Junichiro**
Tokyo 100-8310 (JP)
• **TAKEUCHI, Shiro**
Tokyo 100-8310 (JP)
• **FUJIWARA, Susumu**
Tokyo 100-8310 (JP)

(30) Priority: **21.02.2012 JP 2012034906**

(74) Representative: **Pfenning, Meinig & Partner GbR**
Patent- und Rechtsanwälte
Theresienhöhe 11a
80339 München (DE)

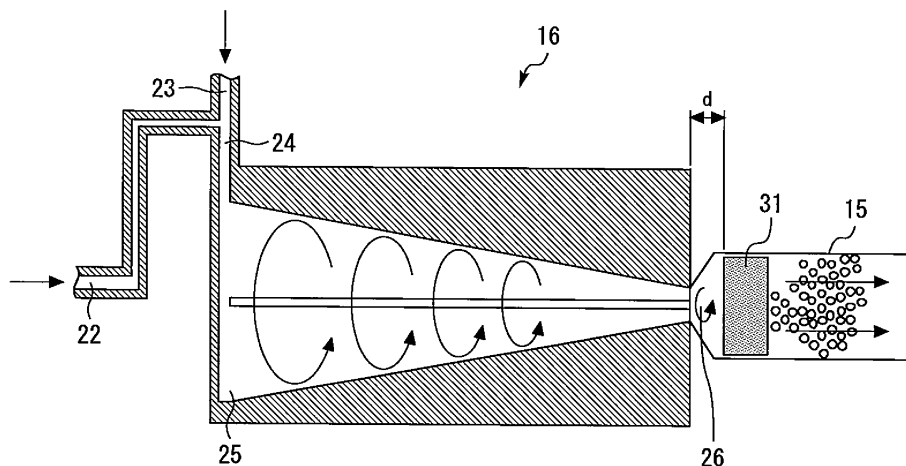
(71) Applicant: **Mitsubishi Electric Corporation**
Tokyo 100-8310 (JP)

(54) **BATH HOT WATER SUPPLY DEVICE**

(57) There is provided a bath hot water supply apparatus capable of reliably supplying fine bubbles to a bathtub. The bath hot water supply apparatus includes: a circulation channel 15 that allows bath water led out of a bathtub to return to the bathtub; a circulation pump that circulates the bath water; a fine bubble generation device 16 that is provided on the circulation channel 15 and is capable of generating fine bubbles in the bath water; and

rectification means 31 that is provided in the circulation channel 15 downstream of the fine bubble generation device 16, and suppresses rotation of a swirl flow containing the fine bubbles generated by the fine bubble generation device 16, and the fine bubble generation device 16 generates the fine bubbles while the bath water is circulated to the circulation channel 15 to supply the fine bubbles to the bathtub.

FIG. 2



Description

Technical Field

[0001] The present invention relates to a bath hot water supply apparatus.

Background Art

[0002] Energy-saving bath hot water supply apparatuses for standard homes are in rapidly expanding demand. In particular, use of an all-electric system has been accelerated and has kept on increasing in new or renovated homes. As recent bath hot water supply apparatuses, products with rapidly improved energy-saving technology and having a function of increasing a cleanliness level such as automatically cleaning pipes in a system have been on the market by various manufacturers.

[0003] As means for achieving the function of increasing a cleanliness level, there is a bath hot water supply apparatus including means for injecting bubbles into a reheating circulation channel (for example, see Patent Literature 1). This device includes an ejector as the means for injecting bubbles into the reheating circulation channel, and thus can clean and remove dirt on an inner wall of a reheating heat exchanger or in the reheating circulation channel, and maintain clean bath water in reheating. Patent Literature 2 discloses a swirl fine bubble generation device that can generate finer bubbles.

Patent Literature

[0004]

Patent Literature 1: Japanese Patent Laid-Open No. 2009-186092

Patent Literature 2: Japanese Patent No. 4525890

Summary of Invention

Technical Problem

[0005] A conventional technique disclosed in Patent Literature 1 has a function of sucking outside gas from a gas suction port in the ejector for injecting bubbles provided in the reheating circulation channel, and introducing bubbles into a fluid. An ejector system includes a duct having a narrowed portion, an inlet and an outlet for a fluid, and a gas suction port from which gas is injected, speeds up a flow velocity of the fluid in the narrowed portion of the duct, sucks outside gas from the gas suction port using a decompression phenomenon that occurs in the narrowed portion, and generates bubbles by air suddenly expanding and collapsing under decompression. This can generate bubbles in the fluid basically without using a pump or the like. However, it is difficult for the ejector system to generate bubbles having a minute diameter. This system generates bubbles with pressure

