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Misumi et al.

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(54) **FILTER MEMBER AND WASHING MACHINE**

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B01D 29/44 (2006.01)

D06F 103/42 (2020.01)

D06F 105/34 (2020.01)

(52) **U.S. Cl.**

CPC **D06F 39/10** (2013.01); **B01D 29/44** (2013.01); **D06F 2103/42** (2020.02); **D06F 2105/34** (2020.02)

(58) **Field of Classification Search**

CPC .. **D06F 39/10**; **D06F 2103/42**; **D06F 2105/34**; **B01D 29/44**; **B01D 2201/306**

See application file for complete search history.

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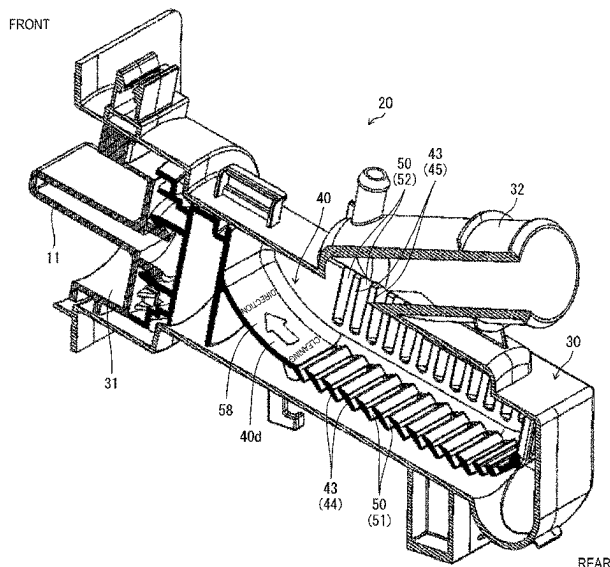
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(57) **ABSTRACT**

A filter member is detachably mounted in a filter case formed with an inflow port through which washing water flows in and an outflow port through which the washing water flows out. The filter member includes a rib-shaped portion partitioning through holes adjacent to each other. At least one of the through holes is inclined from an inner peripheral surface of the filter member.

