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PULSATOR OF WASHING MACHINE

Field of the Invention

5 The present invention relates to a pulsator of a washing machine, which is installed on an inner bottom part of a washer tub and agitates laundry articles and water by rotation thereof.

10 Background of the Invention

 A vortex-type washing machine, such as a twin tub washing machine, which includes a washer tub and a dewatering tub separately, and a fully automatic washing
15 machine wherein a washer tub therein also serves as a dewatering tub, has a pulsator located on an inner bottom part of the washer tub. The pulsator, which is rotationally driven by a motor, generates a vortex-type agitating water stream by rotation thereof, so that water and laundry
20 articles are agitated to thereby execute a washing and a rinse process.

 The pulsator is required to have a high cleaning efficiency and, at the same time, not to cause twists and damages in the laundry articles. Therefore, research
25 activities are focused on shapes of a disk-shaped base of the pulsator and radial ribs formed thereon. For example,

there is disclosed a pulsator of washing machine, which prevents the laundry articles from being caught at leading edge portions of the ribs and also enhances the cleaning efficiency by suppressing poor cleaning, twisting, tangling and the like in the laundry articles (see, e.g., Japanese
5 Examined Patent Publication No. 1990-54113, pages 2~3, Fig. 3). The pulsator is embodied by differentiating, along radial directions, heights and widths of a plurality of ribs formed on a base. The base is formed with a curved surface
10 which is downwardly inclined from a hemispheric portion located at a center thereof and upwardly inclined toward an outer periphery thereof.

The laundry articles are washed by a synergy effect of the ribs agitating the laundry articles directly and water
15 stream generated by the rotation of the pulsator. With the rotation of the pulsator having a conventional structure, water introduced from the hemispheric portion located at the center thereof flows along the curved surface and then flows up along the sidewall of the washer tub, resulting in water
20 streams of a large circular arc. However, with mere tailoring of the shapes of the base and the ribs, the water stream generated in the washer tub follows along a simplified pattern, resulting in a limitation in the cleaning efficiency.

Summary of the Invention

It is, therefore, an object of the present invention to provide a pulsator of a washing machine capable of
5 generating a complicated pattern of water stream to thereby enhance agitating capability, wherein the pulsator includes a plurality of pulsating members assembled in a body.

In accordance with the present invention, there is provided a pulsator of a washing machine, which is
10 rotationally driven by a rotational driving means and installed on an inner bottom part of a washer tub for accommodating therein laundry articles and water, the washer tub having an open top, including: a central pulsating member which is located within a first radial distance from
15 a rotational axis of the pulsator and has thereon a plurality of upwardly extruded center blades; an outer pulsating member which is located within a second radial distance inwardly from an outer periphery of the pulsator and has thereon a number of upwardly extruded outer blades;
20 and an intermediate pulsating member which is rotatably inserted onto a gap between the central pulsating member and the outer pulsating member and has thereon plural upwardly extruded intermediate blades.

Since the intermediate pulsating member is inserted
25 between the central pulsating member and the outer pulsating member, in case the central pulsating member and the outer

pulsating member are rotationally driven, there occurs in the intermediate pulsating member a rotation lagging behind the rotation of the central pulsating member and that of the outer pulsating member. Thus, the intermediate pulsating member produces a water stream which is added to other water streams generated by the outer pulsating member and the central pulsating member to thereby form a complicated water stream. Therefore, frictional movements between the laundry articles are increased resulting in a high cleaning efficiency.

In accordance with the present invention, a diametric width of the intermediate pulsating member is approximately 1/2 of that of the outer pulsating member and that of the central pulsating member is approximately 1/2 of that of the intermediate pulsating member. Thus, a large-sized water stream is generated in a rotational direction by the outer pulsating member occupying a large area, while a small-sized water stream generated by the central pulsating member affects the water stream generated by the intermediate pulsating member to thereby form the complicated water stream. Thus, the laundry articles in the washer tub can be agitated efficiently.

In accordance with the present invention, the central pulsating member and the outer pulsating member are molded as a single body. Thus, a large stress of the construction including the central pulsating member and the outer

pulsating member can be achieved by the single-body structure, and the intermediate pulsating member can be easily inserted onto the gap between the central pulsating member and the outer pulsating member.

