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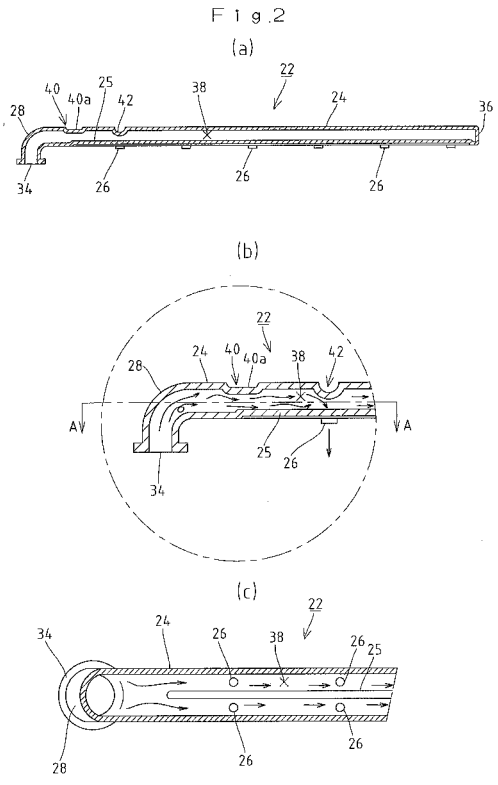
(54) WATER SPRAY PIPE FOR DOWNFLOW TYPE ICE MAKING MACHINE

(57) There is provided a water sprinkle pipe for a downflow type ice making machine that regulates a flow of ice making water to suppress generation of turbulence and can uniformly supply the ice making water from water sprinkle holes. A water sprinkle pipe (22) comprises: a pipe body (24) that is arranged to extend above an ice making section, has a flow region (38) for the ice making water defined therein, and has one end communicating with a discharge opening of a circulation pump (30); and a plurality of water sprinkle holes (26) provided in a lower surface of the pipe body (24) in an extending direction. A regulation portion (40) protruding from an inner surface of the pipe body (24) to the flow region (38) side to locally narrow the flow region (38) is provided on an upper surface of the pipe body (24) on an upstream side of the upstream-most water sprinkle holes (26). Further, a semicircular regulation portion (42) is formed on a downstream side of the regulation portion (40) in the pipe body (24).



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Description

TECHNICAL FIELD

[0001] The present invention relates to a water sprinkle pipe for a downflow type ice making machine and more particularly to a water sprinkle pipe for a downflow type ice making machine that is arranged above an ice making section and supplies ice making water to the ice making section through water spray holes.

BACKGROUND ART

[0002] As an automatic ice making machine that continuously produces ice, a downflow type ice making machine that includes an ice making machine formed of a pair of ice making plates and cools down an ice making surface of each ice making plate by a refrigerant supplied to an evaporation tube arranged between both the ice making plates to produce the ice is known (see Patent Document 1). Briefly explaining an outline configuration of this downflow type ice making machine hereinafter, a plurality of partition members are arranged on the ice making surfaces of the ice making section, and ice making regions extending in a vertical direction are defined between the partition members adjacent to each other. Further, a water sprinkle pipe including a plurality of water spray holes are arranged above the ice making section so that ice making water stored in an ice making water tank and sucked by a circulation pump is supplied to the respective ice making regions through the water spray holes.

[0003] The water sprinkle pipe includes an elongated pipe body having a flow region for the ice making water therein and the plurality of water spray holes provided in a lower surface of the pipe main body. One end side of the pipe body is bent downwards at a substantially right angle to form a bent portion, and a connecting portion is formed at an open end of the pipe body extending downwards from the bent portion. This connecting portion communicates with a discharge opening of the circulation pump through a coupling tube. Furthermore, at the time of an ice making operation, the ice making water stored in the ice making water tank is sucked by the circulation pump to flow into the pipe body from the connecting portion. The ice making water that has flowed in the pipe body is injected to the lower ice making section from the respective water spray holes while flowing through the flow region.

Patent Document 1: Japanese Patent Application Laid-open No. 7-305928 (1995)

DISCLOSURE OF INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0004] Meanwhile, the ice making water flowing through the flow region of the water sprinkle pipe has a water pressure and a flow velocity that are increased on a connecting portion side close to the circulation pump. Moreover, a flow direction of the ice making water is forcibly changed when passing through the bent portion. Therefore, the ice making water flowing through the water sprinkle pipe is apt to become turbulent on the side close to the circulation pump, and the ice making water may not be uniformly supplied in the water spray holes on the upstream side close to the bent portion in particular in some cases. Additionally, when the flow velocity of the ice making water is high, a negative pressure may be formed in the flow region and outside air may be sucked through the water spray holes according to circumstances. Therefore, fine air bubbles are mixed in the ice making water supplied to the ice making section, which becomes a cause of production of clouded ice or ice having a different shape.

[0005] Therefore, in view of the problems inherent in the conventional technology, the present invention is proposed to preferably solve these problems, and an object of the present invention is to provide a water sprinlde pipe for a downflow type ice making machine that can suppress occurrence of a turbulence in the water sprinkle pipe and uniformly supply ice making water from each water spray hole.

MEANS FOR SOLVING PROBLEM

[0006] To solve the above-described problem and preferably achieve the expected object, there is provided a water sprinlde pipe for a downflow type ice making machine according to the present invention, comprising:

a pipe body that is arranged to extend above an ice making section and communicates with a discharge opening of a pump and through which ice making water discharged from the discharge opening of the pump flows; and a plurality of water sprinkle holes provided in a lower surface of the pipe body and placed to be apart from each other in an extending direction of the pipe body, the water sprinkle pipe being configured to supply the ice making water sucked by the pump and flowing through the pipe body to the ice making section through the water sprinlde holes,
wherein a regulation portion that protrudes from an inner surface of the pipe body to locally narrow a flow region for the ice making water is provided on the upstream side of the upstream-most water sprinkle hole in the pipe body.

[0007] To solve the above-described problem and preferably achieve the expected object, there is provided a water sprinkle pipe for a downflow type ice making machine according to the present invention, comprising:

a pipe body that is arranged to extend above an ice

making section and communicates with a discharge opening of a pump and through which ice making water discharged from the discharge opening of the pump flows; and a plurality of water sprinkle holes provided in a lower surface of the pipe body and placed to be apart from each other in an extending direction of the pipe body, the water sprinkle pipe being configured to supply the ice making water sucked by the pump and flowing through the pipe body to the ice making section through the water sprinkle holes,

wherein a reduced-pressure straightening portion comprising a semicircular reduced-pressure space that protrudes upwards from an inner surface of the pipe body to locally expand a flow region for the ice making water is provided on the upstream side of the upstream-most water sprinkle hole in the pipe body.

EFFECT OF THE INVENTION

[0008] According to the water sprinkle pipe for a downflow type ice making machine of the present invention, turbulence of the ice making water flowing through the sprinkle pipe can be suppressed from being produced, and the ice making water can be uniformly supplied from all the sprinkle holes.