fluctuation of air, and cannot finely shear the air. Also, bubbles have a low charge-providing effect and thus have a low effect of preventing bubble joining, and fine bubbles have a bubble diameter of several hundred microns or more while the bubbles are passing through pipes before reaching a bathtub. Also, it is difficult for a self-contained system that sucks outside air using a decompression phenomenon of the narrowed portion to significantly increase a suction amount of air. Patent Literature 1 proposes forced air supply using a pump, which has problems such as cost increases and difficulty in ensuring long-term reliability (stable operation for over 10 years) of the pump itself. Thus, because of insufficient bubble generation and a large bubble diameter, bubbles disappear due to bubble joining or adhesion to an inner wall of the pipe in the reheating circulation channel to the bathtub, and are consumed by pipe cleaning. Only for pipe cleaning, such specifications of the bubbles generation device can achieve the purpose. It is generally known that microbubbles (referring to bubbles having a diameter of ten to several ten micrometers at generation) essentially have various functions, and microbubbles can develop useful functions in bath water in a bathtub. In the prior art in Patent literature 1, insufficient bubbles reach the bath water in the bathtub, and a cleaning function in the bathtub and a warm bath effect of the bath water cannot be expected.

[0006] The swirl fine bubble generation device described in Patent Literature 2 can generate bubbles having a more minute bubble diameter than in the ejector system. However, when the swirl fine bubble generation device is used to generate fine bubbles in the reheating circulation channel, problems arise as described below. A water flow containing fine bubbles having flowed out of the swirl fine bubble generation device is a swirl flow. If the water flow containing fine bubbles continuously rotates in a limited space in the reheating circulation channel, the fine bubbles collide with each other to easily cause bubble joining (joining of bubbles) and easily increase the bubble diameter. A larger bubble diameter reduces a negative potential applied to the bubbles, which reduces effects of preventing bubble joining and preventing adhesion to an inner wall of a channel due to electrostatic repulsion. This easily causes further bubble joining or adhesion of bubbles to the inner wall of the channel. Thus, while bubbles are flowing through the reheating circulation channel before reaching the bathtub, bubble joining further increases the bubble diameter, or bubbles easily adhere to the inner wall of the channel and disappear, thereby preventing sufficient fine bubbles from reaching the bathtub.

[0007] The present invention is achieved in view of the above described problems, and has an object to provide a bath hot water supply apparatus that can reliably supply fine bubbles to a bathtub.

Solution to Problem

[0008] A bath hot water supply apparatus of the invention is an apparatus which comprises a circulation channel that allows bath water led out of a bathtub to return to the bathtub, a circulation pump that circulates the bath water to the circulation channel, a fine bubble generation device that is provided on a way of the circulation channel and is capable of generating fine bubbles in the bath water, and rectification means that is provided in the circulation channel downstream of the fine bubble generation device, and suppresses rotation of a swirl flow containing the fine bubbles generated by the fine bubble generation device, wherein the fine bubble generation device generates the fine bubbles while the bath water is circulated to the circulation channel to supply the fine bubbles to the bathtub.

Advantageous Effects of Invention

[0009] According to the present invention, sufficient fine bubbles can be reliably brought to a bathtub. This provides a warm bath effect by the fine bubbles in the bathtub, and an effect of reducing adhesion of stain or sebum dirt to an inner surface of the bathtub using the fine bubbles.

Brief Description of Drawings

[0010]

Figure 1 is a configuration diagram of a bath hot water supply apparatus according to Embodiment 1 of the present invention.

Figure 2 is a sectional view of a fine bubble generation device and a reheating circulation channel downstream of the fine bubble generation device provided for the bath hot water supply apparatus according to Embodiment 1 of the present invention.

Figure 3 is a sectional view of a rectification means provided for the bath hot water supply apparatus according to Embodiment 1 of the present invention cut along a section perpendicular to the longitudinal direction of the reheating circulation channel.

Figure 4 is a perspective view of the rectification means in the reheating circulation channel provided for the bath hot water supply apparatus according to Embodiment 1 of the present invention.

Figure 5 is a sectional view of a rectification means provided for a bath hot water supply apparatus according to Embodiment 2 of the present invention cut along a section perpendicular to the longitudinal direction of the reheating circulation channel.