11 Claims, 13 Drawing Sheets



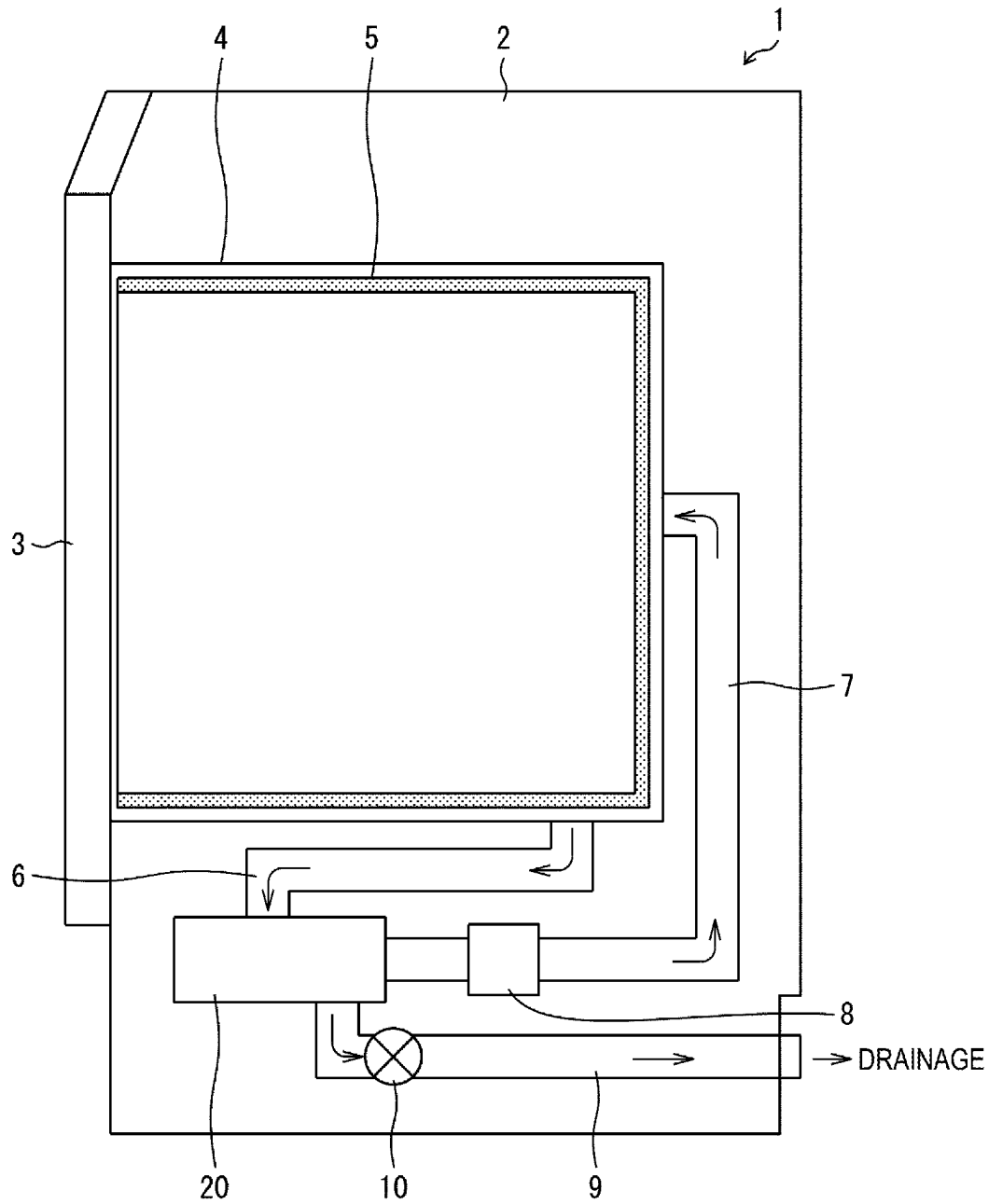


FIG. 1

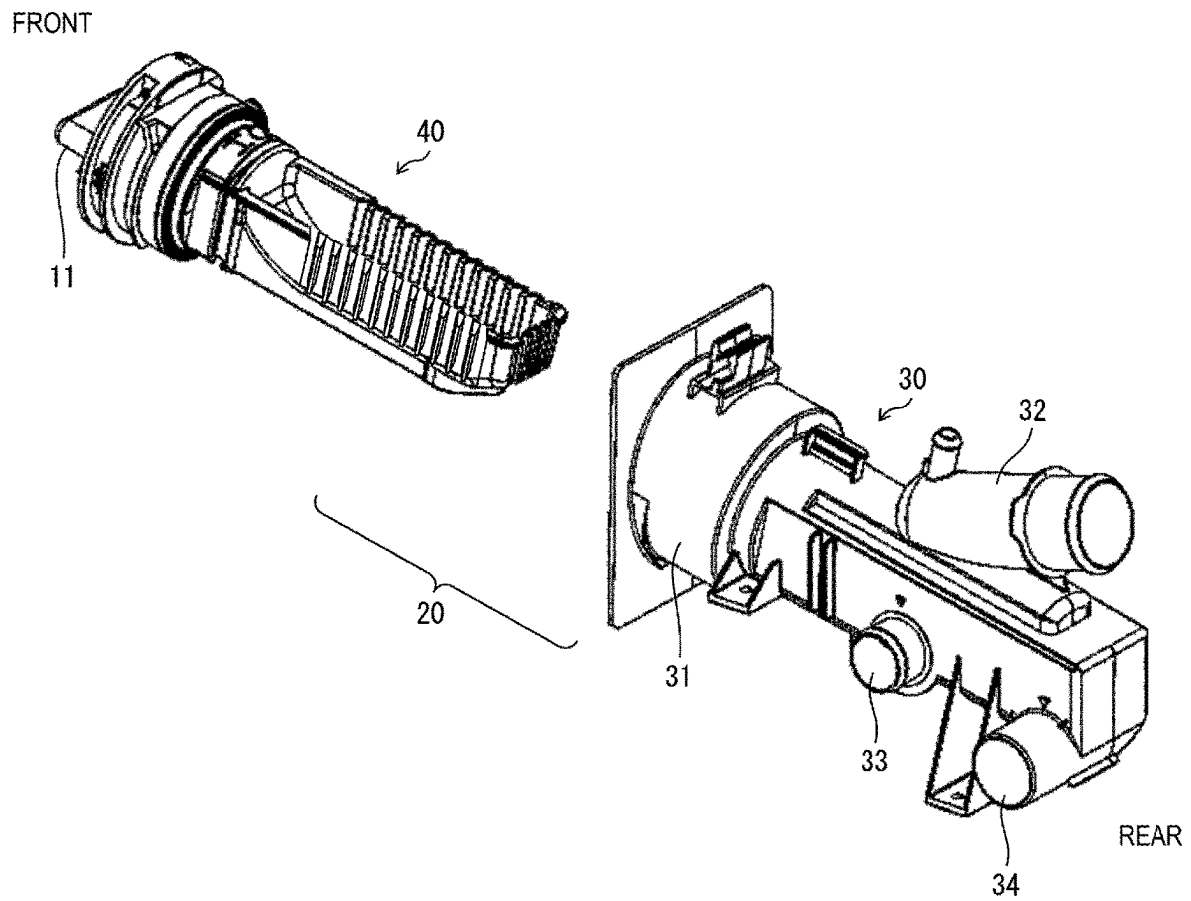


FIG. 2