BRIEF DESCRIPTION OF DRAWINGS

[0009]

FIG. 1 is an overall structural view showing a downflow type ice making machine including a water sprinkle pipe according to Embodiment 1;

FIG. 2 is cross-sectional views showing the water sprinkle pipe according to Embodiment 1, wherein (a) is a longitudinal cross-sectional view showing the entire water sprinkle pipe, (b) is an enlarged longitudinal cross-sectional view showing a primary part of the water sprinkle pipe, and (c) is a transverse cross-sectional view taken along a line A-A in (b);

FIG. 3 is an enlarged longitudinal cross-sectional view showing a primary part of a water sprinkle pipe according to Embodiment 2;

FIG. 4 is an enlarged transverse cross-sectional view showing a primary part of a water sprinkle pipe according to Embodiment 3;

FIG. 5 is an enlarged longitudinal cross-sectional view showing a primary part of a water sprinkle pipe according to Embodiment 4;

FIG. 6 is cross-sectional views showing a primary part of a water sprinkle pipe according to Embodiment 5, wherein (a) is a longitudinal cross-sectional view and (b) is a transverse cross-sectional view taken along a line B-B in (a); and

FIG. 7 is a transverse cross-sectional view showing a primary part of a water sprinkle pipe according to Embodiment 6.

EXPLANATIONS OF REFERENCE NUMERALS

[0010] 14 ... ice making section, 24, 54, 62, 72, 86, and 92 ... pipe body, 26 ... water sprinkle hole, 30 ... circulation pump, 38 ... flow region, 40 ... regulation portion, 42 ... semicircular regulation portion (second regulation portion), 52 ... second regulation portion (second regulation portion), 64 ... lateral regulation portion (second regulation portion), 74 ... conical regulation portion (second regulation portion), 82 ... guide protruding portion, 94 ... reduced-pressure straightening portion, 96 ... reduced-pressure space

BEST MODE(S) FOR CARRYING OUT THE INVENTION

[0011] Preferred embodiments of a water sprinkle pipe for a downflow type ice making machine according to the present invention will now be described hereinafter with reference to the accompanying drawings.

Embodiment 1

[0012] FIG. 1 is a schematic view showing an overall configuration of a downflow type ice making machine 10 having a water sprinkle pipe 22 according to Embodiment 1 provided therein. In the downflow type ice making machine 10, a pair of ice making plates 12 (one ice making plate 12 alone is shown in FIG. 1) are oppositely arranged to constitute an ice making section 14, and an evaporation tube 16 led out from a non-illustrated freezing system is arranged between both the ice making plates 12 in a meandering manner. A plurality of partition members 18 extending in a vertical direction are provided on a surface (an ice making surface) of the ice making plate 12 at predetermined intervals, and each ice making region 20 where ice pieces are manufactured is defined between the partition members 18, 18 adjacent to each other.

[0013] As shown in a longitudinal cross-sectional view of FIG. 2, the water sprinkle pipe 22 through which the ice making water is supplied to the ice making section 14 includes a pipe body 24 extending in a horizontal direction above the ice making section 14 and a plurality of water sprinkle holes 26 provided in a lower surface of the pipe body 24. A bent portion 28 that is bent at a substantially right angle is formed on one end side (an upstream side) of the pipe body 24. A connecting portion 34 that is connected with a discharge opening (not shown) of a later-described circulation pump (a pump) 30 through a coupling tube 32 is formed at an open end (one end) directed to a lower side from the bent portion 28. Further, the other end of the pipe body 24 is closed to form a closed end 36.

[0014] A flow region 38 through which the ice making water flows from the connecting portion 34 side (the one end side) toward the closed end 36 side (the other end

side) is defined in the pipe body 24, whereby the ice making water can flow through the flow region 38 under a predetermined water pressure by the circulation pump 30. The plurality of water sprinkle holes 26 are provided in an extending direction of the pipe body 24 at fixed intervals to supply the ice making water to the corresponding ice making regions 20 so that the ice making water flowing through the flow region 38 can be supplied to the ice making section 14 via the water sprinkle holes 26. It is to be noted that two columns of the water sprinkle holes 26 are provided in the lower surface of the pipe body 24 to be apart from each other in a direction (which will be referred to as a width direction hereinafter) orthogonal to the extending direction of the pipe body 24 in association with the pair of ice making plates 12 (see FIG. 2(c)). Moreover, an installation concave portion 25 that is utilized to position a later-described deicing water supply tube 44 is provided on the lower surface of the pipe body 24. As shown in FIG. 2(c), this installation concave portion 25 extends to be placed between the water sprinkle holes 26, 26 aligned in the width direction of the pipe body 24, and the lower surface of the pipe body 24 is pushed up by the installation concave portion 25 to slightly narrow the flow region 38.

[0015] As shown in FIGS. 2(a) and (b), a regulation portion 40 that protrudes from an inner surface of the pipe body 24 to locally narrow the flow region 38 is provided on an upper surface of the pipe body 24 and on an upstream side of the uppermost water sprinkle holes 26. This regulation portion 40 is formed by making a dent having a predetermined depth in the upper surface of the pipe body 24, and as shown in FIG. 2(b), the regulation portion 40 includes a bottom surface 40a that is one level lower than the upper surface of the pipe body 24 and parallel to a flowing direction of the ice making water. Additionally, a second regulation portion 42 is provided on a downstream side of the regulation portion 40 on the upper surface of the pipe body 24. Like the regulation portion 40, this second regulation portion 42 protrudes from the upper surface of the pipe body 24 toward the flow region 38 side to narrow the flow region 38. As shown in FIG. 2(b), the second regulation portion 42 is formed to have a semicircular cross-sectional shape that is bent from the upstream side toward the downstream side (which will be referred to as a semicircular regulation portion 42 hereinafter). Further, in regard to an arrangement position of the semicircular regulation portion 42, this portion is provided to be placed above the upstream-most water sprinkle holes 26. That is, it is arranged in such a manner that the lowermost end (a top portion) of the semicircular regulation portion 42 is placed above the water sprinkle holes 26. As described above, in Embodiment 1, the regulation portion 40 and the semicircular regulation portion 42 are configured to narrow the flow region 38 on two stages, thereby avoiding generation of turbulence of the ice making water. It is to be noted that, as shown in FIG. 1, the deicing supply tube 44 through which water having an ordinary temperature (deicing water) is supplied to a back surface of the ice making plate 12 in a deicing operation is fixed to the lower surface of the water sprinkle pipe 22 in a state where it is positioned in the installation concave portion 25.

[0016] An ice making water tank 46 that is opened on an upper side to store the ice making water is provided below the ice making section 14. A discharge opening 46a is provided in a bottom portion of this ice making water tank 46, and an inlet tube 48 of the circulation pump 30 is connected to the discharge opening 46a. Further, the coupling tube 32 is led out from an outlet opening of the circulation pump 30, and the coupling tube 32 is connected with the connecting portion 34 as described above. Furthermore, the ice making water in the ice making water tank 46 is supplied to the water sprinkle pipe 22 through the inlet tube 48 and the coupling tube 32 by the circulation pump 30. It is to be noted that the ice making water that has been supplied to the ice making water 14 but not been frozen in the ice making section 14 falls to be collected in the ice making water tank 46 from the ice making section 14 to be circulated and supplied.