Description of Embodiments

[0011] Now, with reference to the drawings, embodiments of the present invention will be described. In the

drawings, common components are denoted by the same reference numerals, and overlapping descriptions will be omitted.

[0012] Figure 1 is a configuration diagram of a bath hot water supply apparatus according to Embodiment 1 of the present invention. The bath hot water supply apparatus of this embodiment in Figure 1 has a function of storing an amount of heat for hot water supply in a hot water storage tank 1, and a function of reheating (warming or keeping warm) bath water 6 in a bathtub 5. The hot water storage tank 1 is connected to a heat pump unit 2. In a heating operation, cold water 3 in the hot water storage tank 1 is fed to the heat pump unit 2 and turned into hot water 4 by heat supplied from a refrigeration cycle. The hot water 4 returns to the hot water storage tank 1. Expanded water that is water with an expanded volume in the heating operation passes through a drain 29 connected to the hot water storage tank 1 and is discharged from a relief valve 30 to an outside of a system. A water supply pipe 8 branching from a clean water pipe 7 that supplies clean water is connected to the hot water storage tank 1. The hot water 4 in the hot water storage tank 1 is fed through a hot water supply pipe 10 to a faucet 9, and supplied from the faucet 9 to the bathtub 5.

[0013] The bath hot water supply apparatus of this embodiment further includes a reheating heat exchanger 11 for reheating the bath water 6 in the bathtub 5, a heating pipe 12 that supplies the hot water 4 in the hot water storage tank 1 to the reheating heat exchanger 11, a circulation pump 13 that circulates the hot water 4 to the heating pipe 12, a reheating circulation channel 15 that circulates the bath water 6 in the bathtub 5 to the reheating heat exchanger 11, a circulation pump 14 that circulates the bath water 6 in the bathtub 5 to the reheating circulation channel 15, and a swirl-type fine bubble generation device 16 for injecting fine bubbles placed on the way of the reheating circulation channel 15. The circulation pump 14, the fine bubble generation device 16, and the reheating heat exchanger 11 are placed in this order from an upstream side toward a downstream side of the reheating circulation channel 15.

[0014] For reheating the bath water 6 in the bathtub 5, the hot water 4 is fed from the hot water storage tank 1 through the heating pipe 12 to the reheating heat exchanger 11 by the circulation pump 13. The bath water 6 in the bathtub 5 is fed through the reheating circulation channel 15 to the reheating heat exchanger 11 by the circulation pump 14. In the reheating heat exchanger 11, by heat exchange between the hot water 4 from the hot water storage tank 1 and the bath water 6, heat is taken from the hot water 4 and the hot water 4 reduced in temperature is returned through the heating pipe 12 to the hot water storage tank 1, and the bath water 6 receives heat and is increased in temperature, and is returned through the reheating circulation channel 15 to the bathtub 5.

[0015] The bath hot water supply apparatus of this embodiment further includes a water supply pipe 18 that is

connected to the faucet 9 and supplies water to the bathtub 5, a water supply pipe 19 that supplies clean water to the reheating circulation channel 15, and a fine bubble generation device 20 for injecting bubbles provided in the water supply pipe 19. The fine bubble generation device 20 is used for cleaning the reheating circulation channel 15. In the above description, descriptions on usual on-off valves or a check valve mounted to the pipes are omitted.

[0016] Figure 2 is a sectional view of the fine bubble generation device 16 and the reheating circulation channel 15 downstream of the fine bubble generation device 16. As shown in Figure 2, the fine bubble generation device 16 in this embodiment includes an air introducing portion 22, a bath water introducing portion 23, a gas-liquid mixing portion 24, a water flow swirling portion 25, and a fine bubble generation portion 26. A flow of bath water fed into the bath water introducing portion 23 by the circulation pump 14 is mixed with outside air taken from the air introducing portion 22 in the gas-liquid mixing portion 24 and turned into a gas-liquid mixed fluid. The gas-liquid mixed fluid flows into the water flow swirling portion 25. The water flow swirling portion 25 is a structure that has a conical swirl-flow-generation-space. A cross-sectional diameter of an inner channel of the swirl-flow-generation-space smoothly decreases toward an outlet. The gas-liquid mixed fluid from the gas-liquid mixing portion 24 tangentially flows into a bottom of the cone of the water flow swirling portion 25. A water flow in the gas-liquid mixed fluid centrifugally becomes a swirling water flow along a wall surface of the water flow swirling portion 25. Air in the gas-liquid mixed fluid is separated from the water flow, and an air column passing through a central axis of the water flow swirling portion 25 and narrowed by the rotation flows toward the outlet of the water flow swirling portion 25 while rotating at high speed. The outlet of the water flow swirling portion 25 is a merging portion where the high-speed swirling water flow and the air flow merge again. At the merging portion, a sudden decompression phenomenon occurs, and thus air suddenly expands and is separated from the air column to generate bubbles. At this time, the high-speed swirl flow further finely shears the air, and the fine bubble generation portion 26 can efficiently generate fine bubbles having a diameter of several ten micrometers or less. Herein, microbubbles, micro-nanobubbles, nanobubbles are collectively referred to as fine bubbles. Generally, a microbubble is defined as a bubble having a diameter of ten to several ten micrometers at generation, and has a nature of contraction after the generation. With increasing degree of contraction, the microbubble is turned into a micro-nanobubble (bubble having a diameter of several hundred nanometers to ten micrometers). Further, it is known that when the diameter is 8 micrometers or less, a contraction speed steeply increases.