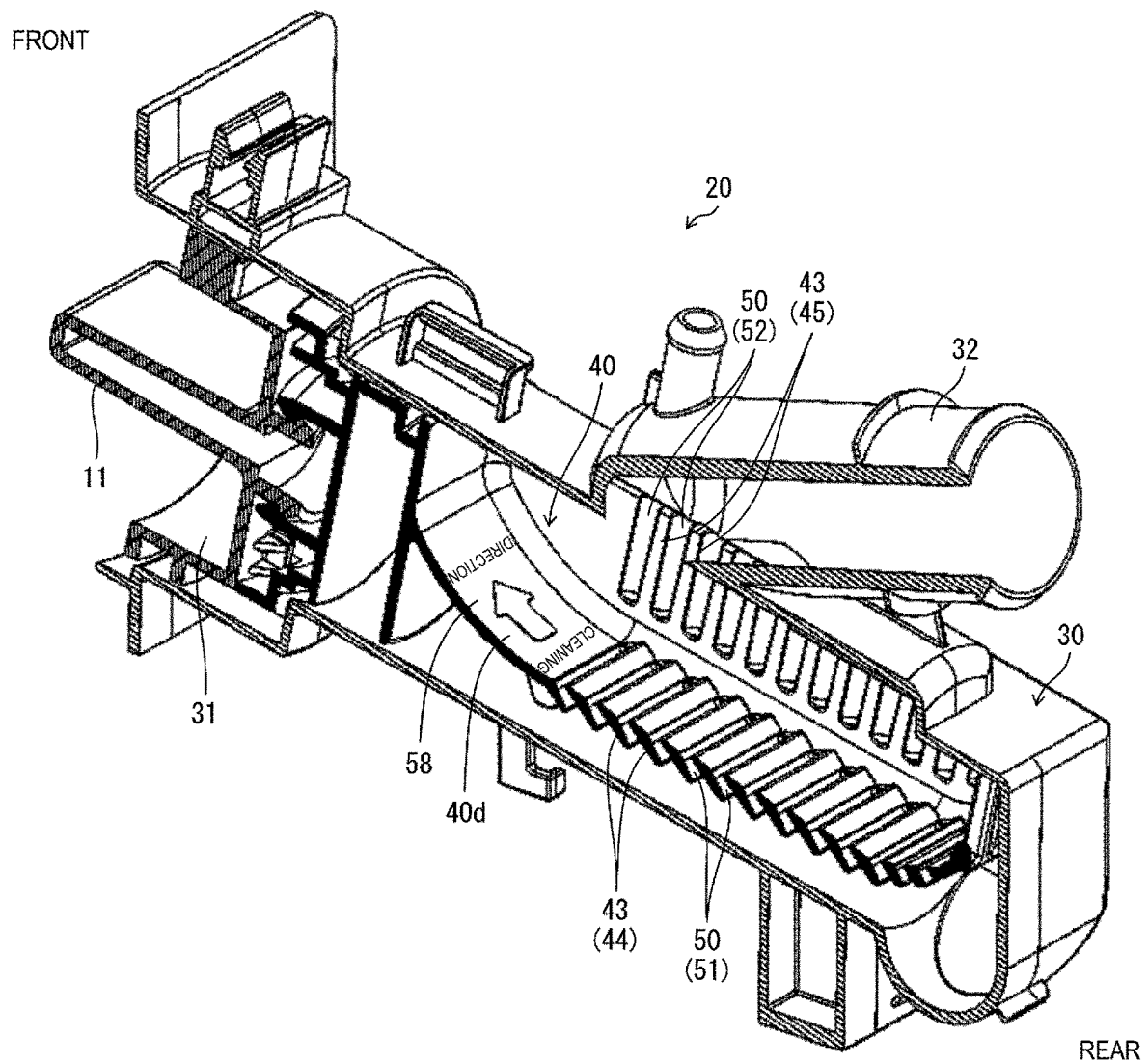


FIG. 3

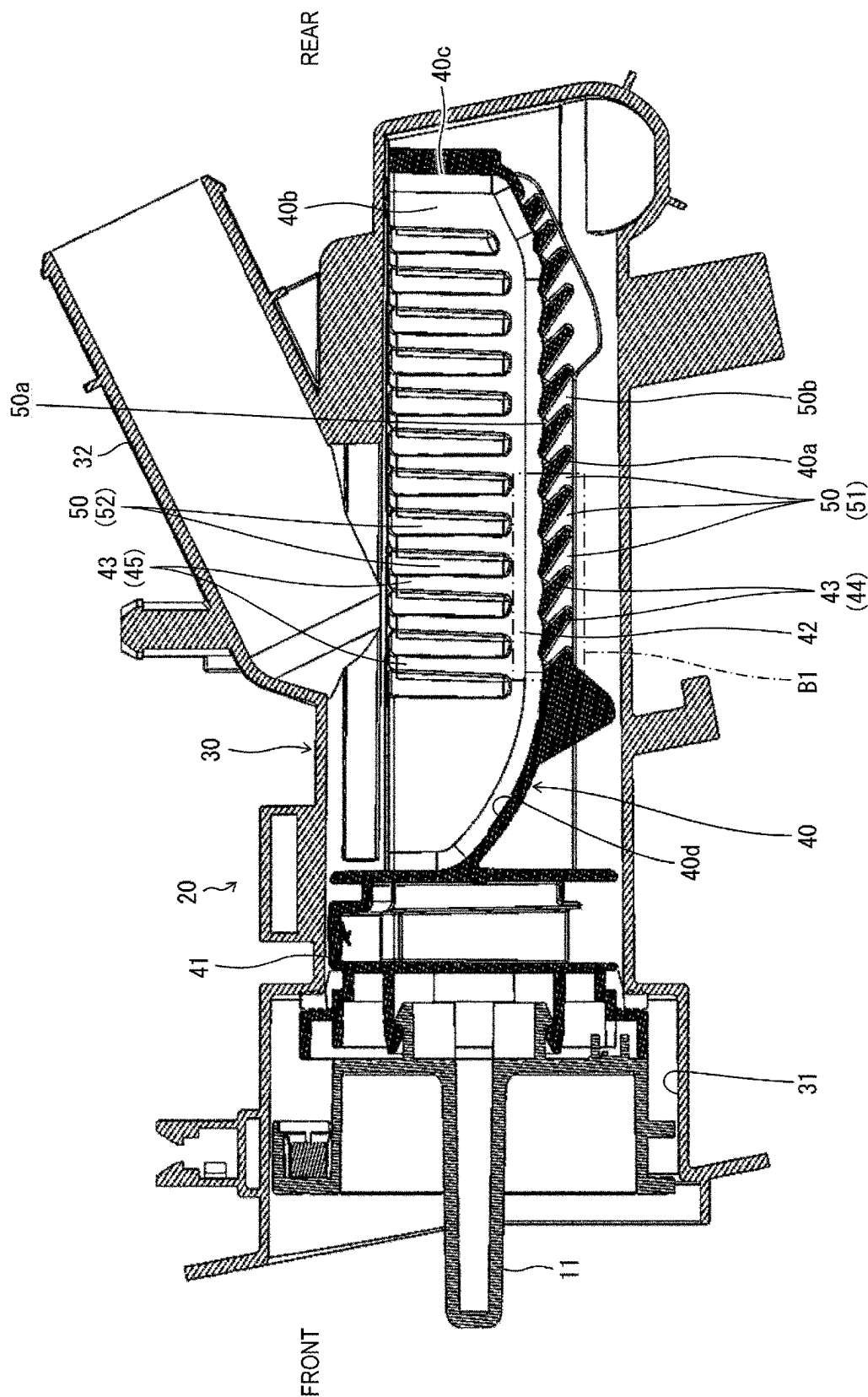


FIG. 4

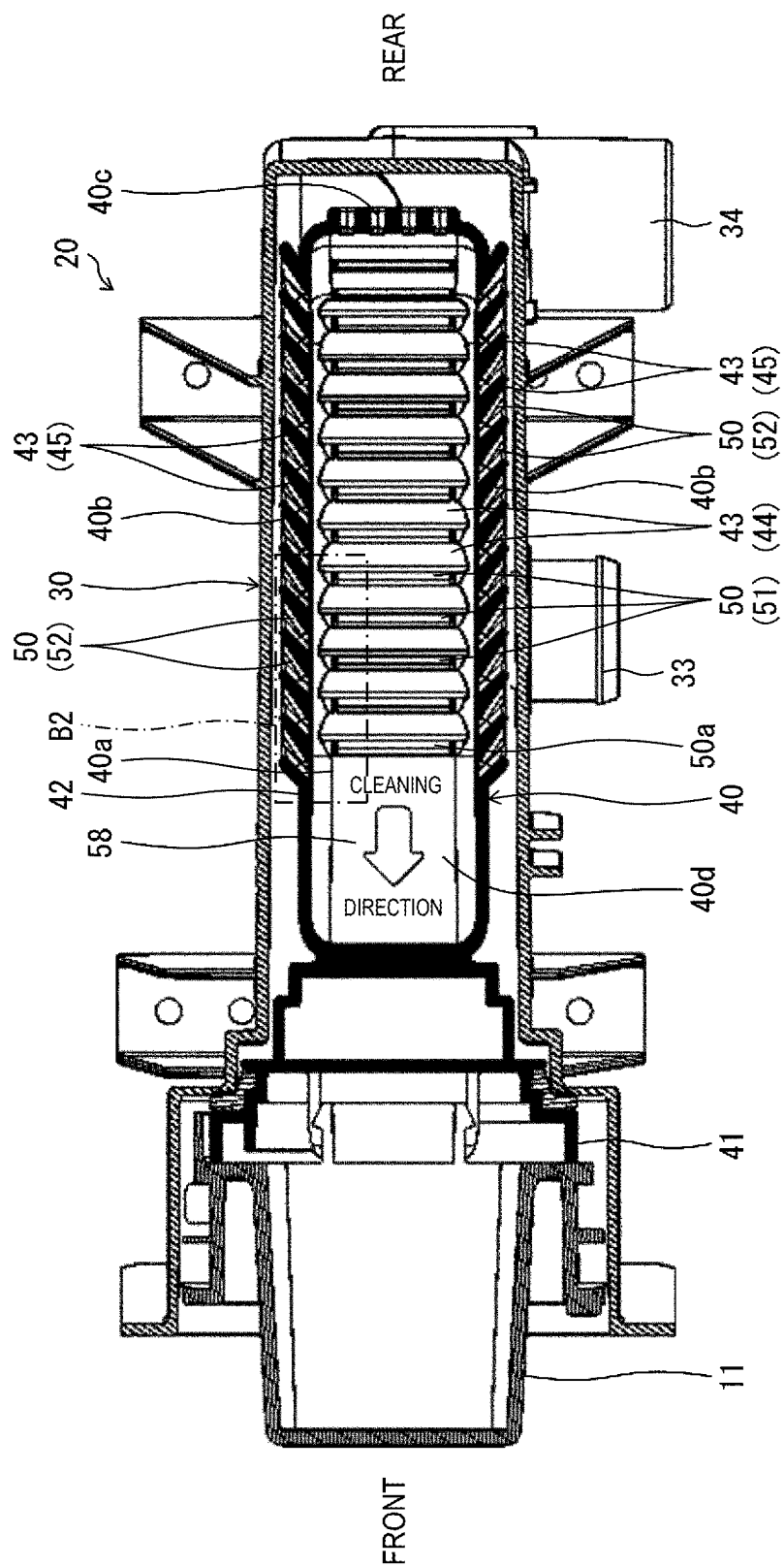