(Operation of Embodiment 1)

[0017] An operation of the water sprinkle pipe 22 according to Embodiment 1 will now be described hereinafter. At the time of an ice making operation, a refrigerant is circulated and supplied to the evaporation tube 16 from the freezing system, the circulation pump 30 is actuated, and the ice making water in the ice making tank 46 is sucked through the inlet tube 48. The ice making water sucked from the ice making water tank 46 is supplied to the upper side through the coupling tube 32 to reach the connecting portion 34 of the water sprinkle pipe 22. Then, the ice making water flows into the water sprinkle pipe 22 through the connecting portion 34, whereby a direction of the ice making water is forcibly changed to a horizontal direction in the bent portion 28. Then, this change in direction disturbs a flowing direction of the ice making water, and turbulence is apt to be produced in the ice making water that has passed through the bent portion 28. Further, the proximity of the bent portion 28 of the flow region 38 is close to the circulation pump 30, and a flow rate of the ice making water is high.

[0018] Therefore, when the ice making water arrives at the regulation portion 40, a water pressure of the ice making water is temporarily increased whilst a flow rate of the same is reduced since the ice making water flows through the flow region 38 narrowed by the regulation portion 40 (see FIG. 2(b)). Furthermore, when the ice making water passes through the regulation portion 40, the flow region 38 broadens to reduce the pressure of the ice making water, whereby the direction of the ice making water is set to an extending direction of the water sprinkle pipe 22.

[0019] Subsequently, the ice making water that has passed through the regulation portion 40 arrives at the semicircular regulation portion 42. That is, when the ice

making water flows through the flow region 38 narrowed by the semicircular regulation portion 42, the water pressure of the ice making water is again increased, and the flow rate of the ice making water is further reduced. Moreover, the ice making water is guided to the water sprinkle holes 26 by the semicircular regulation portion 42, and the ice making water is smoothly supplied to the ice making section from the water sprinkle holes 26. When the ice making water passes through the semicircular regulation portion 42, the water pressure thereof is reduced, and the direction of the ice making water is further set to the extending direction of the pipe body 24. As described above, in the water sprinkle pipe 22 according to Embodiment 1, when the ice making water passes through the regulation portion 40 and the semicircular regulation portion 42, two-stage deceleration is carried out. As a result, the ice making water can flow straightforward in the flow region 38 at a fixed low rate. Although the thus decelerated ice making water is supplied to the ice making section 14 through each water sprinkle hole 26, the ice making water can be likewise stably supplied through the upstream-most water sprinkle holes 26 where supply of the ice making water is unstable in conventional examples. That is, the ice making water can be uniformly supplied from all the water sprinkle holes 26, thereby uniforming sizes of ice pieces to be manufactured. Furthermore, since the ice making water flows through the flow region 38 at the fixed low rate and the ice making water is supplied toward the water sprinkle holes 26 by the semicircular regulation portion 42, cavitation and the like hardly occur in the water sprinkle holes 26. As a result, clouding of ice pieces to be manufactured can be suppressed, or ice pieces having different shapes can be prevented from being manufactured.

[0020] It is to be noted that one semicircular regulation portion 42 is provided in Embodiment 1, but the plurality of semicircular regulation portions 42 may be provided on the downstream side of the regulation portion 40 at fixed intervals. In this case, each semicircular regulation portion 42 is provided to be placed above the corresponding water sprinkle holes 26. When the plurality of semicircular regulation portions 42 are provided, the ice making water can be decelerated more than once, thereby realizing more stable supply of the ice making water.

Embodiment 2

[0021] In regard to a water sprinkle pipe for a downflow type ice making water according to Embodiment 2, differences from Embodiment 1 will be mainly explained. It is to be noted that like reference numerals denote members equal to those in Embodiment 1, thereby omitting a description thereof. FIG. 3 is a longitudinal cross-sectional view showing a primary part of a water sprinkle pipe 50 according to Embodiment 2, and the same regulation portion 40 as that in Embodiment 1 is provided on an upper surface of a pipe body 54 close to a bent portion 28 by making a dent in this upper surface. Further, a plurality of second regulation portions 52 (which will be referred to as second regulation portions hereinafter) are provided on the upper surface of the pipe body 54 on a downstream side of the regulation portion 40. The second regulation portion 52 is bent in such a manner that an upstream-side surface thereof is inclined toward corresponding water sprinkle holes 26 and a downstream-side surface thereof is inclined toward the upper surface of the pipe body 54 at a gentler inclination angle than that of the upstream-side surface thereof. In the second regulation portion 52, the lowest bottom portion 52a is placed to be biased toward the upstream side, and a flow region 38 is narrowed by an amount corresponding to downward protrusion of each second regulation portion 52. Moreover, the second regulation portions 52 are provided in association with all the water sprinkle holes 26, and the bottom portions 52a are placed above the respective water sprinkle holes 26. It is to be noted that the second regulation portions 52, 52 adjacent to each other are configured to couple their ends on the upstream side and the downstream side with each other as shown in FIG. 3.

[0022] In an ice making operation, when ice making water is supplied to the water sprinkle pipe 50, the ice making water first passes through the regulation portion 40 via the bent portion 28. Then, the ice making water is temporarily decelerated in this regulation portion 40, and the ice making water is directed to an extending direction of the water sprinkle pipe 50. Subsequently, the ice making water passes through the upstream-most second regulation portion 52 where secondary deceleration is carried out. That is, since the upstream-side surface of the second regulation portion 52 has a shape inclined downwards at a sharp angle, a water pressure of the ice making water is precipitously increased to carry out the deceleration. Additionally, the ice making water is guided to the water sprinkle holes 26 by the upstream-side surface of each second regulation portion 52, thereby smoothly supplying the ice making water from the water sprinkle holes 26. On the other hand, since the downstream-side surface of the second regulation portion 52 is inclined upwards at a gentle inclination angle, the ice making water is gradually depressurized in accordance with this shape. Meanwhile, the ice making water is directed toward the extending direction of the water sprinkle pipe 22.

[0023] Then, the ice making water is continuously decelerated by the subsequent second and third second regulation portions 52, 52, whereby the ice making water is further directed. That is, the regulation portion 40 and the plurality of second regulation portions 52 suppress generation of turbulence, and the ice making water can thereby flow through the flow region 38 at a fixed low rate. As a result, the ice making water can be uniformly supplied from all the water sprinkle holes 26 to uniform sizes of ice pieces to be manufactured. Further, since the ice making water likewise flows on the upstream side of the flow region 38 at the fixed low rate, cavitation hardly occurs in the water sprinkle holes 26, thus suppressing manufacture of clouded ice pieces/ice pieces having dif-

ferent shapes. Furthermore, since the ice making water is supplied toward the water sprinkle holes 26 by the respective second regulation portions 52, the ice making water can be smoothly supplied from the water sprinkle holes 26.