[0017] The swirl fine bubble generation device 16 as described above can efficiently generate fine bubbles having a diameter of several ten micrometers or less.

Since the fine bubbles having such a diameter may have a large negative potential, electrostatic repulsion provides beneficial effects of preventing bubble joining and preventing adhesion to an inner wall of a channel. The formation of the fine bubble generation device 16 described above is an example, and the formation of the fine bubble generation device used in the present invention is not limited to this. For example, the same advantage can be obtained if a fine bubble generation device having a formation with a wing-like swirl-flow-generation-member is used instead of the structure having the conical swirl-flow-generation-space having a smoothly decreasing diameter.

[0018] Rectification means 31 is provided in the reheating circulation channel 15 downstream of the fine bubble generation device 16. A water flow (gas-liquid flow) containing fine bubbles generated by the fine bubble generation device 16 is a swirl flow. The rectification means 31 has a function of preventing rotation of the swirl flow. If the swirl flow containing fine bubbles generated by the fine bubble generation device 16 continuously rotates in a limited space in the reheating circulation channel 15, the fine bubbles collide with each other to easily cause bubble joining and increase a bubble diameter. A larger bubble diameter reduces a negative potential applied to the bubbles, which reduces effects of preventing bubble joining and preventing adhesion to the inner wall of the channel due to electrostatic repulsion. This easily causes further bubble joining or adhesion of bubbles to the inner wall of the channel. Thus, while bubbles are flowing through the reheating circulation channel 15 before reaching the bathtub 5, bubble joining further increases a bubble diameter, or bubbles easily adhere to the inner wall of the channel and disappear, thereby preventing sufficient fine bubbles from reaching the bathtub 5.

[0019] On the other hand, in this embodiment, the rectification means 31 suppresses rotation of the swirl flow containing fine bubbles generated by the fine bubble generation device 16, thereby preventing collision between the fine bubbles. This can reliably prevent bubble joining of formed fine bubbles, and prevent an increase in bubble diameter. Specifically, fine bubbles having a diameter of several ten micrometers or less generated by the fine bubble generation device 16 can be stably passed downstream of the reheating circulation channel 15 without increasing the bubble diameter. This can avoid a reduction in negative potential applied to the bubbles, and reliably ensure effects of preventing bubble joining and preventing adhesion to the inner wall of the channel due to electrostatic repulsion. This can prevent bubble joining from increasing a bubble diameter, or prevent bubbles from adhering to the inner wall of the channel and disappearing while bubbles are flowing through the reheating circulation channel 15, thereby allowing sufficient fine bubbles to be supplied into the bathtub 5.

[0020] Any clearance may be chosen between the outlet of the water flow swirling portion 25 and the rectification means 31 (distance d in Figure 2), but the clearance

is preferably adjusted for each use condition since an optimum clearance is determined depending on a generation state of fine bubbles and a speed of the swirl flow. In Figure 2, for convenience, a length of the rectification means 31 (longitudinal size of the reheating circulation channel 15) is shorter than that in Figure 4 described later.