5 In accordance with the present invention, the central pulsating member has a hemispheric shape, an apex thereof being located on the rotational axis. Thus, the water stream generated by the central pulsating member flows toward the outward radial direction so that it affects the
10 water stream generated by the intermediate pulsating member to thereby form a complicated water stream, resulting in a high-efficient agitation.

 In accordance with the present invention, the intermediate pulsating member has a curved surface which is
15 upwardly inclined toward the outward radial direction. Thus, a water stream in a vertical direction is generated by the intermediate pulsating member and it is affected by the water stream generated by the central pulsating member to thereby be transformed into a water stream moving in an
20 inclined direction. Therefore, a complicated agitation is applied to the laundry articles so that a frictional force and a force in a twist direction can be applied to the laundry articles, resulting in a good cleaning efficiency.

 In accordance with the present invention, the outer
25 pulsating member has a curved surface which is downwardly inclined from an inner periphery thereof to an approximately

central region thereof in a radial direction and upwardly inclined toward an outer periphery thereof, the inner periphery being an apex of the outer pulsating member. Thus, the laundry articles can be easily loaded on the outer
5 pulsating member, so that the laundry articles are agitated efficiently and, at the same time, a water stream in the rotational direction is generated by the outer pulsating member.

In accordance with the present invention, apexes of
10 the intermediate blades are located lower than those of the center blades and the outer blades. Thus, the intermediate pulsating member is prevented from being rotated together with the outer pulsating member and the central pulsating member due to a drag exerted by the laundry articles which
15 are sitting between the outer pulsating member and the central pulsating member. Therefore, a strong stress cannot be exerted to the intermediate pulsating member.

In accordance with the present invention, at the time of forming the central pulsating member and the outer
20 pulsating member in a body, an intermediate pulsating member holding recess is formed simultaneously and then a sliding motion bedplate for supporting the rotation of the intermediate pulsating member is fixated therein. Thereafter, the intermediate pulsating member is combined
25 with the sliding motion bedplate which is fixated in the intermediate pulsating member holding recess, the

intermediate pulsating member holding recess being located between the central pulsating member and the outer pulsating member, and the intermediate pulsating member is rotatably supported on a support ring portion formed on the sliding motion bedplate.

In accordance with the present invention, the intermediate pulsating member includes: a pair of concentric rings facing sidewalls of the support ring portion with gaps therebetween; and sliding motion prominences having slidable contact with an upper surface of the support ring portion. Thus, an air trap is effectuated above the upper surface of the support ring portion. Therefore, grits, water and the like cannot get onto the upper surface of the support ring portion, so that the rotation of the intermediate pulsating member cannot be disturbed thereby.

In accordance with the present invention, a bottom surface of the intermediate pulsating member holding recess is provided with openings. Thus, foreign substances such as the grits and the like, which get into the intermediate pulsating member holding recess, are discharged through the openings. Therefore, the rotation of the intermediate pulsating member is not disturbed by the foreign substances.

In accordance with the present invention, a step is formed on each side peripheral surface of the intermediate pulsating member holding recess. Thus, the foreign substances such as coin and the like can be prevented from

getting into the intermediate pulsating member holding
recess through gaps between the intermediate pulsating
member and the outer pulsating member and between the
intermediate pulsating member and the central pulsating
5 member.

Brief Description of the Drawings

The above and other objects and features of the
10 present invention will become apparent from the following
description of a preferred embodiment given in conjunction
with the accompanying drawings, in which:

Fig. 1 shows a structure of a washing machine
employing a pulsator in accordance with the preferred
15 embodiment of the present invention;

Fig. 2 depicts a structure of the pulsator;

Fig. 3 presents a cross sectional view of the pulsator
along a line A-A in Fig.2;

Fig. 4A represents a plan view showing a structure of
20 a driving body of the pulsator;

Fig. 4B describes a cross sectional view of a driving
body along a line B-B in Fig. 4A;

Fig. 5A offers a plan view showing a structure of a
sliding motion bedplate of the pulsator;

25 Fig. 5B illustrates a cross sectional view of the
sliding motion bedplate along a line C-C in Fig. 5A;

Fig. 6A provides a plan view illustrating a structure of an intermediate pulsating member of the pulsator; and

Fig. 6B sets forth a cross sectional view of the intermediate pulsating member along a line D-D in Fig. 6A.