FIG. 5

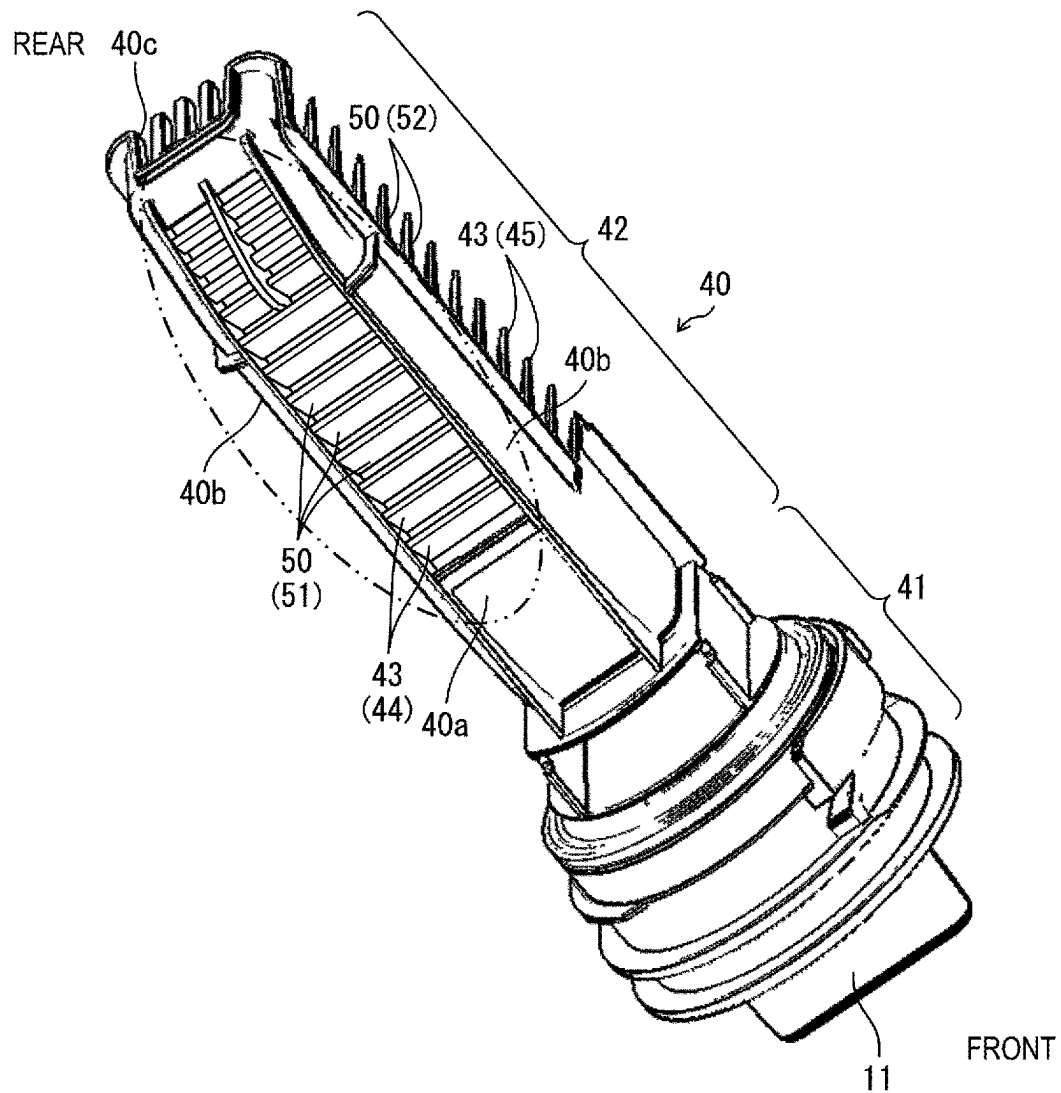


FIG. 6

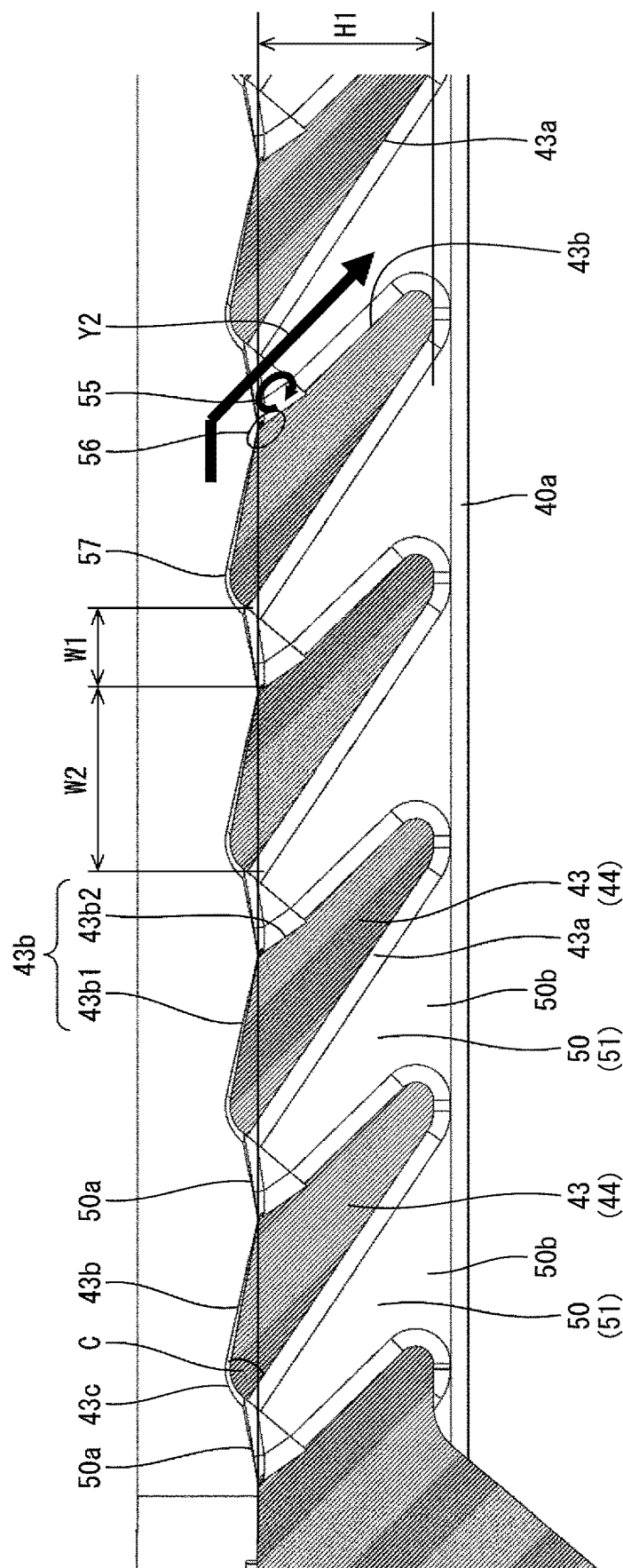
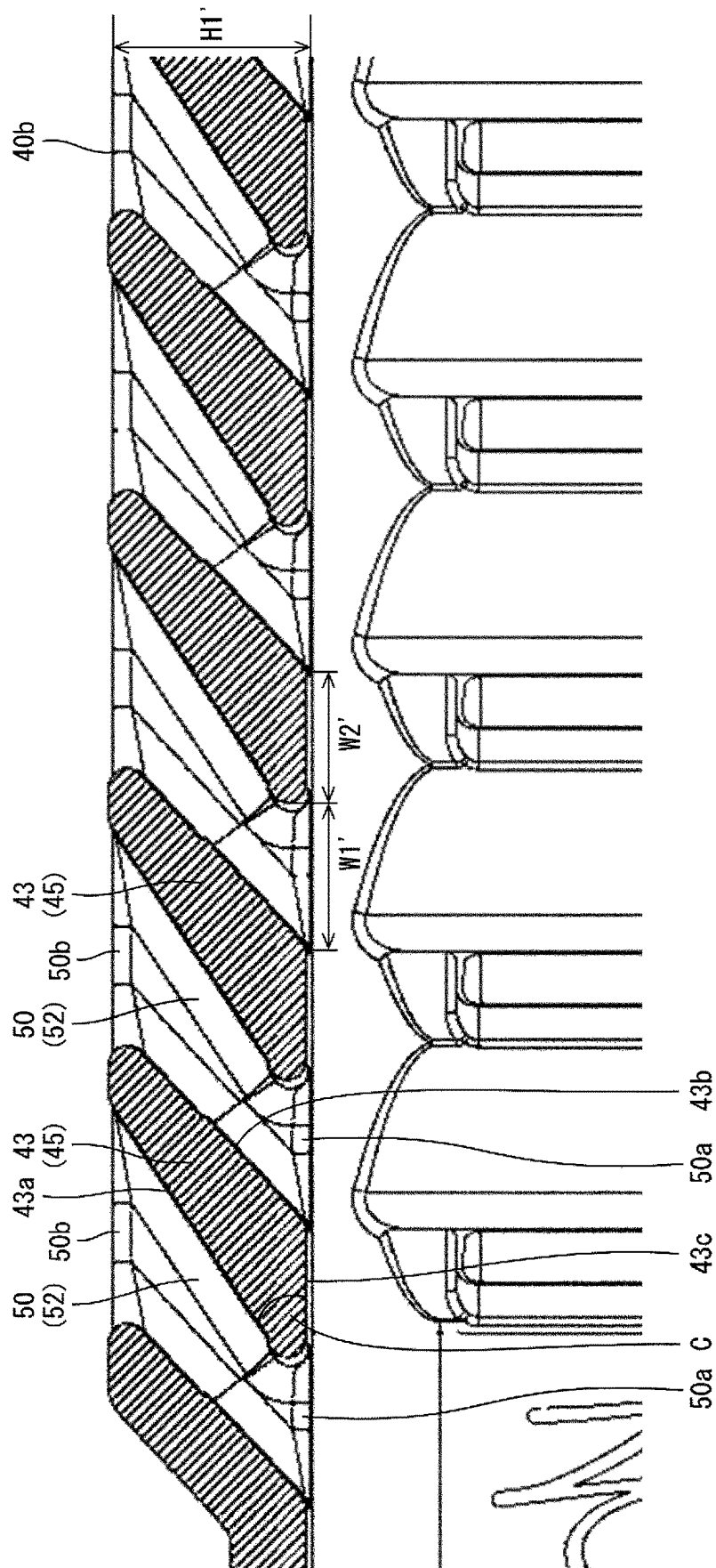