[0021] Figure 3 is a sectional view of the rectification means 31 cut along a section perpendicular to the longitudinal direction of the reheating circulation channel 15. Figure 4 is a perspective view of the rectification means 31 provided in the reheating circulation channel 15. As in these drawings, the rectification means 31 in this embodiment has a plurality of plate-like rectification walls 34 radially placed with respect to a center 33 of the section perpendicular to the longitudinal direction of the reheating circulation channel 15. In the shown configuration, eight rectification walls 34 are placed at regular angular intervals (at 45° intervals), but not limited to such a configuration, the number of the rectification walls 34 may be adjusted depending on configurations of a pipe system (pressure loss tolerance). The rectification walls 34 each extend from a periphery in the reheating circulation channel 15 to the center 33. The rectification walls 34 may be coupled and integrated at the center 33. As shown in Figure 4, the rectification walls 34 extend in the longitudinal direction of the reheating circulation channel 15. Any extension distance of the rectification wall 34 may be chosen, but the distance is preferably adjusted for each use condition since an optimum distance is determined depending on a generation state of fine bubbles and a speed of the swirl flow.

[0022] The water flow having flowed out of the fine bubble generation device 16 is a swirl flow, and passes while rotating along a circumferential surface of the inner wall of the reheating circulation channel 15. The rectification means 31 in this embodiment can extremely effectively suppress rotation of the water flow having flowed out of the fine bubble generation device 16 by the arrangement of the rectification walls 34 as described above. This can more reliably prevent bubble joining of formed fine bubbles.

[0023] As described above, the bath hot water supply apparatus of this embodiment can reliably prevent bubble joining of fine bubbles generated by the fine bubble generation device 16, and thus can bring sufficient fine bubbles to the bathtub 5. This provides a warm bath effect by the fine bubbles in the bathtub 5, and an effect of preventing adhesion of stain or sebum dirt to the inner surface of the bathtub 5 using the fine bubbles.

[0024] A switch valve (not shown) may be provided that can switch the bath water circulating in the reheating circulation channel 15 between a state where the bath water is passed through the fine bubble generation device 16 and a state where the bath water is not passed therethrough, and when generation of fine bubbles is unnecessary, the bath water circulating in the reheating circulation channel 15 may be switched so as not to be

passed through the fine bubble generation device 16.

[0025] Also, in this embodiment, the circulation pump 14 and the reheating circulation channel 15 that circulate the bath water 6 in reheating the bathtub 5 are used to supply fine bubbles to the bathtub 5, and thus the pump and the pipe can be shared, thereby preventing cost increases. However, in the present invention, it may be allowed that the circulation pipe and the circulation pump for supplying fine bubbles to the bathtub 5 are not shared with those for reheating.

Embodiment 2

[0026] Next, with reference to Figure 5, Embodiment 2 of the present invention will be described. Differences from Embodiment 1 described above are mainly described, and the same or corresponding components are denoted by the same reference numerals and descriptions thereof will be omitted.

[0027] Figure 4 is a sectional view of rectification means 41 included in a bath hot water supply apparatus according to Embodiment 2 of the present invention cut along a section perpendicular to a longitudinal direction of a reheating circulation channel 15. The bath hot water supply apparatus of Embodiment 2 is similar to the bath hot water supply apparatus of Embodiment 1 except including the rectification means 41 instead of the rectification means 31.

[0028] The rectification means 41 in this embodiment has a plurality of plate-like rectification walls 44 radially placed with respect to a center 43 of the section perpendicular to the longitudinal direction of the reheating circulation channel 15. In the shown configuration, eight rectification walls 44 are placed at regular angular intervals (at 45° intervals), but not limited to such a configuration, the number of the rectification walls 44 may be adjusted depending on configurations of a pipe system (pressure loss tolerance). The rectification walls 44 extend partway from a periphery in the reheating circulation channel 15 to the center 43. Specifically, the rectification walls 44 do not exist within a predetermined radius around the center 43.

[0029] The rectification means 41 in this embodiment can extremely effectively suppress rotation of a water flow having flowed out of a fine bubble generation device 16 by the arrangement of the rectification walls 44 as described above, and also reliably prevent dirt (such as sebum or water stain) or foreign matter (such as hair) in the bath water passing through the reheating circulation channel 15 from being caught in the rectification walls 44. This is extremely effective in reliably preventing clogging of pipes due to accumulation of the dirt or foreign matter.

Industrial Applicability

[0030] The bath hot water supply apparatus according to the present invention can be applied to systems in-

cluding a circulation channel that allows bath water led out of a bathtub to return to the bathtub.