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Detailed Description of the Preferred Embodiments

Fig. 1 shows a structure of a washing machine including pulsator 1 in accordance with a preferred
10 embodiment of the present invention. The exemplified washing machine is a fully automatic washing machine which executes a series of processes automatically, i.e., from a washing process to a dewatering process. Outer tub 12
15 installed in housing 10 is elastically supported by a plurality of suspensions 11, so that vibrations generated at the time of the dewatering process can be absorbed by suspensions 11. Inner tub 13 (washer tub), which includes pulsator 1 disposed on a bottom part thereof, is installed
20 in outer tub 12. Pulsator 1 and inner tub 13 are rotationally driven by motor 14 fixated at a bottom part of outer tub 12. The driving force of motor 14 is selectively transferred to pulsator 1 and/or inner tub 13 by clutch 15. Herein, a feed and a drain structure of water are omitted in the drawing.

25 In case the washing machine is driven after loading laundry articles and a detergent into inner tub 13 with

cover 16 installed on an upper portion of housing 10 being opened; water is fed into inner tub 13 and then pulsator 1 is rotationally driven by motor 14, so that the washing process is carried out by the agitation of the laundry articles and the water stream generated by the rotation of pulsator 1. After the washing process carried out for a given period of time, a rinse process, i.e., draining the water blurred during the washing process and then agitating the laundry articles and newly fed water by pulsator 1, begins to be executed. After the rinse process, the rotational force of motor 14 is switched to inner tub 13 by clutch 15 so that the dewatering process, i.e., ejecting water soaked into the laundry articles into outer tub 12 through small openings formed on the sidewall of inner tub 13 by a centrifugal force due to the rotation of inner tub 13, is initiated. The series of processes, i.e., from the washing process to the dewatering process, is controlled by a controller (not shown), to be executed automatically.

In the course of the washing process and the rinse process, a cleaning efficiency is affected by the formation of water stream and the agitation of the laundry articles generated by pulsator 1. In accordance with a preferred embodiment of the present invention, pulsator 1 generates the complicated water stream in inner tub 13 and, at the same time, agitates the laundry articles with increasing frictional forces thereamong, to thereby enhance the

cleaning efficiency. Hereinafter, a structure of pulsator 1 is explained with reference to Figs. 2 to 6B.

As shown in Figs. 2 and 3, pulsator 1 includes three parts, i.e., outer pulsating member 2 having a large area formed at an outer peripheral region thereof, central pulsating member 4 having a small area at a central region thereof, and intermediate pulsating member 3 located between outer pulsating member 2 and central pulsating member 4. As shown in Figs. 4A and 4B, outer pulsating member 2 and central pulsating member 4 are resin-molded in a single body to form driving body 20. Moreover, insertion fitting axial portion 6 formed beneath central pulsating member 4 is rotationally driven by inserting and fixedly mounting insertion fitting axial portion 6 around a rotating axis to which a rotational driving force of motor 14 is transferred via clutch 15. Between outer pulsating member 2 and central pulsating member 4 of driving body 20, intermediate pulsating member holding recess 7 is formed. Moreover, as shown in Fig. 3, sliding motion bedplate 5 is installed in intermediate pulsating member holding recess 7 and is fixated to driving body 20 by screws 9 screwed into a plurality of openings provided in a bottom surface of intermediate pulsating member holding recess 7. Intermediate pulsating member 3 is rotatably inserted onto sliding motion bedplate 5.

As shown in Figs. 5A and 5B, sliding motion bedplate 5

includes support ring portion 5a, formed at an outer peripheral side thereof to have a substantially rectangular cross sectional shape with one side opened, for supporting intermediate pulsating member 3 mounted thereon; and
5 hitching ring portion 5b, which is formed at an inner peripheral side of sliding motion bedplate 5 and to be engaged with hitching hook 3a formed at parts of an inner peripheral side of intermediate pulsating member 3. In case intermediate pulsating member 3 is press-fitted onto sliding
10 motion bedplate 5 fixed on driving body 20, a pair of concentric rings 3b, 3c formed under a bottom surface of intermediate pulsating member 3 is placed at both sides of support ring portion 5a with very small gaps therebetween, as shown in Fig. 3. Moreover, sliding motion prominences 3d
15 extruded between concentric rings 3b, 3c are in contact with the top of support ring portion 5a, so that intermediate pulsating member 3 is rotatably supported on sliding motion bedplate 5. Furthermore, hook-shaped portions of hitching hook 3a formed at intermediate pulsating member 3 is
20 combined with those of hitching ring portion 5b of sliding motion bedplate 5. Therefore, intermediate pulsating member 3 inserted onto sliding motion bedplate 5 is maintained thereat without being disengaged therefrom.