FIG. 7


$$\frac{G}{F} \infty$$

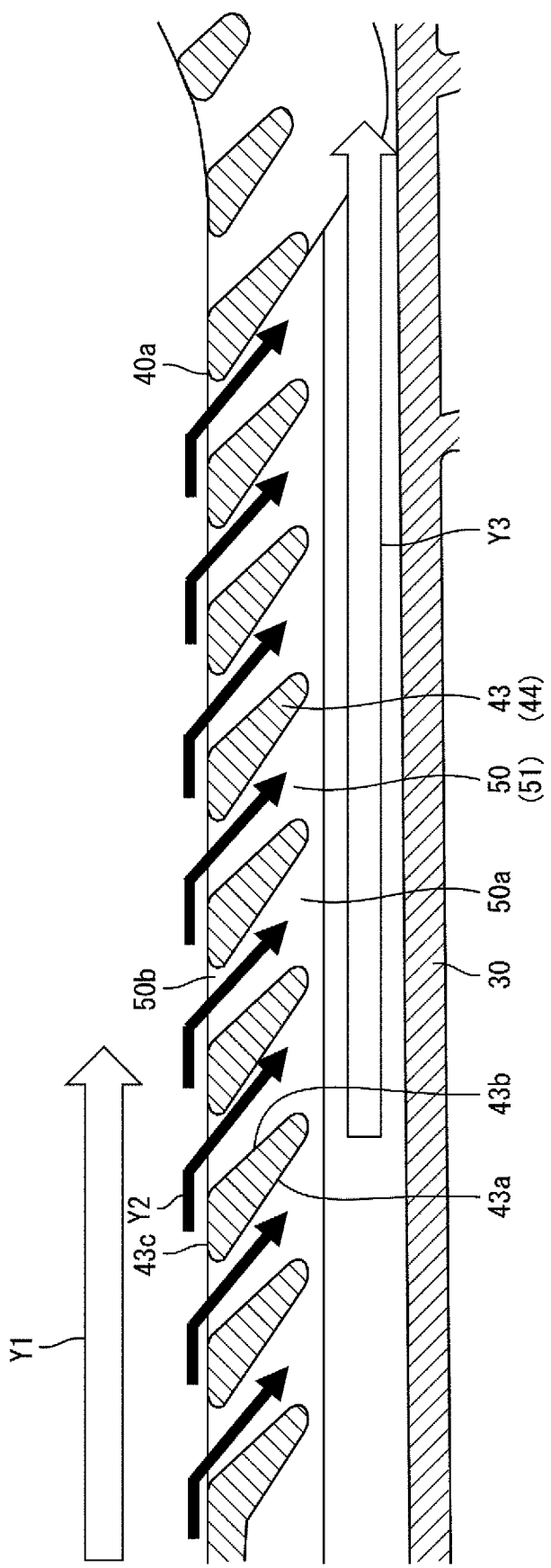


FIG. 9

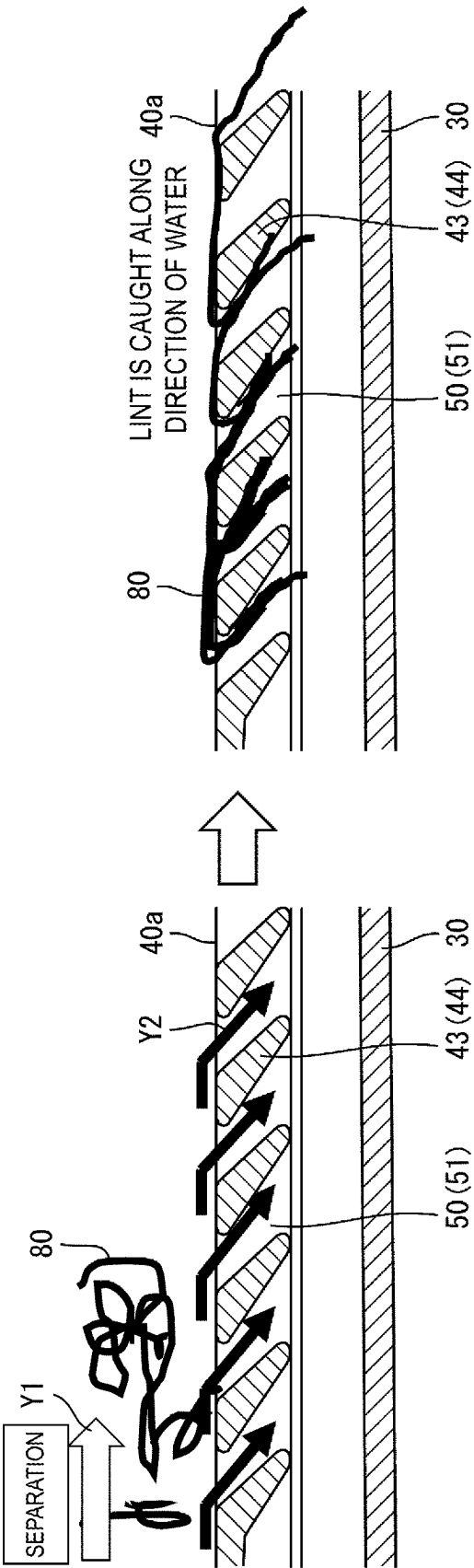


FIG. 10

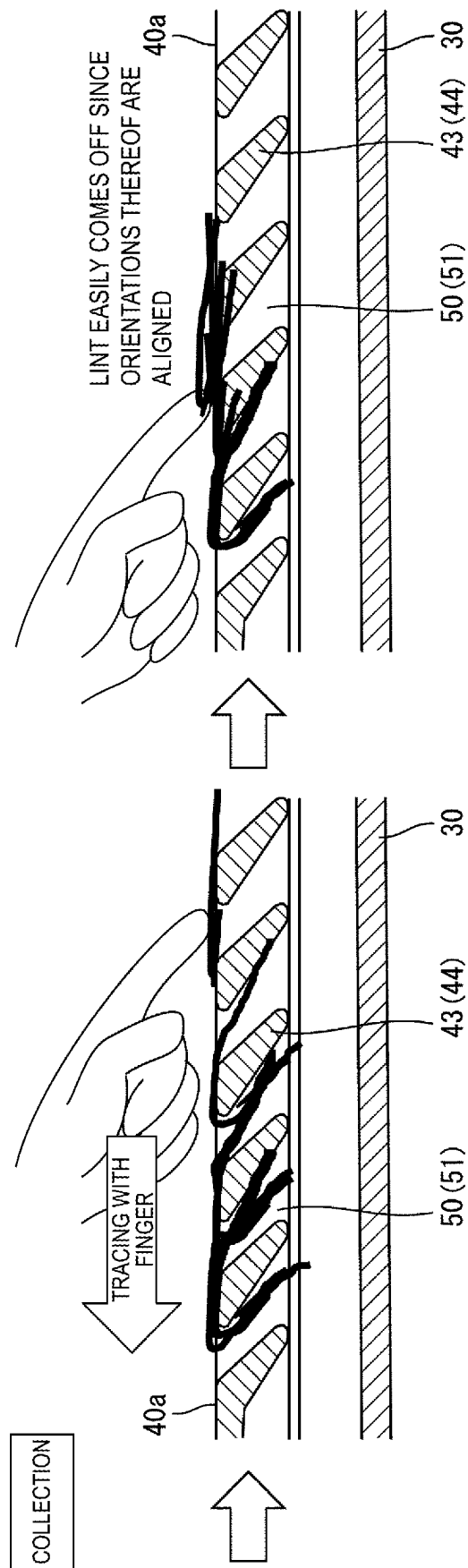


FIG. 11

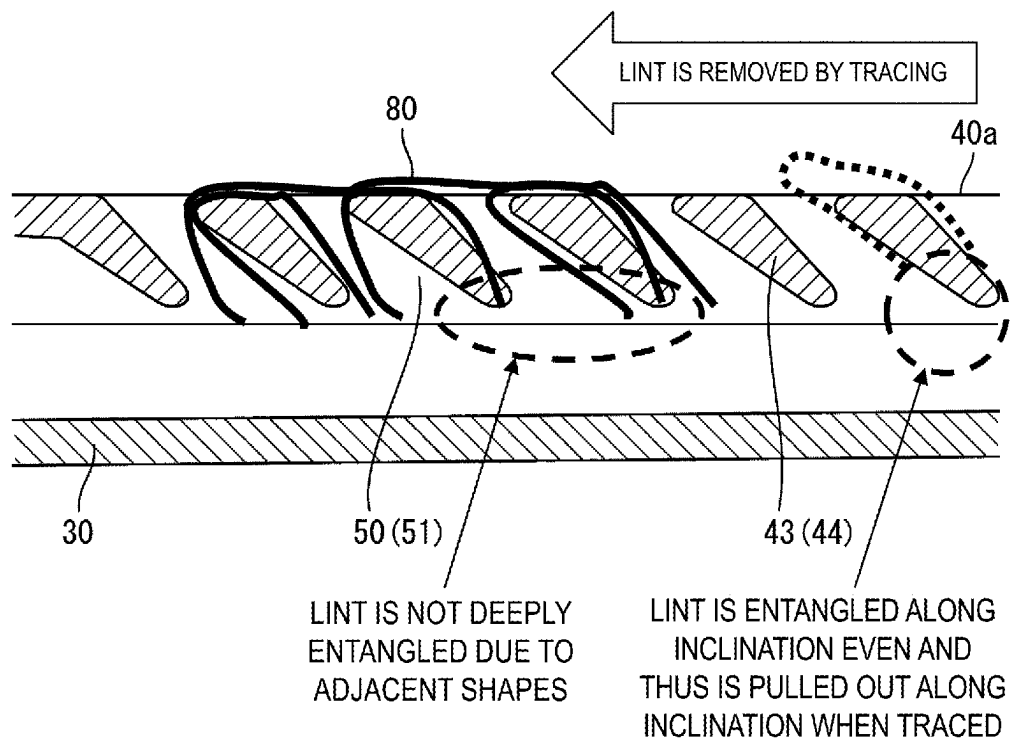


FIG. 12

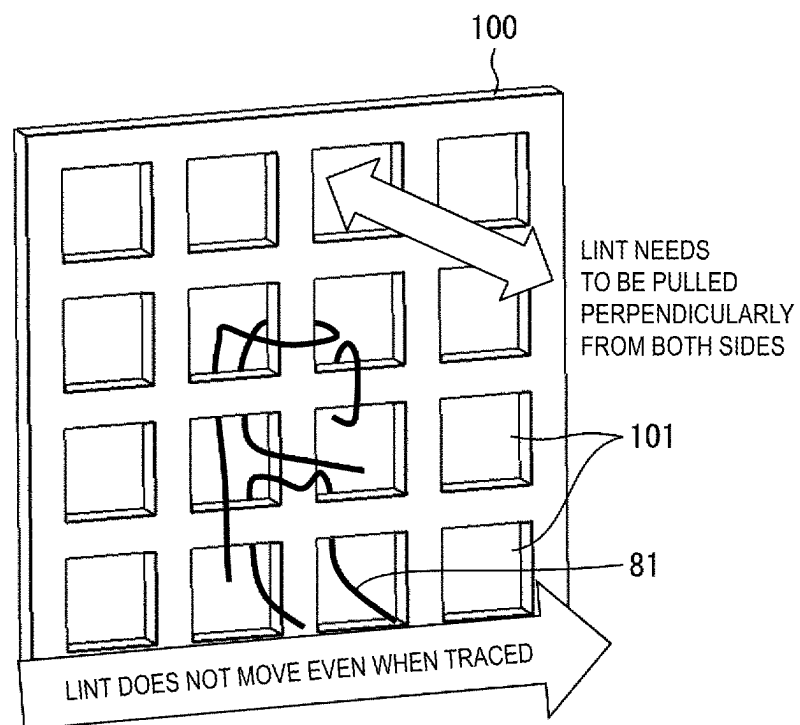


FIG. 13

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FILTER MEMBER AND WASHING MACHINE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of priority to Japanese Patent Application Number 2022-099756 filed on Jun. 21, 2022. The entire contents of the above-identified application are hereby incorporated by reference.

BACKGROUND

Technical Field

The disclosure relates to a filter member and a washing machine including the filter member.

In recent years, attention has been focused on technologies that mimic and utilize various functions of organisms, so-called biomimetics. Nature technology (trademark) is known as an example of manufacturing that employs such a biomimetic technology in electrical products and the like.

Some washing machines include a filter member for capturing lint or the like contained in washing water (see, for example, JP 2015-54107 A). The filter member is detachably provided in a case member (filter case) into which washing water flowing out from a bottom portion of a washing tub flows. The filter member is provided with a plurality of rectangular through holes to capture lint or the like in washing water.

SUMMARY

However, in the related art as described above, it is not necessarily easy to collect captured lint or the like.

An object of an aspect of the disclosure is to achieve a filter member and a washing machine capable of easily collecting captured lint or the like.

To solve the above-described problem, a filter member according to an aspect of the disclosure is a filter member detachably mounted in a filter case formed with an inflow port through which water flows in and an outflow port through which the water flows out, the filter member including a rib-shaped portion configured to partition through holes adjacent to each other, wherein each of the through holes is inclined from an inner peripheral surface of the filter member.

In order to solve the above problem, a washing machine according to another aspect of the disclosure includes the above-described filter member.

According to an aspect of the disclosure, it is possible to achieve a filter member and a washing machine capable of easily collecting captured lint or the like.

BRIEF DESCRIPTION OF DRAWINGS

The disclosure will be described with reference to the accompanying drawings, wherein like numbers reference like elements.

FIG. 1 is a schematic view illustrating configurations of main parts of a washing machine according to a present embodiment.

FIG. 2 is an exploded perspective view of a filter device included in the washing machine illustrated in FIG. 1 when viewed obliquely from above.

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FIG. 3 is a perspective vertical cross-sectional view illustrating an internal configuration of the filter device illustrated in FIG. 2.

FIG. 4 is a vertical cross-sectional view illustrating the internal configuration of the filter device illustrated in FIG. 2.

FIG. 5 is a transverse cross-sectional view illustrating the internal configuration of the filter device illustrated in FIG. 2.

FIG. 6 is a perspective view illustrating a specific configuration of a filter member of the filter device illustrated in FIG. 2 when viewed obliquely from below.