Reference Signs List

[0031]

1	hot water storage tank	
2	heat pump unit	
3	cold water	
4	hot water	10
5	bathtub	
6	bath water	
7	clean water pipe	
8, 18, 19	water supply pipe	15
9	faucet	
10	hot water supply pipe	
11	reheating heat exchanger	
12	heating pipe	
13, 14	circulation pump	20
15	reheating circulation channel	
16, 20	fine bubble generation device	
22	air introducing portion	
23	bath water introducing portion	
24	gas-liquid mixing portion	25
25	water flow swirling portion	
26	fine bubble generation portion	
29	drain	
30	relief valve	
31, 41	rectification means	30
33, 43	center	
34, 44	rectification wall	

Claims

1. A bath hot water supply apparatus comprising:

a circulation channel that allows bath water led out of a bathtub to return to the bathtub; 40
a circulation pump that circulates the bath water to the circulation channel;
a fine bubble generation device that is provided on a way of the circulation channel and is capable of generating fine bubbles in the bath water; 45
and
rectification means that is provided in the circulation channel downstream of the fine bubble generation device, and suppresses rotation of a swirl flow containing the fine bubbles generated by the fine bubble generation device, 50
wherein the fine bubble generation device generates the fine bubbles while the bath water is circulated to the circulation channel to supply the fine bubbles to the bathtub. 55

2. The bath hot water supply apparatus according to claim 1, wherein the rectification means comprises

a plurality of plate-like rectification walls radially placed with respect to a center of a section perpendicular to a longitudinal direction of the circulation channel.

3. The bath hot water supply apparatus according to claim 2, wherein the plurality of rectification walls each extend from a periphery in the circulation channel to the center.

4. The bath hot water supply apparatus according to claim 2, wherein the plurality of rectification walls each extend partway from a periphery in the circulation channel to the center.

5. The bath hot water supply apparatus according to any one of claims 2 to 4, wherein the rectification walls extend in a longitudinal direction of the circulation channel.

6. The bath hot water supply apparatus according to any one of claims 1 to 5, wherein the fine bubble generation device comprises a structure in which an inner channel is formed, the inner channel being circular in cross-section, the inner channel rotating a fluid at high speed, the fine bubble generation device discharging a water flow from an outlet of the structure.