Embodiment 3

[0024] A water sprinkle pipe for a downflow type ice making machine according to Embodiment 3 will now be described. In a description of Embodiment 3, differences from Embodiment 1 will be mainly explained. As shown in FIG. 4, in a water sprinkle pipe 60 according to Embodiment 3, a regulation portion 40 is provided near a bent portion 28 on an upper surface of a pipe body 62 by making a dent in this upper surface like Embodiment 1. Moreover, a plurality of pairs of lateral regulation portions (second regulation portions) 64, 64, which protrude to face each other, are provided on both inner side surfaces of the pipe body 62. Each lateral regulation portion 64 is constituted by integral molding so as to bulge with a semicircular cross section from the inner side surface of the pipe body 62, and one pair of lateral regulation portions 64, 64 narrow a flow region 38 from laterals. Here, the upstream-most lateral regulation portions 64 are provided between the regulation portion 40 and the upstream-most water sprinkle holes 26. The lateral regulation portions 64 on the downstream side of these regulation portions 64 are provided to be placed between the water sprinkle holes 26, 26 adjacent to each other. It is to be noted that the upstream-most lateral regulation portions 64, 64 are provided at positions biased toward the regulation portion 40 side between the regulation portion 40 and the upstream-most water sprinkle holes 26. Further, the lateral regulation portions 64, 64 placed between the water sprinkle holes 26, 26 are provided at positions biased to the upstream-side water sprinkle holes 26. That is, the water sprinkle holes 26 are provided near the upstream side of the respective lateral regulation portions 64 (see FIG. 4) to facilitate supply of ice making water decelerated by the lateral regulation portions 64 to an ice making section 14 through the water sprinkle holes 26.

[0025] In an ice making operation, when the ice making water is supplied to the water sprinkle pipe 60, the ice making water first passes through the regulation portion 40 via the bent portion 28. Then, in this regulation portion 40, the ice making water is temporarily decelerated and directed toward an extending direction of the water sprinkle pipe 60. Subsequently, the ice making water arrives at the upstream-most lateral regulation portions 64, 64 where secondary deceleration is carried out. That is, since the flow region 38 is narrowed from both laterals by the pairs of the lateral regulation portions 64, 64, a water pressure of the ice making water is increased and a flow rate of the same is reduced on the upstream side of the lateral regulation portions 64. Further, when the ice making water passes through the lateral regulation portions 64, 64, the ice making water is depressurized and directed to a horizontal direction. Furthermore, since a flow of the ice making water is regulated by the lateral regulation portions 64, 64 protruding from both the laterals in a well balanced manner, thereby more effectively directing the ice making water.

[0026] Then, the ice making water is continuously decelerated in the subsequent second and third lateral regulation portions 64, 64, whereby the ice making water is further directed. Here, the ice making water decelerated by the lateral regulation portions 64, 64 is smoothly supplied to an ice making section 14 through the water sprinkle holes 26, 26 provided in the vicinity of the upstream side of the lateral regulation portions 64, 64. As described above, the regulation portion 40 and the plurality of lateral regulation portions 64 can decelerate the ice making water on multiple stages, whereby the ice making water can flow through the flow region 38 at a fixed low rate. Therefore, the ice making water can be stably supplied from all the water sprinkle holes 26, thus uniforming sizes of ice pieces to be manufactured. Moreover, since the ice making water likewise flow at the fixed low rate on the upstream side of the flow region 38, cavitation hardly occurs in the water sprinkle holes 26 on the upstream side, thus suppressing manufacture of clouded ice pieces/ice pieces having different shapes. It is to be noted that the lateral regulation portion 64 has the shape protruding with the semicircular cross section from the inner side surface of the pipe body 62 in Embodiment 3, but the lateral regulation portion 64 may be configured to protrude with a triangular cross section from the inner side surface of the pipe body 62.

Embodiment 4

[0027] A water sprinkle pipe for a downflow type ice making machine according to Embodiment 4 will now be described. In a description of Embodiment 4, differences from Embodiment 1 will be mainly explained. As shown in FIG. 5, a water sprinkle pipe 70 according to Embodiment 4 includes a plurality of conical regulation portions 74 provided on an inner upper surface of a pipe body 72 in addition to the same regulation portion 40 as that in Embodiment 1. Each conical regulation portion 74 is formed to be suspended from the inner upper surface of the pipe body 72 by a predetermined distance, and the flow region 38 is narrowed by this conical regulation portion 74. Further, each conical regulation portion 74 is provided in accordance with each water sprinkle hole 26 on the upper surface of the pipe body 72, and a lower end portion thereof is directed toward the water sprinkle hole 26.

[0028] In an ice making operation, when ice making water is supplied to the water sprinkle pipe 70, the ice making water is first supplied via a bent portion 28 to the regulation portion 40 where the ice making water is temporarily decelerated. Then, the ice making water is secondarily decelerated by the upstream-most conical reg-

ulation portion 74. That is, the ice making water is subjected to the secondary deceleration when passing through the flow region 38 narrowed by the conical regulation portions 74. Further, since the ice making water is guided to the corresponding water sprinkle holes 26 along the conical regulation portions 74, the ice making water can be smoothly supplied to the ice making section 14 through the water sprinkle holes 26. The ice making water is depressurized when passing through each conical regulation portion 74, whereby the ice making water is directed toward an extending direction of the water sprinkle pipe 70. Thereafter, continuous deceleration is performed by the subsequent second and third conical regulation portions 74,74, and hence the ice making water flows through the flow region 38 at a fixed low rate. As a result, the ice making water can be stably supplied to each water sprinkle hole 26, occurrence of cavitation and others can be suppressed, and a quality of ice pieces to be manufactured can be improved. Furthermore, since each conical regulation portion 74 has a conical shape protruding downwards, the ice making water that has adhered to the conical regulation portions 74 naturally falls when supply of the ice making water to the water sprinkle pipe 70 is stopped, thus improving drainage. It is to be noted that the ice making water that has fallen from the conical regulation portions 74 is discharged to the outside of the water sprinkle pipe 22 through the water sprinkle holes 26, and hence it does not stay in the water sprinkle pipe 70.

[0029] It is to be noted that the configuration that the regulation portion 42 is provided on the upper surface of the pipe body 24, 54, 62, or 72 has been explained in each of Embodiments 1 to 4, but the regulation portion 42 may be provided on the side surface of the pipe body 24, 54, 62, or 72 or may be provided on the entire inner peripheral surface of the pipe body 24, 54, 62, or 72 as long as the regulation portion 42 can locally narrow the flow region 38. Moreover, the shape of the regulation portion 42 can be arbitrarily changed, and the regulation portion 42 does not have to include the bottom portion 40a explained in Embodiments 1 to 4. Additionally, the shapes of the second regulation portions 42, 52, 64, and 74 are not restricted to the shapes described in Embodiments 1 to 4, and any other shapes can be adopted as long as such shapes can locally narrow the flow region 38. For example, the second regulation portion may be configured to protrude with an equilateral-triangular cross section from the upper surface of the pipe body 24, 54, 62, or 72.