FIG. 7 is an enlarged view of a region B1 illustrated in FIG. 4.

FIG. 8 is an enlarged view of a region illustrated in FIG. 5.

FIG. 9 is a view for describing a flow of washing water flowing into the filter member illustrated in FIG. 6.

FIG. 10 is a view for describing a step of separating and capturing lint or the like by the filter member illustrated in FIG. 6.

FIG. 11 is a view for describing a step of collecting the lint or the like captured by the filter member illustrated in FIG. 6.

FIG. 12 is a view illustrating a state in which the lint or the like is captured in the filter member illustrated in FIG. 6.

FIG. 13 is a view illustrating a state in which lint or the like is captured by a related-art filter member including a plurality of rectangular through holes.

DESCRIPTION OF EMBODIMENTS

Embodiment

An embodiment of the disclosure will be described in detail below.

Summary of Washing Machine

FIG. 1 is a schematic view illustrating configurations of main parts of a washing machine 1 according to the present embodiment. As illustrated in FIG. 1, the washing machine 1 includes a main body 2 and a door 3. The main body 2 includes a washing tub 4 therein, and a rotary drum 5 is rotatably provided in the washing tub 4. The washing tub 4 is open at a portion proximate to the front surface of the main body 2, and when the door 3 is closed, the inside thereof is liquid-tightly sealed.

The washing tub 4 is connected to a filter device 20 via a first pipe 6 and a second pipe 7. A circulation pump 8 is provided in the middle of the second pipe 7. The first pipe 6, the second pipe 7, the filter device 20, and the circulation pump 8 constitute a circulation path for washing water (water).

A third pipe 9 for water drain is further connected to the filter device 20. An electromagnetic valve 10 is provided in the middle of the third pipe 9. In FIG. 1, the second pipe 7 is connected to the rear surface of the washing tub 4, but the connection position of the second pipe 7 to the washing tub 4 is not particularly limited.

At the time of washing, the electromagnetic valve 10 is closed and the circulation pump 8 is operated, so that the washing water is circulated. The washing water is sent from the washing tub 4 to the filter device 20 through the first pipe 6 and is returned from the filter device 20 to the washing tub 4 through the second pipe 7.

At the time of water drain, the circulation pump 8 is stopped and the electromagnetic valve 10 is opened, so that the washing water can be drained. The washing water is sent

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from the washing tub 4 to the filter device 20 through the first pipe 6 and is drained through the third pipe 9.

When the washing water passes through the filter device during both washing and water drain, lint or the like, which is a captured substance mixed in the washing water, is captured by the filter device 20.

Filter Device

A configuration of the filter device 20 according to the present embodiment will be described. FIG. 2 is an exploded perspective view of the filter device 20 viewed obliquely from above. FIG. 3 is a perspective vertical cross-sectional view illustrating an internal configuration of the filter device 20. In the following description, the orientation of the filter device 20 will be indicated using the orientation in a state where the filter device 20 is disposed in the washing machine 1. That is, the front direction of the filter device 20 corresponds to the front surface direction of the washing machine 1, and the rear direction of the filter device 20 corresponds to the rear surface direction of the washing machine 1.

As illustrated in FIGS. 2 and 3, the filter device 20 includes a filter case 30 and a filter member 40 housed in the filter case 30. The filter case 30 is a tubular case member having a bottom and is configured to house the filter member 40 therein. The filter case 30 is fixedly supported at a front lower portion inside the main body 2 of the washing machine 1 (see FIG. 1). The filter case 30 is disposed inside the washing machine 1 such that the longitudinal axis of the tubular portion is oriented in the front-rear direction of the washing machine 1.

At the front of the filter case 30, an insertion port 31 for inserting the filter member 40 is provided. The filter member 40 is detachably mounted in the filter case 30 through the insertion port 31.

A knob member 11 is attached to a front end portion of the filter member 40. Although not illustrated, a male screw portion is formed at the knob member 11, and a female screw portion is formed at the insertion port 31 of the filter case 30. The knob member 11 is rotated in a state where the filter member 40 is inserted in the filter case 30, and thus the filter member 40 can be attached to and detached from the filter case 30.

An inflow port 32 through which washing water flows in and outflow ports 33 and 34 through which the washing water flows out are formed at the filter case 30. Specifically, the inflow port 32, and a first outflow port 33 and a second outflow port 34 serving as the outflow ports are formed on side surfaces of a tubular portion of the filter case 30. The inflow port 32 is provided on an upper surface of the filter case 30 and is connected to the above-described first pipe 6 (see FIG. 1). The first outflow port 33 and the second outflow port 34 are provided at lower portions of a side surface of the filter case 30. The first outflow port 33 is connected to the above-described second pipe 7 (see FIG. 1), and the second outflow port 34 is connected to the above-described third pipe 9 (see FIG. 1).

In the present embodiment, the inflow port 32 has a shape in which an upper portion thereof is inclined rearward in a side view. Thus, the washing water from the inflow port 32 obliquely flows in from the rear toward the front. Note that the inflow port 32 may be provided parallel to the up-down direction in a side view.

The filter member 40 is disposed in the filter case 30 so as to be positioned between the inflow port 32, and the first outflow port 33 and the second outflow port 34. Thus, the filter member 40 can perform a filter function on washing water flowing from the inflow port 32 to the first outflow

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port 33 during washing and can perform a filter function on washing water flowing from the inflow port 32 to the second outflow port 34 during water drain.

Filter Member

A configuration of the filter member 40 according to the present embodiment will be described. FIG. 4 is a vertical cross-sectional view illustrating the internal configuration of the filter device 20. Note that the filter device 20 is cut at different positions in FIGS. 3 and 4. FIG. 5 is a transverse cross-sectional view illustrating the internal configuration of the filter device 20. FIG. 6 is a perspective view illustrating a specific configuration of the filter member 40 of the filter device 20 when viewed obliquely from below. FIG. 7 is an enlarged view of a region B1 illustrated in FIG. 4. FIG. 8 is an enlarged view of a region B2 illustrated in FIG. 5.

As illustrated in FIGS. 4 to 6, the filter member 40 includes a base portion 41 to which the above-described knob member 11 is attached and a filter portion 42 extending rearward from the base portion 41. The filter portion 42 has a box shape with one open side. The filter member 40 is mounted inside the filter case 30 so that the open side of the filter portion 42 faces upward.

The filter member 40 has a shape extending from an upstream portion proximate to the inflow port 32 toward a downstream portion proximate to the outflow ports 33 and 34. The washing water that has flowed into the filter member 40 through the inflow port 32 flows from one end to another end in the longitudinal direction of the filter member 40. Hereinafter, a flow from the one end to the other end in the longitudinal direction of the filter member 40 will be referred to as a main water stream. The upstream portion can be referred to as an upstream side of the flow of the main water stream.

The filter portion 42 of the filter member 40 is provided with a plurality of through holes 50. Each through hole 50 is a hole extending through the filter member 40 from the inner peripheral surface to the outer peripheral surface thereof. The adjacent through holes 50 and 50 are partitioned by a rib-shaped portion 43. That is, the filter member 40 includes the rib-shaped portions 43 each partitioning adjacent through holes 50 and 50.

In the present embodiment, the filter member 40 includes a bottom portion 40a, left and right side portions 40b, and a rear portion 40c. The rib-shaped portions 43 and the through holes 50 are formed at each of the bottom portion 40a and the left and right side portions 40b.

Specifically, a plurality of bottom through holes 51 as the plurality of through holes 50 are arranged at the bottom portion 40a side by side in the longitudinal direction of the filter member 40. A bottom rib-shaped portion 44 as the rib-shaped portion 43 is located between the adjacent bottom through holes 51 and 51. The bottom rib-shaped portions 44 extend in the left-right direction, that is, in the width direction orthogonal to the longitudinal direction of the filter member 40 and are arranged side by side in the longitudinal direction of the filter member 40.

A plurality of side through holes 52 are formed as the plurality of through holes 50 in each of the left and right side portions 40b and are arranged side by side in the longitudinal direction of the filter member 40. A side rib-shaped portion 45 as the rib-shaped portion 43 is located between the adjacent side through holes 52 and 52. The side rib-shaped portions 45 extend in the up-down direction, that is, in the height direction orthogonal to the longitudinal direction of the filter member 40 and are arranged side by side in the longitudinal direction of the filter member 40.

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The plurality of bottom through holes **51** and the plurality of side through holes **52**, which are the plurality of through holes **50**, are provided to be inclined from the inner peripheral surface of the filter member **40**. The inner peripheral surface of the filter member **40** is an inner surface of the filter portion **42** having a box shape with one open side. A surface opposite to the inner peripheral surface is defined as an outer peripheral surface of the filter member **40**. Thus, the inner peripheral surface of the bottom portion **40a** corresponds to the upper surface of the bottom portion **40a**, and the outer peripheral surface of the bottom portion **40a** corresponds to the lower surface of the bottom portion **40a**.

The plurality of bottom through holes **51** are inclined in the same direction, and the plurality of side through holes **52** are also inclined in the same direction. In other words, the plurality of bottom rib-shaped portions **44** are inclined in the same direction, and the plurality of side rib-shaped portions **45** are also inclined in the same direction.