Since both sidewalls of support ring portion 5a are
25 surrounded by concentric rings 3b, 3c with the minute gaps therebetween by virtue of the structure where intermediate

pulsating member 3 is inserted onto sliding motion bedplate 5, an air trap is effectuated above an upper surface of support ring portion 5a where intermediate pulsating member 3 is rotated with sliding motion. Therefore, grits or the like cannot get onto the upper surface of support ring portion 5a, so that the rotation of intermediate pulsating member 3 cannot be disturbed thereby. Moreover, since foreign substances, such as grits and the like, entered into intermediate pulsating member holding recess 7 through a gap between intermediate pulsating member 3 and outer pulsating member 2 are discharged through openings 7a formed at the bottom surface of intermediate pulsating member holding recess 7, the rotation of intermediate pulsating member 3 is prevented from being disturbed by the engagement of the grits and the like. Moreover, a step is formed on each of the two inner peripheral surfaces of intermediate pulsating member holding recess 7 with peripheral protrusion 7b formed at an inner peripheral side of the step, and hang-down parts 3e, 3f are extruded downwardly from outer and inner peripheries of intermediate pulsating member 3. Therefore, foreign substances such as coin and the like can be prevented from getting into the gap between intermediate pulsating member 3 and outer pulsating member 2 and that between intermediate pulsating member 3 and central pulsating member 4.

Outer pulsating member 2, intermediate pulsating

member 3 and central pulsating member 4 have differently inclined curved surfaces and a number of blades 22, 23, 24, which are extruded upwardly, are formed on the respective curved surfaces. Herein, an effective diametric width of intermediate pulsating member 3 is approximately 1/2 of that of outer pulsating member 2, and that of central pulsating member 4 is approximately 1/2 of that of intermediate pulsating member 3. As shown in Fig. 3, central pulsating member 4 has a convex curved surface which is gradually inclined downward in every direction from an apex at a rotational axis, and center blades 24 is upwardly extruded on the downwardly inclining curved surface. Intermediate pulsating member 3 has a concave curved surface which is consecutive to the downwardly inclining curved surface of central pulsating member 4 and, at the same time, upwardly inclined in outward radial directions. Intermediate blades 23 are upwardly extruded on the concave curved surface. Outer pulsating member 2 has a concave curved surface which is downwardly inclined from an inner periphery thereof, which is an apex of the concave curved surface and consecutive to the upwardly inclining curved surface of intermediate pulsating member 3, and then gradually inclined upwards toward an outer periphery thereof. Large-sized outer blades 22 are upwardly extruded on the concave curved surface.

As above-mentioned pulsator 1 is rotationally driven,

a large-sized rotational water stream is generated in a horizontal direction by outer pulsating member 2 which is largest in area among all the pulsating members and has big outer blades 22 formed thereon. A small-sized rotational water stream, which moves outwards from the center portion, is generated by central pulsating member 4 which is rotated together with outer pulsating member 2. No driving force is applied to intermediate pulsating member 3, but, instead, a frictional force generated by the water streams and the laundry articles is transmitted to intermediate pulsating member 3. Therefore, intermediate pulsating member 3 begins to rotate after outer pulsating member 2 and central pulsating member 4 start to rotate. The rotation of intermediate pulsating member 3 generates a water stream in a vertical direction, which in turn is changed to an inclined direction because the rotational water stream generated by central pulsating member 4 moves outwards to thereby exert an outward force to the water stream generated by intermediate pulsating member 3. As mentioned above, three kinds of pulsating members generate water streams respectively, and there occur delays in the rotation of intermediate pulsating member 3, resulting in a complicated water stream generated in inner tub 13. Thus, frictional movements among the laundry articles are increased due to a complicated agitation and dirt can be effectively removed from the laundry articles by contortive and vertical

movements thereof.