Embodiment 5

[0030] A water sprinkle pipe for a downflow type ice making machine according to Embodiment 5 will now be described. In a description of Embodiment 5, differences from Embodiment 1 will be mainly explained. As shown in FIG. 6, in a water sprinkle pipe 80 according to Embodiment 5, a regulation portion 40 is provided on an upper surface of a pipe body 86 on an upstream side of the upstream-most water sprinkle holes 26. The regulation portion 40 according to Embodiment 5 is constituted of a pair of guide protruding portions 82, 82. Each guide protruding portion 82 protrudes downwards from an upper inner surface of a pipe body 86, extends with a predetermined length in an extending direction of the pipe body 86, and has a transverse cross section formed into a rectangular shape (see FIG. 6(b)). Further, the pair of guide protruding portions 82, 82 are provided to be apart from each other in a width direction of the pipe body 86, and a guide region 84 through which ice making water is guided in the extending direction of the pipe body 86 is defined between both the guide protruding portions 82, 82 and between each guide protruding portion 82 and the inner side surface of the pipe body 86.

[0031] In an ice making operation, when the ice making water is supplied to the water sprinkle pipe 80, the ice making water arrives at the regulation portion 40 through a bent portion 28. Then, the guide protruding portions 82, 82 decelerate the ice making water. On the other hand, when a part of the ice making water passes through the guide region 84, it is directed toward an extending direction of the pipe body 86. As a result, the ice making water flows through a flow region 38 at a fixed low rate, thereby uniformly supplying the ice making water from respective water spray holes 26. Furthermore, occurrence of cavitation and others can be suppressed, and a quality of ice pieces to be manufactured can be improved. It is to be noted that the example where the two guide protruding portions 82 are formed has been explained in Embodiment 5, the three or more guide protruding portions 82 may be formed. Moreover, a transverse crows-sectional shape of each guide protruding portion 82 may be an elliptic shape that is long in the extending direction of the water sprinkle pipe 70. As a result, flow resistance of the ice making water can be suppressed. Additionally, a plurality of pairs (or triplets or above) of guide protruding portions 82, 82 may be formed in the extending direction of the pipe body 86. It is to be noted that the above-described second regulation portion 42, 52, 64, or 74 may be provided on a downstream side of the guide protruding portions 82, 82 in the pipe body 86.

Embodiment 6

[0032] A water sprinkle pipe for a downflow type ice making machine according to Embodiment 6 will now be described. In a description of Embodiment 6, differences from Embodiment 1 will be mainly explained. As shown in FIG. 7, in a water sprinkle pipe 90 according to Embodiment 6, a pressure-reduced straightening portion 94 is provided on an upper surface of a pipe body 92 near a bent portion 28 on an upstream side of the upstream-most water spray holes 26. This reduced-pressure straightening portion 94 is formed to bulge upwards from the upper surface of the pipe body 92, and a semicircular

reduced-pressure space 96 into which ice making water can flow is defined in this reduced-pressure straightening portion 94. That is, the reduced-pressure space 96 protrudes upwards in the pipe body 92 from an inner surface thereof, whereby a flow region 38 is expanded. Further, when the ice making water flows into the reduced-pressure space 96, the ice making water flows in the reduced-pressure space 96 in a swirl (generation of a swirling current), thereby reducing a water pressure of the ice making water.

[0033] In an ice making water, when the ice making water is supplied to the water sprinkle pipe 90, the ice making water arrives at the reduced-pressure straightening portion 94 through the bent portion 28. Then, a part of the ice making water flows into the reduced-pressure space 96 of the reduced-pressure straightening portion 94 to generate a swirling current in the reduced-pressure space 96 (see FIG. 7). As a result, the ice making water is depressurized to suppress a flow rate of the ice making water, thereby uniformly supplying the ice making water from the respective water sprinkle holes 26. Further, occurrence of cavitation and others can be suppressed, and a quality of ice pieces to be manufactured can be improved. Additionally, since the ice making water further flows into the reduced-pressure space 96 as the flow rate of the ice making water increases, a depressurizing effect can be further improved, and the ice making water can be uniformly supplied. It is to be noted that, in the water sprinkle pipe 90 according to Embodiment 6, the second regulation portion 42, 52, 64, or 74 described in each of Embodiments 1 to 4 may be provided.

[0034] It is to be noted that the configuration that the water sprinkle pipe 22, 50, 60, 70, 80, or 90 is arranged above the ice making section 14 in parallel has been explained in each of Embodiments 1 to 6, but the water sprinkle pipe may be arranged in a slightly inclined state, for example.

Claims

1. A water sprinkle pipe for a downflow type ice making machine, comprising: a pipe body (24, 54, 62, 72, 86) that is arranged to extend above an ice making section (14) and communicates with a discharge opening of a pump (30) and through which ice making water discharged from the discharge opening of the pump (30) flows; and a plurality of water spray holes (26) provided on a lower surface of the pipe body (24, 54, 62, 72, 86) and placed to be apart from each other in an extending direction of the pipe body (24, 54, 62, 72, 86), the water sprinkle pipe being configured to supply the ice making water sucked by the pump (30) and flowing through the pipe body (24, 54, 62, 72, 86) to the ice making section (14) through the water spray holes (26),
   wherein a regulation portion (40) that protrudes from an inner surface of the pipe body (24, 54, 62, 72, 86) to locally narrow a flow region (38) for the ice making water is provided on the upstream side of the upstream-most water spray hole (26) in the pipe body (24, 54, 62, 72, 86).

2. The water sprinkle pipe for a downflow type ice making machine according to claim 1, wherein one or more second regulation portions (42, 52, 64, 74) that protrude from the inner surface of the pipe body (24, 54, 62, 74) to locally narrow the flow region (38) for the ice making water are provided on the downstream side of the regulation portion (40) in the pipe body (24, 54, 64, 72).

3. The water sprinkle pipe for a downflow type ice making machine according to claim 2, wherein the second regulation portion (42) is provided to be placed above the water spray holes (26) and formed into a semicircular shape bending from the upstream side toward the downstream side.

4. The water sprinkle pipe for a downflow type ice making machine according to claim 2, wherein the second regulation portion (52) is provided to be placed above the water spray holes (26) and formed into a bent shape in such a manner that its surface on the upstream side inclines toward the corresponding water spray hole (26) and its surface on the downstream side inclines toward an upper surface of the pipe body (54) from the surface on the upstream side at a more gentle inclination angle.

5. The water sprinkle pipe for a downflow type ice making machine according to claim 2, wherein the second regulation portion is a pair of side regulation portions (64, 64) that are provided to be placed between the regulation portion (40) and the water spray hole (26) adjacent thereto or between the water spray holes (26, 26) adjacent to each other and protrude from a side surface of the pipe body (62) to face each other.