Hereinafter, when there is no need to distinguish between the plurality of bottom through holes **51** and the plurality of side through holes **52**, these holes are collectively referred to as the plurality of through holes **50**. Similarly, when there is no need to distinguish between the plurality of bottom rib-shaped portions **44** and the plurality of side rib-shaped portions **45**, these portions are collectively referred to as the plurality of rib-shaped portions **43**.

As illustrated in FIGS. 7 and 8, each through hole **50** includes an inflow portion **50a** through which the washing water flows in and an outflow portion **50b** through which the washing water flows out. The inflow portion **50a** is located on the inner peripheral surface of the filter member **40**, and the outflow portion **50b** is located on the outer peripheral surface of the filter member **40**. In the present embodiment, the outflow portion **50b** is formed so as to be located at a downstream portion more than the inflow portion **50a** in the filter case **30**, the downstream portion being a portion where the outflow ports **33** and **34** (see FIG. 2) are located. That is, the through hole **50** is inclined in the flow direction of the main water stream described above.

Each rib-shaped portion **43** includes an upstream surface **43a** facing the upstream portion, a downstream surface **43b** facing the downstream portion, and a top surface **43c** located on the inner peripheral surface of the filter member **40**. Since the rib-shaped portion **43** is also inclined in the flow direction of the main water stream described above, a corner portion C at which the top surface **43c** and the upstream surface **43a** of the rib-shaped portion **43** intersect has an acute angle.

Description of Effects

FIG. 9 is a view for describing a flow of the washing water flowing into the filter member **40**. In FIG. 9, an arrow Y1 indicates a flow of the main water stream flowing in from the inflow port **32** (see FIG. 2) of the filter case **30**. Arrows Y2 indicate flows of the washing water passing through the bottom through holes **51**. An arrow Y3 indicates a flow of the main water stream passing through the bottom through holes **51** and directed toward the outflow ports **33** and **34** (see FIG. 2) through the lower portion of the filter case **30**.

As illustrated in FIG. 9, the washing water that has flowed into the filter case **30** flows on the upper surface of the bottom portion **40a** in the downstream direction (Y1), passes through the plurality of bottom through holes **51** (Y2) during that time, and flows out through the lower portion of the filter case **30** (Y3).

FIG. 10 is a view for describing a step of separating and capturing lint or the like by the filter member **40**. As illustrated in FIG. 10, when the main water stream flows into

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the bottom through holes **51**, the lint or the like **80** contained in the main water stream is caught and captured by the bottom rib-shaped portions **44**. The lint is caught along the flow direction of the main water stream and captured in a state in which orientations thereof are aligned. In each bottom rib-shaped portion **44**, since the corner portion C at which the top surface **43c** and the upstream surface **43a** intersect has an acute angle, the lint or the like **80** can be more effectively entangled than when the corner portion C has an obtuse angle or a right angle.

FIG. 11 is a view for describing a step of collecting the lint or the like captured by the filter member **40**. As illustrated in FIG. 11, the captured lint or the like **80** is collected by tracing the bottom portion **40a** of the filter member **40** with a finger or the like in the direction opposite to the flow direction of the main water stream. The lint or the like **80** is captured in a state where orientations thereof are aligned and thus can be easily collected by tracing in one direction. The direction of tracing during the collection is a direction in which the lint or the like **80** is pulled out along the inclinations of the bottom through holes **51**.

FIG. 12 is a view illustrating a state in which the lint or the like **80** is captured in the filter member **40**. FIG. 13 is a view illustrating a state in which lint or the like **80** is captured by a related-art filter member **100** including a plurality of rectangular through holes **101**. As illustrated in FIG. 12, in the filter member **40**, the bottom through holes **51** are adjacent to each other in the flow direction of the main water stream. Thus, even when the lint or the like **80** is long, it is unlikely that the lint or the like **80** reaches the lower surface of the bottom portion **40a** and is wound around each bottom rib-shaped portion **44**, and the lint or the like **80** is caught across the plurality of bottom rib-shaped portions **44**. In addition, even when entangled with the bottom rib-shaped portions **44**, the lint or the like **80** is captured along the inclinations of the bottom rib-shaped portions **44** and thus easily pulled out from the bottom through holes **51** along the inclinations by tracing.

On the other hand, as illustrated in FIG. 13, in the case of the related-art filter member **100** in which the plurality of rectangular through holes **101** are arranged side by side in a lattice pattern in the front-rear direction and in the left-right direction, when the lint or the like **80** is long, the lint or the like **80** is captured in a state of being entangled with the plurality of rectangular through holes **101** located in the upper, lower, left and right directions. Thus, it is impossible to collect the lint or the like **80** only by tracing in one direction, and entanglement needs to be loosened and removed by being pulled from both sides of the filter member **100**.

Although the effect has been described with reference to FIG. 9, it is obvious that the side through holes **52** and the side rib-shaped portions **45** have the same effect as the bottom through holes **51** and the bottom rib-shaped portions **44**.

Additional Configurations

Furthermore, in the present embodiment, the filter member further has the following configurations 1) to 8).

Configuration 1) As illustrated in FIGS. 5 and 7, in each bottom through hole **51**, the outflow portion **50b** is covered and hidden by the corresponding bottom rib-shaped portion **44** in a plan view seen from the upper surface of the bottom portion **40a**. That is, the filter member **40** is formed such that the inflow portion **50a** and the outflow portion **50b** of the same bottom through hole **51** do not overlap each other in a plan view seen from the upper surface of the bottom portion **40a**.

The above-described configuration enables the bottom through hole **51** to have a sufficient depth and the lint or the like to be effectively captured. In addition, the outflow portion **50b** of the bottom through hole **51** cannot be seen in a plan view seen from the upper surface of the bottom portion **40a**, which can cause the user to feel that the capturing effect is excellent.

Although details will not be described for the sake of convenience, as illustrated in FIG. 8, the outflow portion **50b** of each side through hole **52** is covered and hidden by the corresponding side rib-shaped portion **45** in a plan view seen from the inner peripheral surface of each side portion **40b**, and the same effect is achieved.

Configuration 2) As to each bottom through hole **51**, when the thickness of the bottom portion **40a** is denoted as a thickness H1 and the width of the inflow portion **50a** between the adjacent bottom rib-shaped portions **44** and **44** is denoted as a width W1, the thickness H1 is larger than the width W1 as illustrated in FIG. 7. That is, the bottom through hole **51** of the filter member **40** is formed such that the width W1 of the inflow portion **50a** is smaller than the thickness H1 of the bottom portion **40a**.

The depth of the bottom through hole **51** depends on the thickness of the bottom portion **40a**. According to the above-described configuration, the bottom through holes **51** can have a sufficient depth, and even when the lint or the like **80** is long and is easily entangled, the lint or the like **80** can be effectively avoided from being wound around and entangled with the bottom rib-shaped portions **44** and can be captured in an easily collectible state.

Although details will not be described for the sake of convenience, as illustrated in FIG. 8, each side through hole **52** is formed such that a width W1' of the inflow portion **50a** is smaller than a thickness H1' of the side portion **40b**, and the same effect is achieved.

Configuration 3) As to each bottom through hole **51**, when the width of the inflow portion **50a** is denoted as the width W1 and the width of each bottom rib-shaped portion **44** between the adjacent inflow portions **50a** and **50a** is denoted as a width W2, the width W2 is larger than the width W1 as illustrated in FIG. 7. That is, the bottom through hole **51** of the filter member **40** is formed such that the width W1 of the inflow portion **50a** is smaller than the width W2 of the bottom rib-shaped portion **44**.

According to the above-described configuration, a decrease in the width W1 of the inflow portion **50a** can increase the number of bottom through holes **51** disposed in the flow direction of the main water stream flowing into the filter member **40**. This can increase the rate of openings in the bottom portion **40a** and improve both the rate of capturing and the water drain property.

Although details will not be described for the sake of convenience, each side through hole **52** may be formed such that the width W1' of the inflow portion **50a** is smaller than a width W2' of each side rib-shaped portion **45**, and, in this case, the same effect is achieved.

Configuration 4) In each bottom through hole **51**, the opening area of the outflow portion **50b** is larger than the opening area of the inflow portion **50a** as illustrated in FIG. 7. That is, in the filter member **40**, the bottom through hole **51** is formed such that the size of the hole increases from the upper surface of the bottom portion **40a** toward the lower surface of the bottom portion **40a**.

According to the above-described configuration, since the bottom through hole **51** widens toward the lower surface of the bottom portion **40a**, the flow velocity of the flow indicated by an arrow Y2, which branches off from the main

water stream flowing on the upper surface of the bottom portion **40a** and flows into the bottom through hole **51**, is higher on the downstream surface **43b** located in the flow direction of the main water stream than on the upstream surface **43a** located on the opposite side. Thus, a vortex **55** is formed at or near the inflow portion **50a** of the bottom through hole **51**. The formation of the vortex makes it difficult for the lint or the like **80** to flow into the bottom through hole **51**. As a result, it is possible to suppress passing of the lint or the like **80** through the bottom through hole **51** and improve the rate of capturing.

Although details will not be described for the sake of convenience, as illustrated in FIG. 8, each side through hole **52** is also formed such that the size of the hole increases from the inner peripheral surface of the side portion **40b** toward the outer peripheral surface of the side portion **40b**, and the same effect is achieved.