Apexes of intermediate blades 23 formed on intermediate pulsating member 3 are located lower than those of outer blades 22 and center blades 24. Therefore, intermediate pulsating member 3 can be prevented from being rotated in unison with outer pulsating member 2 and central pulsating member 4 due to the laundry articles caught thereat. Thus, the functionality of intermediate pulsating member 3 is prevented from being degraded, and, at the same time, a large stress is prevented from being exerted to intermediate pulsating member 3.

Moreover, inter-blade prominences 25 are formed between outer blades 22, so that friction between outer pulsating member 2 and laundry articles increases, which are sitting in recess parts between outer blades 22. Thus, the laundry articles can be agitated with a greater efficiency by outer pulsating member 2.

Though the preferred embodiment of the present invention has been described with respect to the pulsator employed in a fully automatic washing machine, it is to be appreciated by those skilled in the art that the pulsator of the present invention can be equally applied to attain same effects in other types of washing machine, e.g., a twin tub washing machine having separated washer tub and dewatering tub or a washer drier which adds a drying function to functions of the fully automatic washing machine.

As mentioned above, in accordance with the preferred embodiment of the present invention, the pulsator includes 3 portions, i.e., the central pulsating member, the outer pulsating member, and the intermediate pulsating member which is located therebetween. In case the central pulsating member and the outer pulsating member are rotationally driven, there occurs in the intermediate pulsating member a rotation lagging behind the rotation of the central pulsating member and the outer pulsating member. The rotation of the intermediate pulsating member produces a water stream which is added to other water streams generated by the rotation of the central pulsating member and that of the outer pulsating member, causing interferences therebetween to form a complicated water stream. Thus, the frictional forces among the laundry articles are increased due to the complicated movements thereof, so that the cleaning efficiency can be enhanced.

While the invention has been shown and described with respect to the preferred embodiment, it will be understood by those skilled in the art that various changes and modifications may be made without departing from the spirit and the scope of the invention as defined in the following claims.

What is claimed is:

1. A pulsator of a washing machine, which is rotationally driven by a rotational driving means and installed on an inner bottom part of a washer tub for accommodating therein laundry articles and water, the washer tub having an open top, comprising:

a central pulsating member which is located within a first radial distance from a rotational axis of the pulsator and has thereon a plurality of upwardly extruded center blades;

an outer pulsating member which is located within a second radial distance inwardly from an outer periphery of the pulsator and has thereon a number of upwardly extruded outer blades; and

an intermediate pulsating member which is rotatably inserted between the central pulsating member and the outer pulsating member and has thereon plural upwardly extruded intermediate blades.

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2. The pulsator of claim 1, wherein a diametric width of the intermediate pulsating member is approximately 1/2 of that of the outer pulsating member and that of the central pulsating member is approximately 1/2 of that of the intermediate pulsating member.

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3. The pulsator of claim 1 or 2, wherein the central pulsating member and the outer pulsating member are molded as a single body.

5 4. The pulsator of claim 1 or 2, wherein the central pulsating member has a hemispheric shape, an apex thereof being located on the rotational axis.

10 5. The pulsator of claim 1 or 2, wherein the intermediate pulsating member has a curved surface which is upwardly inclined toward an outward radial direction.

15 6. The pulsator of claim 1 or 2, wherein the outer pulsating member has a curved surface which is downwardly inclined from an inner periphery thereof to an approximately central region thereof in a radial direction and upwardly inclined toward an outer periphery thereof, the inner periphery being an apex of the outer pulsating member.

20 7. The pulsator of claim 1 or 2, wherein apexes of the intermediate blades are located lower than those of the center blades and the outer blades.

25 8. The pulsator of claim 1, wherein the intermediate pulsating member is combined with a sliding motion bedplate which is fixated in an intermediate pulsating member holding

recess, the intermediate pulsating member holding recess being located between the central pulsating member and the outer pulsating member and including a support ring portion on which the intermediate pulsating member is rotatably supported.

9. The pulsator of claim 8, wherein the intermediate pulsating member includes:

a pair of concentric rings facing sidewalls of the support ring portion with gaps therebetween; and
sliding motion prominences having slidable contact with an upper surface of the support ring portion.

10. The pulsator of claim 8, wherein a bottom surface of the intermediate pulsating member holding recess is provided with openings.

11. The pulsator of claim 8, wherein a step is formed on each side peripheral surface of the intermediate pulsating member holding recess.