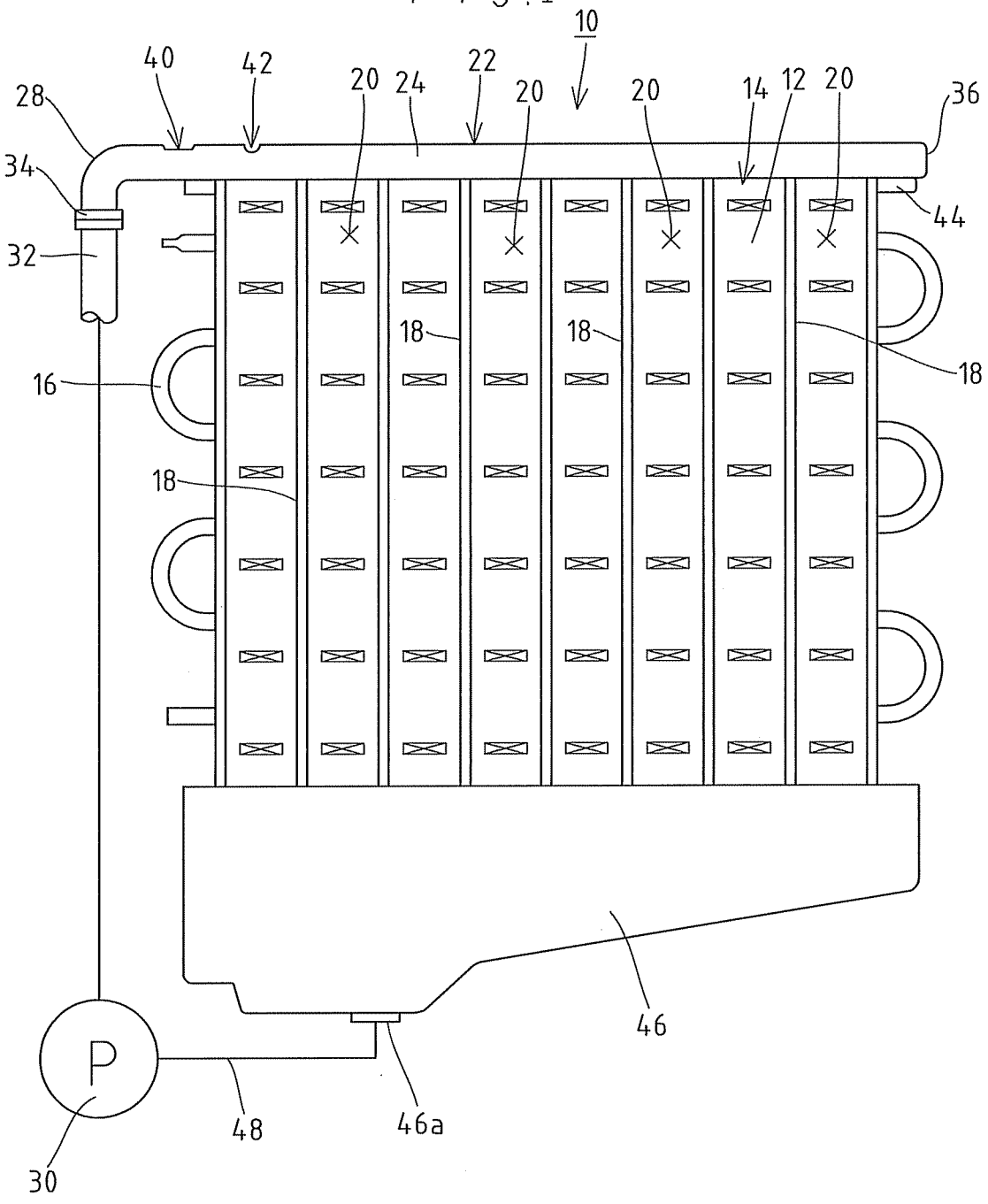
6. The water sprinkle pipe for a downflow type ice making machine according to claim 2, wherein the second regulation portion is a conical regulation portion (74) that is provided to be placed above the water spray holes (26) and hung from an upper portion of the inner surface of the pipe body (72) toward the corresponding water spray hole (26).

7. The water sprinkle pipe for a downflow type ice making machine according to any one of claims 1 to 6, wherein the regulation portion (40) comprises a plurality of guide protruding portions (82, 82) that are provided on the upper surface of the pipe body (86) to be apart from each other in a direction orthogonal to the extending direction of the pipe body (86) and extend in the extending direction of the pipe body

(86) while downwardly protruding from the inner surface of the pipe body (86).

8. A water sprinkle pipe for a downflow type ice making machine, comprising: a pipe body (92) that is arranged to extend above an ice making section (14) and communicates with a discharge opening of a pump (30) and through which ice making water discharged from the discharge opening of the pump (30) flows; and a plurality of water spray holes (26) provided on a lower surface of the pipe body (92) and placed to be apart from each other in an extending direction of the pipe body (92), the water sprinkle pipe being configured to supply the ice making water sucked by the pump (30) and flowing through the pipe body (92) to the ice making section (14) through the water spray holes (26),
wherein a reduced-pressure straightening portion (94) comprising a semicircular reduced-pressure space (96) that protrudes upwards from an inner surface of the pipe body (92) to locally expand a flow region (38) for the ice making water is provided on the upstream side of the upstream-most water spray hole (26) in the pipe body (92).

Fig.1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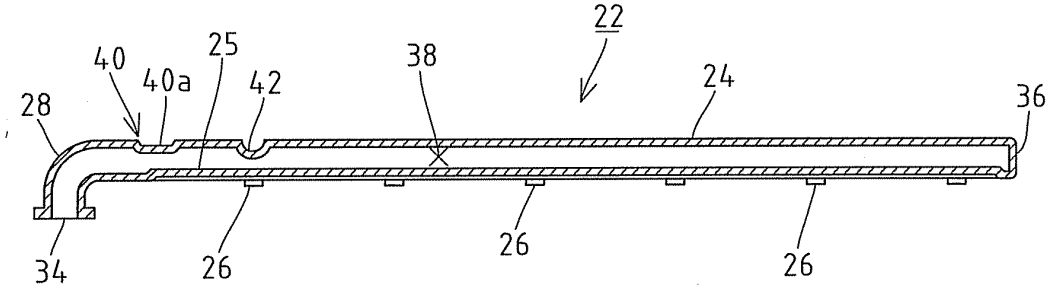
48
46a
46
30

Fig.2

(a)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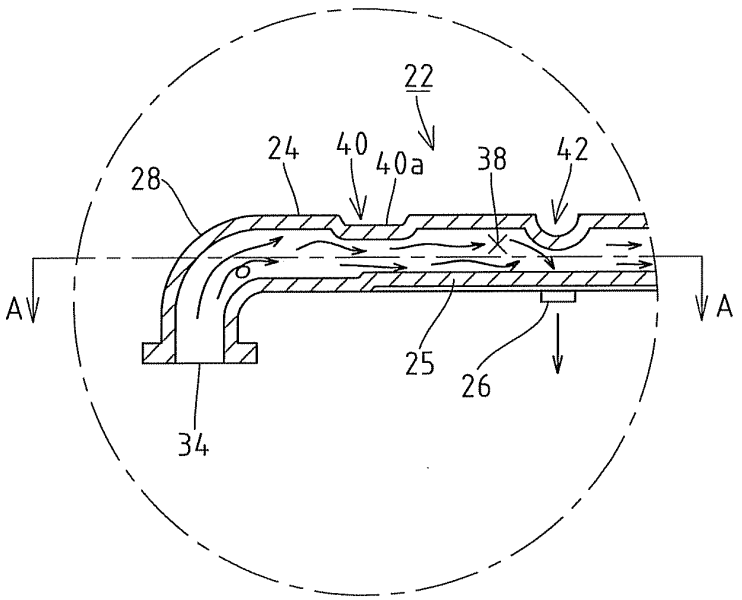
26