Configuration 5) As illustrated in FIG. 7, in each bottom through hole **51**, the downstream surface **43b** includes a first surface **43b1** inclined at a first angle and a second surface **43b2** provided closer to the outflow portion **50b** than the first surface **43b1**, the second surface **43b2** forming an obtuse angle with the first surface **43b1**. A corner portion having an obtuse angle formed by the first surface **43b1** and the second surface **43b2** forms a bent shape **56**.

In other words, the filter member **40** has the bent shape **56** protruding in the flow direction of the main water stream at a portion including the downstream surface **43b** of the bottom rib-shaped portion **44** or at a portion including the downstream surface **43b** and the top surface **43c** intersecting the downstream surface **43b**.

According to the above-described configuration, the flow indicated by the arrow Y2, which branches off from the main water stream flowing on the upper surface of the bottom portion can be drawn into the bottom through hole **51** at a high flow velocity at the bent shape **56**. As a result, a larger vortex **55** can be formed, and the rate of capturing can be further improved.

Although details will not be described for the sake of convenience, a bent shape **56** may be formed on the downstream surface **43b** of each side through hole **52**. In this case, the same effect is achieved.

Configuration 6) Further, in this case, as illustrated in FIG. 7, the first surface **43b1** may be provided so as to be exposed in a plan view seen from the upper surface of the bottom portion **40a**. In other words, the top surface **43c** and the first surface **43b1** of the bottom rib-shaped portion **44** may be provided to form an obtuse angle and have a curved surface shape **57** protruding upward.

According to the above-described configuration, the bottom rib-shaped portion **44** has the curved surface shape **57** protruding upward on the upper surface of the bottom portion and thus, when the lint or the like **80** is collected by tracing, a force more easily acts in the pressing direction than when the upper surface of the bottom rib-shaped portion **44** is formed flat. As a result, the lint or the like **80** can be collected by tracing more easily.

Although details will not be described for the sake of convenience, each side rib-shaped portion **45** may also be provided such that the top surface **43c** and the first surface **43b1** of the side rib-shaped portion **45** form an obtuse angle and have a curved surface shape **57** protruding inward. In this case, the same effect is achieved.

Configuration 7) As illustrated in FIGS. 3 to 5, in the filter member **40**, a curved surface portion **40d** extending upward from the bottom portion **40a** is formed upstream of the region where the bottom through holes **51** are formed.

According to the above-described configuration, the inflow water hits the curved surface portion **40d** and thus the washing water flowing in from the inflow port **32** can be smoothly guided to the regions where the plurality of through holes **50** are formed. Further, when collected by tracing, the lint or the like **80** can be smoothly taken out by using the curved surface portion **40d**.

Configuration 8) Further, as illustrated in FIGS. **3** and **5**, an indication portion **58** indicating the direction for removing the lint or the like **80**, which is a captured substance, is formed at the curved surface portion **40d**. Since the curved surface portion **40d** is at a position traced at the time of collecting the lint or the like **80**, providing the indication portion **58** at this position makes it noticeable, and the user can intuitively recognize the tracing direction and perform the collecting operation. The position at which the indication portion **58** is provided is not limited to the position of the curved surface portion **40d**. The indication portion **58** may be formed by any method such as stamping, printing, or sealing.

All of Configurations 1) to 8) described above may be provided at the same time or may be selectively provided in a range of possible combinations. In addition, in the present embodiment, the plurality of through holes **50** are inclined in the direction in which the main water stream flows. However, by providing the plurality of through holes **50** so as to be inclined at least in the same direction, the lint or the like **80** captured by the rib-shaped portion **43** can be collected by tracing.

According to the above-described configuration, the washing water can be drained in a state where a foreign substance such as the lint or the like **80** is effectively removed from the washing water. Such an effect also contributes to achievement of, for example, Goal **6** "Ensure availability and sustainable management of water and sanitation for all" of the sustainable development goals (SDGs) proposed by the UN.

Supplement

A filter member according to the disclosure is a filter member detachably mounted in a filter case formed with an inflow port through which water flows in and an outflow port through which the water flows out, the filter member including a rib-shaped portion configured to partition through holes adjacent to each other, wherein each of the through holes is inclined from an inner peripheral surface of the filter member. With such a configuration, the captured lint or the like can be easily collected. Such a filter member may be provided in the washing machine.

For example, the filter member may have a shape extending from an upstream portion proximate to the inflow port toward a downstream portion proximate to the outflow port, and each of the through holes may include an inflow portion through which the water flows in and an outflow portion through which the water flows out, the outflow portion being formed closer to the downstream portion than the inflow portion.

In addition, for example, the through holes may include a bottom through hole provided at a bottom portion of the filter member, and the outflow portion of the bottom through hole may be covered with and hidden by the rib-shaped portion in a plan view seen from an upper surface of the bottom portion.

Further, for example, a thickness of the bottom portion may be larger than a width of the inflow portion between a plurality of the rib-shaped portions adjacent to each other. A width of the inflow portion may be larger than a width of the rib-shaped portion between the inflow portions adjacent to

each other. In each of the through holes, an opening area of the outflow portion may be larger than an opening area of the inflow portion.

Further, for example, the rib-shaped portion may include an upstream surface facing the upstream portion and a downstream surface facing the downstream portion, and the downstream surface may include a first surface inclined at a first angle and a second surface provided closer to the outflow portion than the first surface, the second surface forming an obtuse angle with the first surface. Here, the first surface may be exposed in a plan view seen from the upper surface of the bottom portion.

In addition, for example, a curved surface portion extending upward from the bottom portion may be formed at the upstream portion further than a region in which the bottom through hole is formed. Further, an indication portion indicating a direction for removing a captured substance is formed at the curved surface portion.

Note that the disclosure includes a technical idea focusing on a structure of a gill raker of a gill of a manta. In other words, the disclosure relates to biomimetics.

The disclosure is not limited to each of the above-described embodiments. It is possible to make various modifications within the scope of the claims. An embodiment obtained by appropriately combining technical elements disclosed in different embodiments falls also within the technical scope of the disclosure. Further, technical elements disclosed in the respective embodiments may be combined to provide a new technical feature.

While preferred embodiments of the present invention have been described above, it is to be understood that variations and modifications will be apparent to those skilled in the art without departing from the scope and spirit of the present invention. The scope of the present invention, therefore, is to be determined solely by the following claims.

The invention claimed is:

1. A filter member detachably mounted in a filter case, the filter case being formed with an inflow port through which water flows in and an outflow port through which the water flows out, the filter member comprising:

a filter portion which has a box shape with one open side; a plurality of through holes with which the filter portion is provided; and

a rib-shaped portion which is configured to partition through holes, among the plurality of through holes, that are adjacent to each other in a longitudinal direction of the filter portion,

wherein the one open side of the filter portion coincides with an up direction of the filter portion, which is orthogonal to the longitudinal direction of the filter portion,

each of the plurality of through holes extends through the filter portion from an inner peripheral surface of the filter portion to an outer peripheral surface of the filter portion,

one side of a longitudinal direction of the filter member is an upstream side of a flow direction of water flowing on the inner peripheral surface, and another side of the longitudinal direction of the filter member is a downstream side of the flow direction of the water flowing on the inner peripheral surface,

at least one of the through holes includes an inflow portion which is located on the inner peripheral surface and through which the water flows in and an outflow portion through which the water flows out, and

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the at least one of the through holes is inclined, such that the outflow portion is located further on the other side of the longitudinal direction of the filter member than is the inflow portion.

2. The filter member according to claim 1,
wherein the filter member has a shape extending from an upstream portion proximate to the inflow port toward a downstream portion proximate to the outflow port, and the outflow portion is formed closer to the downstream portion than to the inflow portion.

3. The filter member according to claim 2,
wherein the plurality of through holes includes a bottom through hole provided at a bottom portion of the filter member, and

the outflow portion of the bottom through hole is covered with and hidden by the rib-shaped portion in a plan view viewed from an upper surface of the bottom portion.

4. The filter member according to claim 3,
wherein a thickness of the bottom portion is larger than a width of the inflow portion provided between the rib-shaped portion and another rib-shaped portion adjacent to the rib-shaped portion.

5. The filter member according to claim 4,
wherein the width of the inflow portion is smaller than a width of the rib-shaped portion between the inflow portion and another inflow portion adjacent to the inflow portion.

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6. The filter member according to claim 3,
wherein the rib-shaped portion includes an upstream surface facing the upstream portion and a downstream surface facing the downstream portion, and

the downstream surface includes a first surface inclined at a first angle and a second surface provided closer to the outflow portion than the first surface, the second surface forming an obtuse angle with the first surface.

7. The filter member according to claim 6,
wherein the first surface is exposed in the plan view viewed-seen from the upper surface of the bottom portion.

8. The filter member according to claim 3, further comprising:

a curved surface portion extending upward from the bottom portion at the upstream portion located further upstream from a region where the bottom through hole is formed.

9. The filter member according to claim 8, further comprising:

an indication portion configured to indicate a direction for removing a captured substance, the indication portion being formed at the curved surface portion.

10. The filter member according to claim 1,
wherein in the at least one of the through holes, an opening area of the outflow portion is larger than an opening area of the inflow portion.

11. A washing machine comprising the filter member according to claim 1.

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