FIG. 1

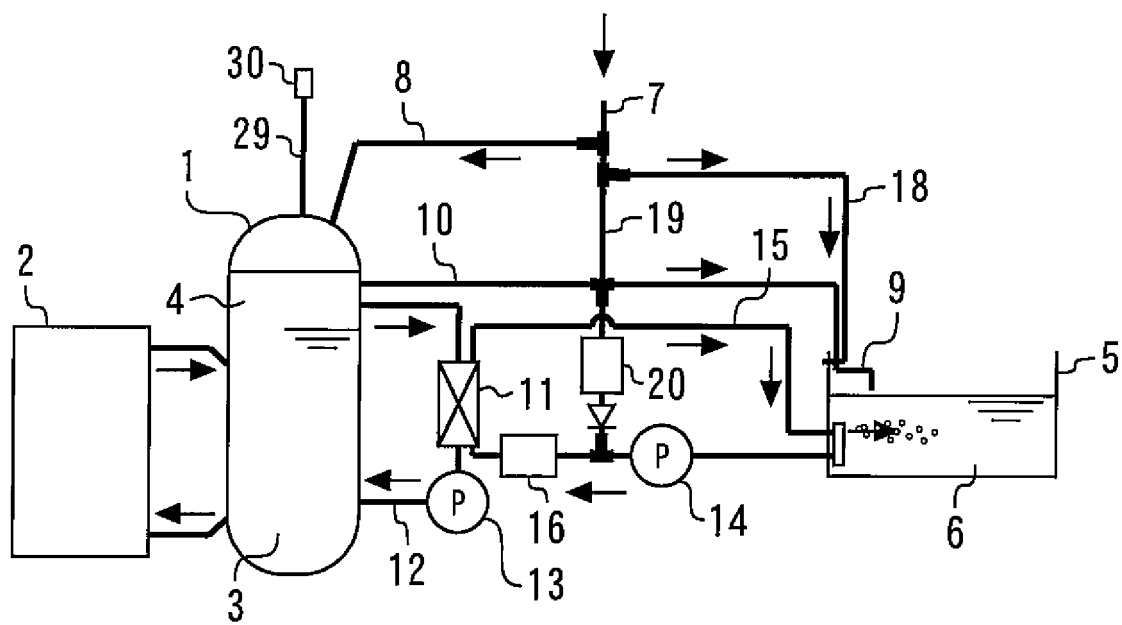


FIG. 2

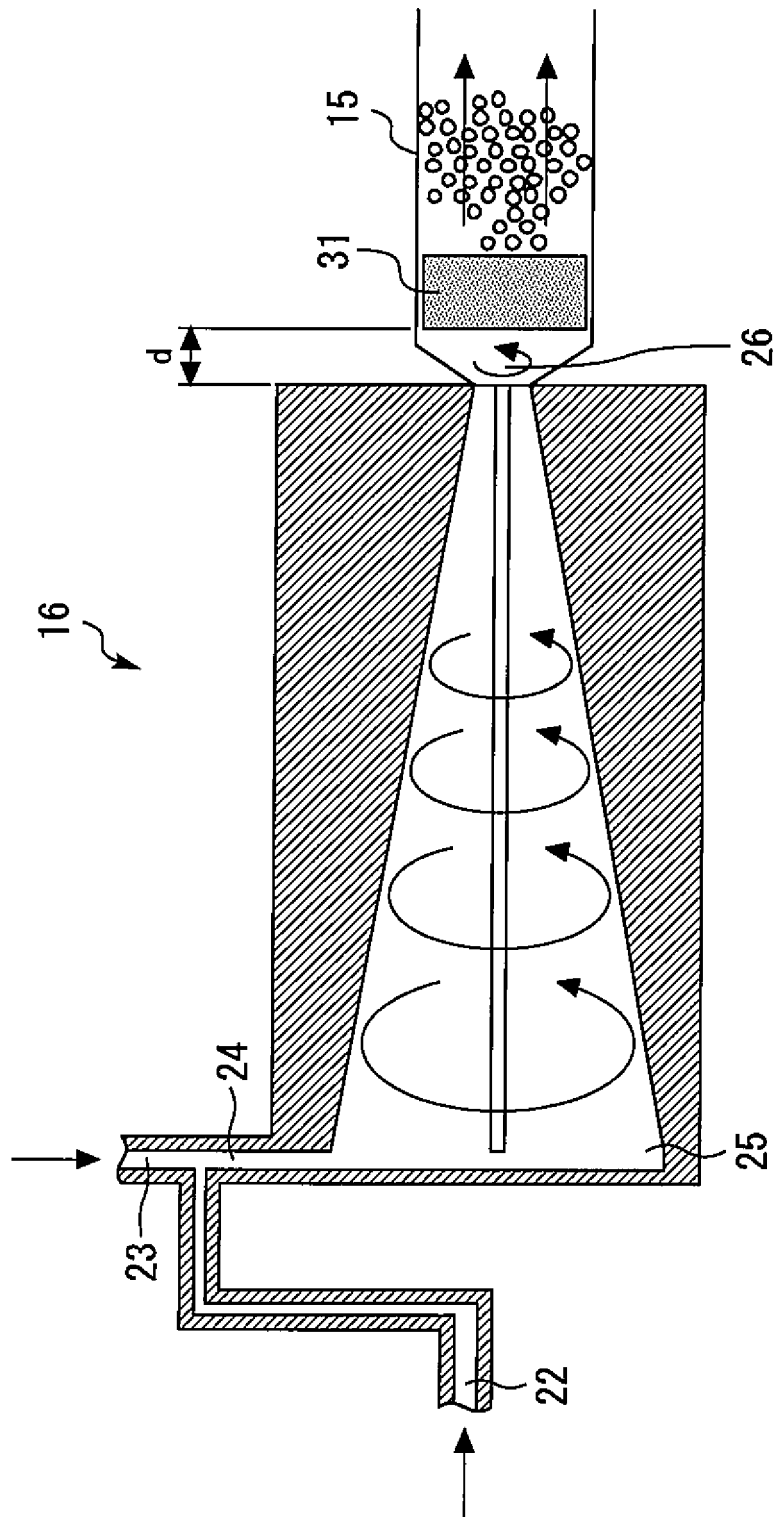


FIG. 3

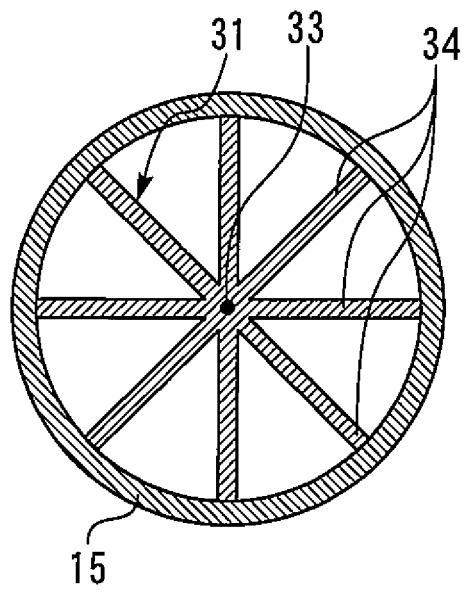


FIG. 4

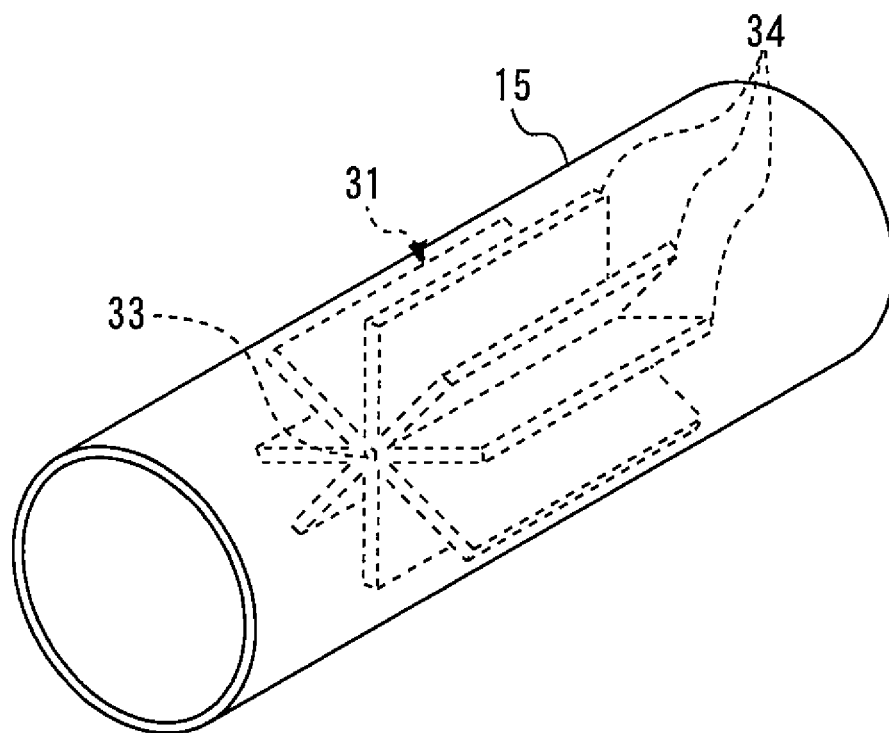
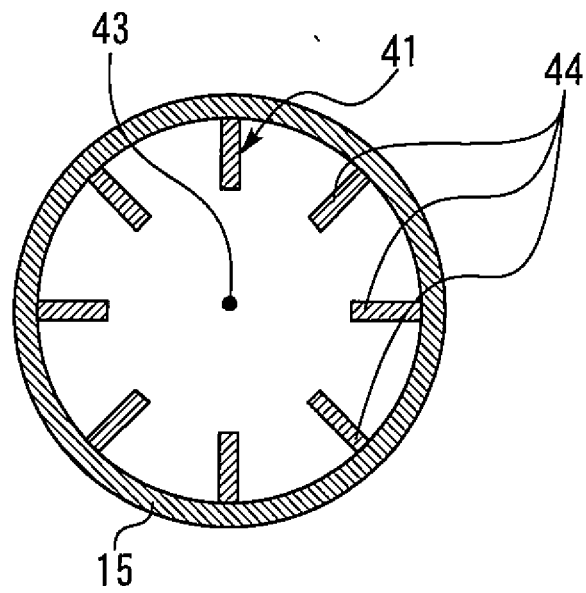


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/052021

A. CLASSIFICATION OF SUBJECT MATTER

F24H1/00 (2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24H1/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2013
Kokai Jitsuyo Shinan Koho	1971-2013	Toroku Jitsuyo Shinan Koho	1994-2013

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2006-334556 A (Hitachi Housetec Co., Ltd.), 14 December 2006 (14.12.2006), paragraphs [0017], [0026]; fig. 1, 5 (Family: none)	1-6
Y	JP 2008-229516 A (University of Tsukuba), 02 October 2008 (02.10.2008), paragraph [0081]; fig. 40 (Family: none)	1-6
Y	JP 2002-085949 A (Kabushiki Kaisha Asupu), 26 March 2002 (26.03.2002), paragraphs [0016], [0020] to [0021]; fig. 1, 3, 4 & TW 499552 B	1-6

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
26 February, 2013 (26.02.13)Date of mailing of the international search report
05 March, 2013 (05.03.13)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

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 2009186092 A [0004]
- JP 4525890 B [0004]