(b)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42
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A
A
25
26
34

(c)

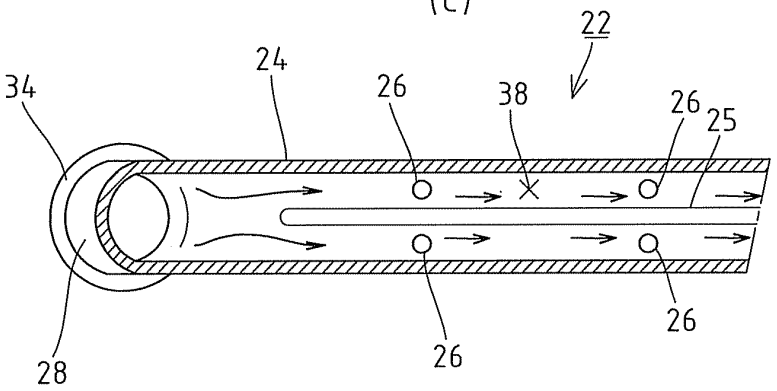
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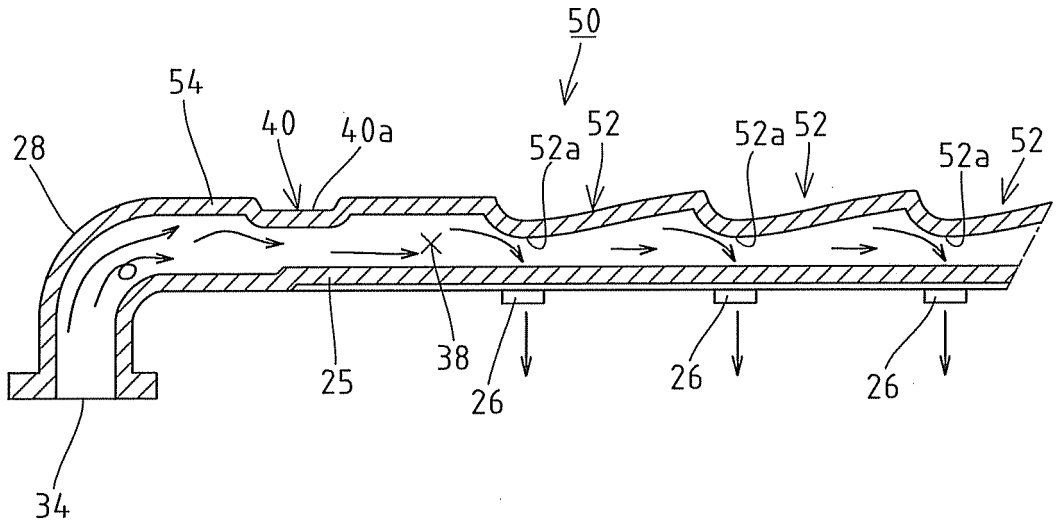
Fig.3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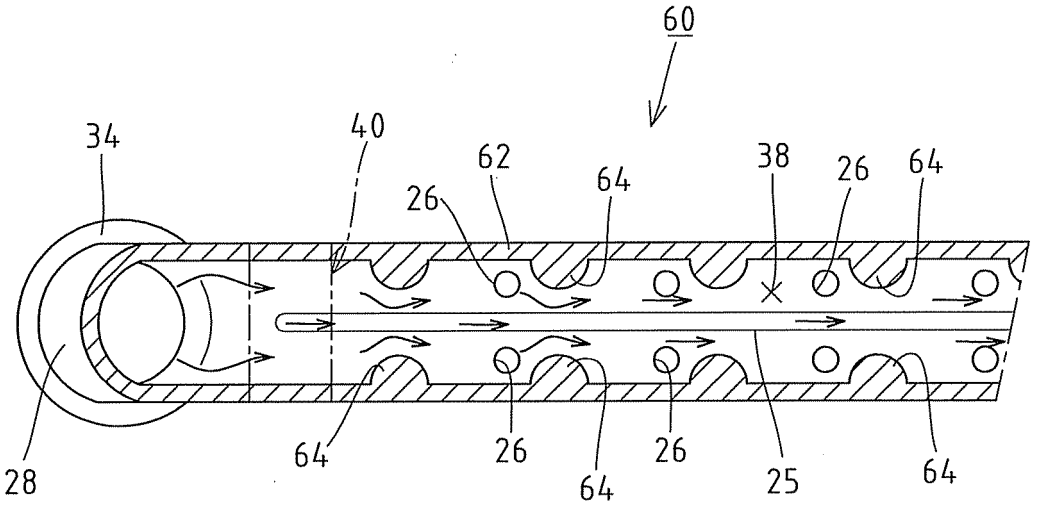
26
26
34

Fig.4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64

Fig.5

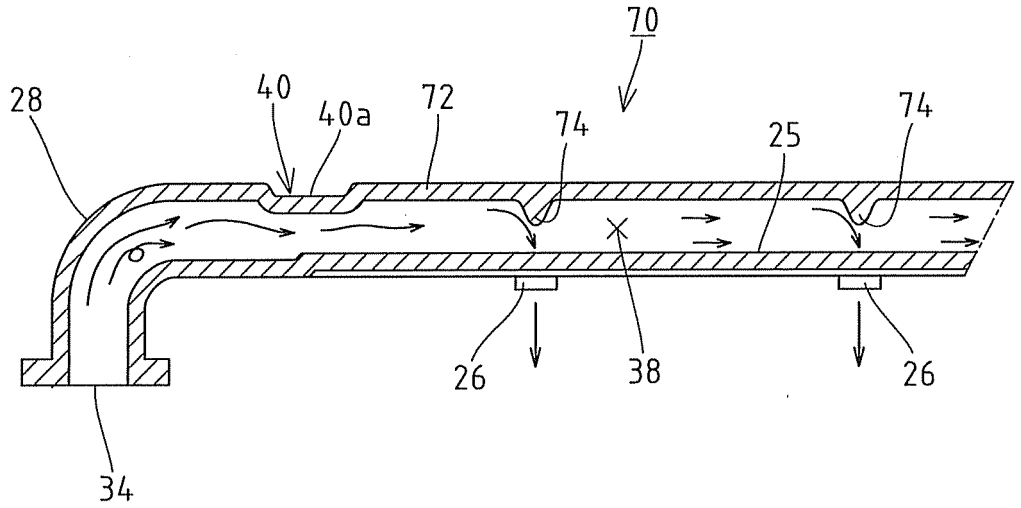
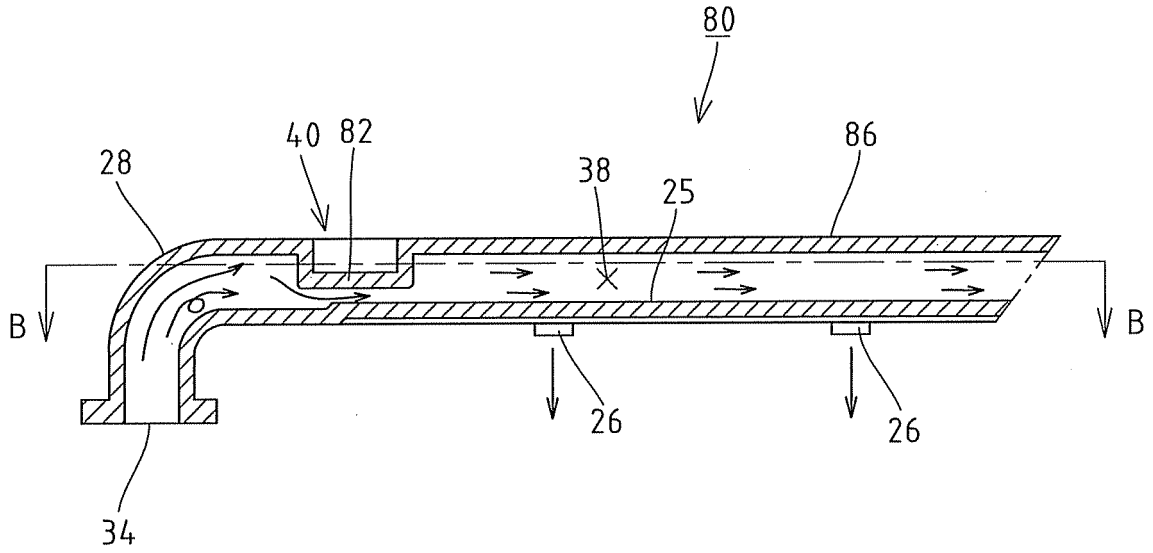


Fig.6

(a)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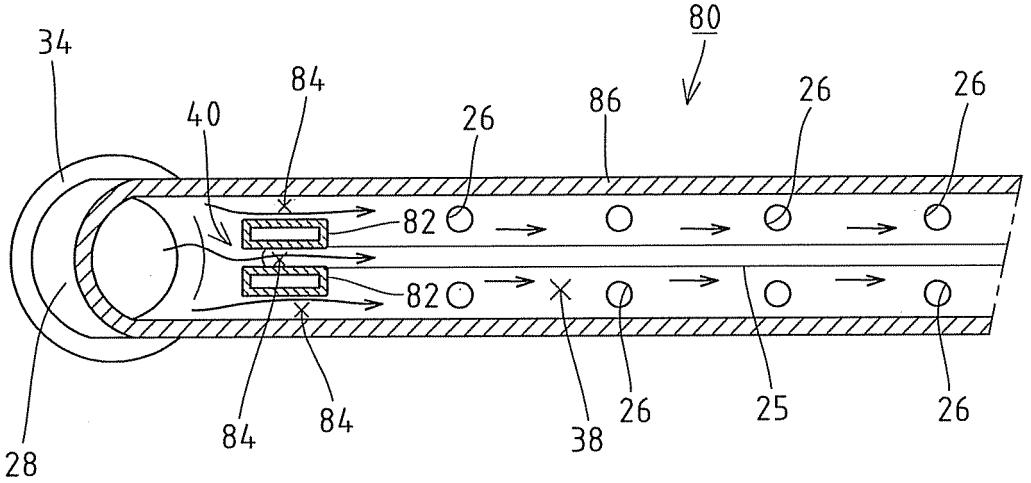
(b)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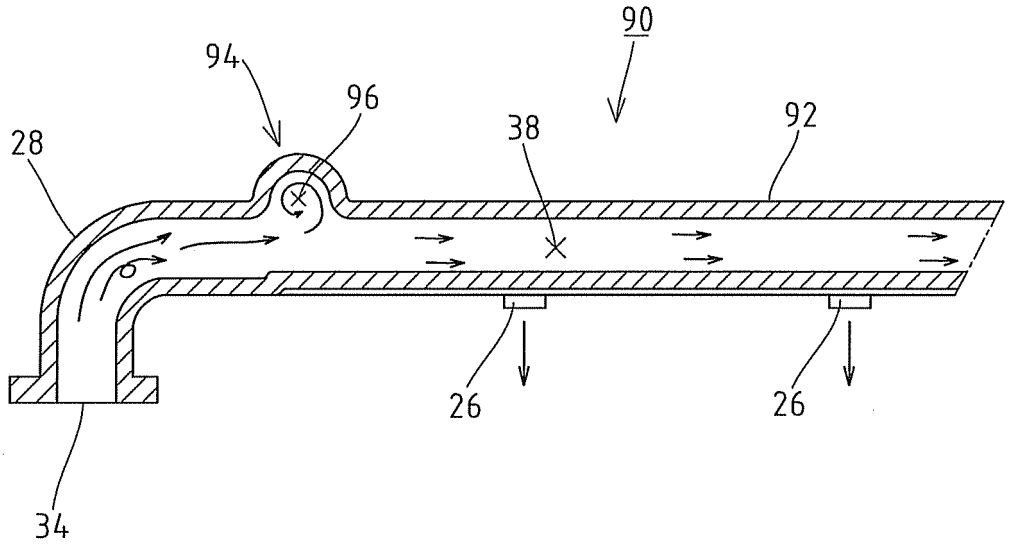
26

Fig.7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/063060

A. CLASSIFICATION OF SUBJECT MATTER
F25C1/22(2006.01)i, F25C1/12(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)
F25C1/22, F25C1/12, F28F25/06

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 1996-2009
Kokai Jitsuyo Shinan Koho 1971-2009 Toroku Jitsuyo Shinan Koho 1994-2009

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 07-305928 A (Hoshizaki Electric Co., Ltd.), 21 November, 1995 (21.11.95), Full text; Figs. 1 to 3 (Family: none)	1-8
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 039852/1972(Laid-open No. 114352/1973) (Pacific Industrial Co., Ltd.), 27 December, 1973 (27.12.73), Page 2, line 5 to page 4, line 14; Fig. 3 (Family: none)	1-7

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

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Date of the actual completion of the international search	Date of mailing of the international search report
28 August, 2009 (28.08.09)	15 September, 2009 (15.09.09)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/063060

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2004-270738 A (Toshiba Corp.), 30 September, 2004 (30.09.04), Par. Nos. [0101] to [0108]; Figs. 28, 29 (Family: none)	8
P,X	JP 2009-127911 A (Hoshizaki Electric Co., Ltd.), 11 June, 2009 (11.06.09), Par. No. [0013]; Fig. 3 & WO 2009/066489 A1	1

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 7305928 A **[0003]**