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(54) GASKET AND DRUM-TYPE WASHING MACHINE HAVING THE SAME

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(57) **ABSTRACT**

A gasket and washing machine having the same is provided to prevent gasket deformation and damage. A gasket is coupled between a cabinet of a drum-type washing machine including a drying duct for providing a drying function and a tub disposed inside the cabinet. The gasket includes a duct receptacle for receiving the drying duct, and a shock absorber having a bent shape for preventing a vibration appearing in the tub from being transferred to the cabinet, the shock absorber including a first portion that is adjacent the duct receptacle and has a first thickness and a second portion that is not adjacent the duct receptacle and has a second thickness, wherein the first thickness is at least twice the second thickness.

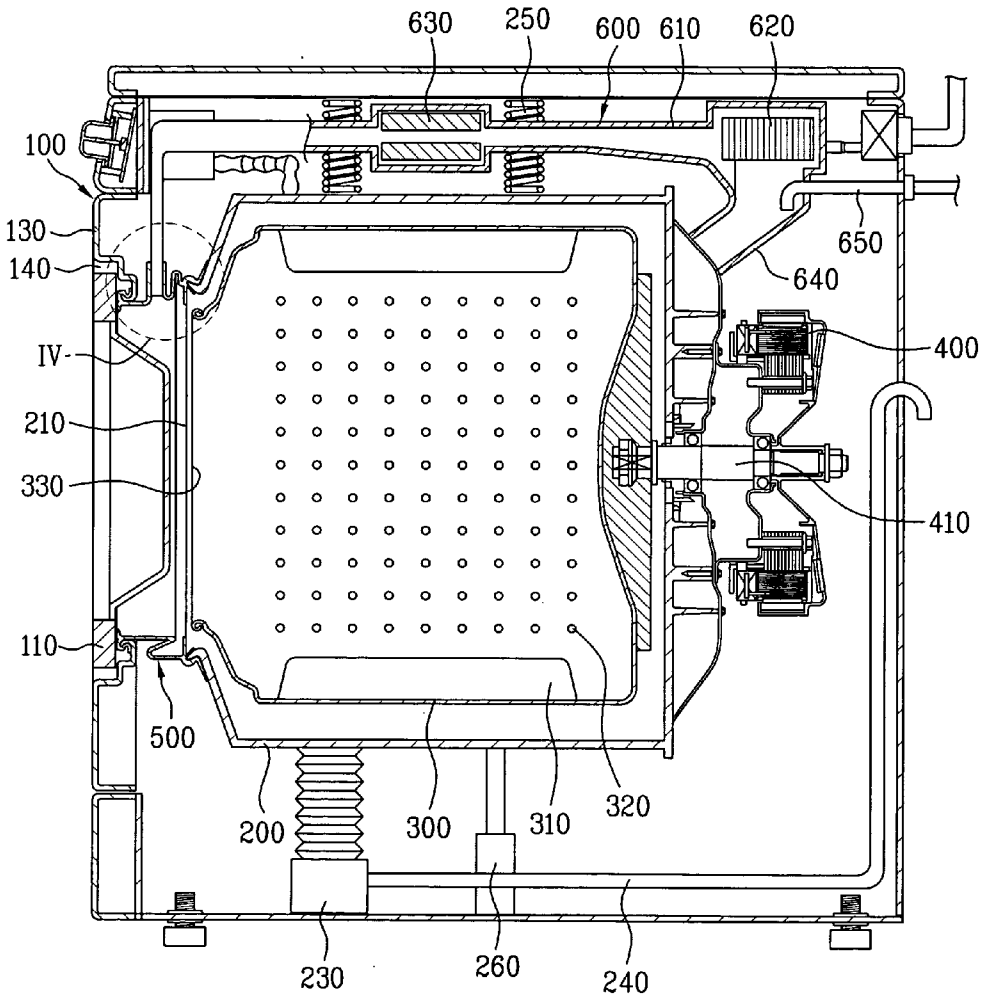


FIG. 1
Related Art

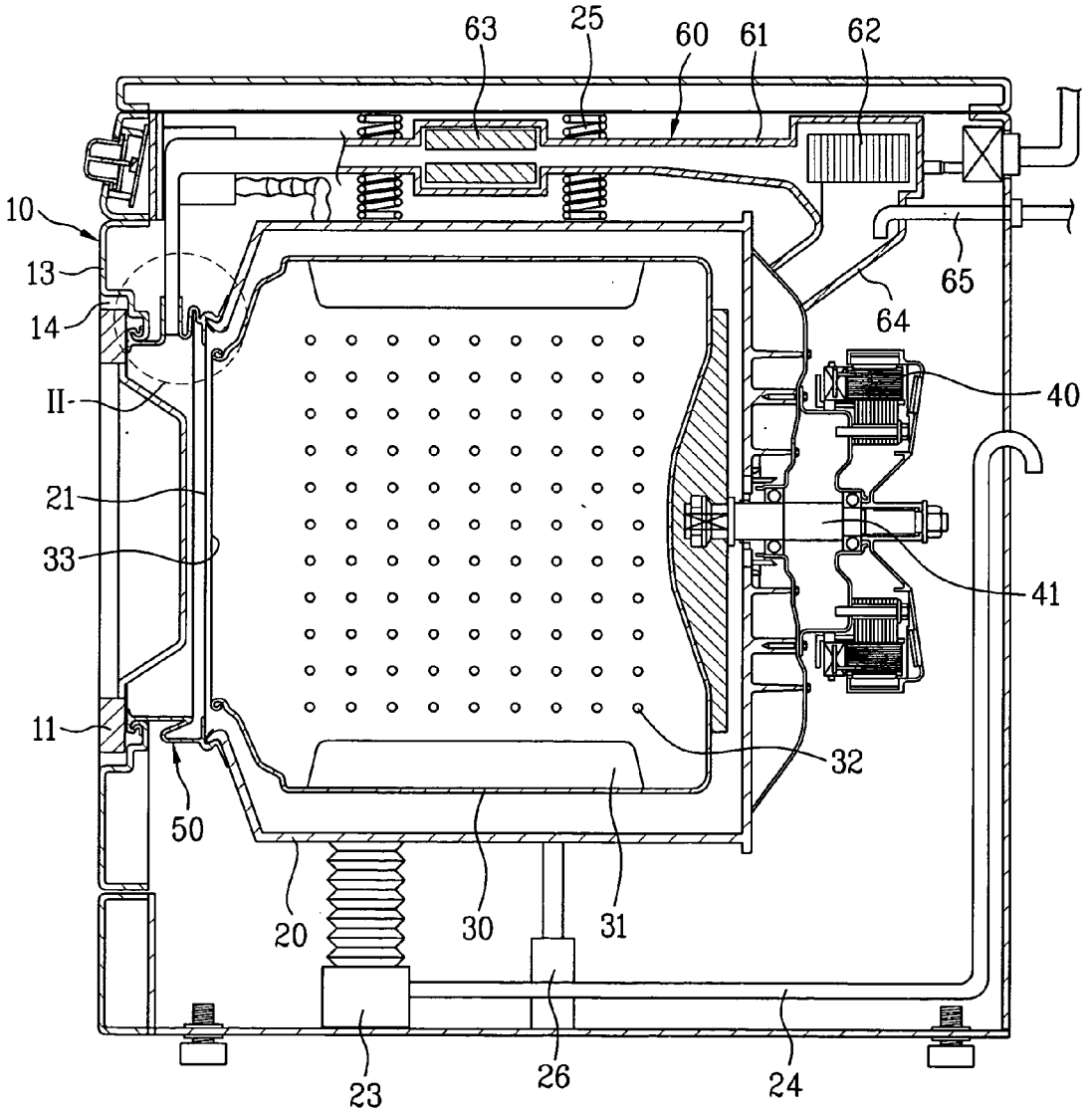


FIG. 2
Related Art

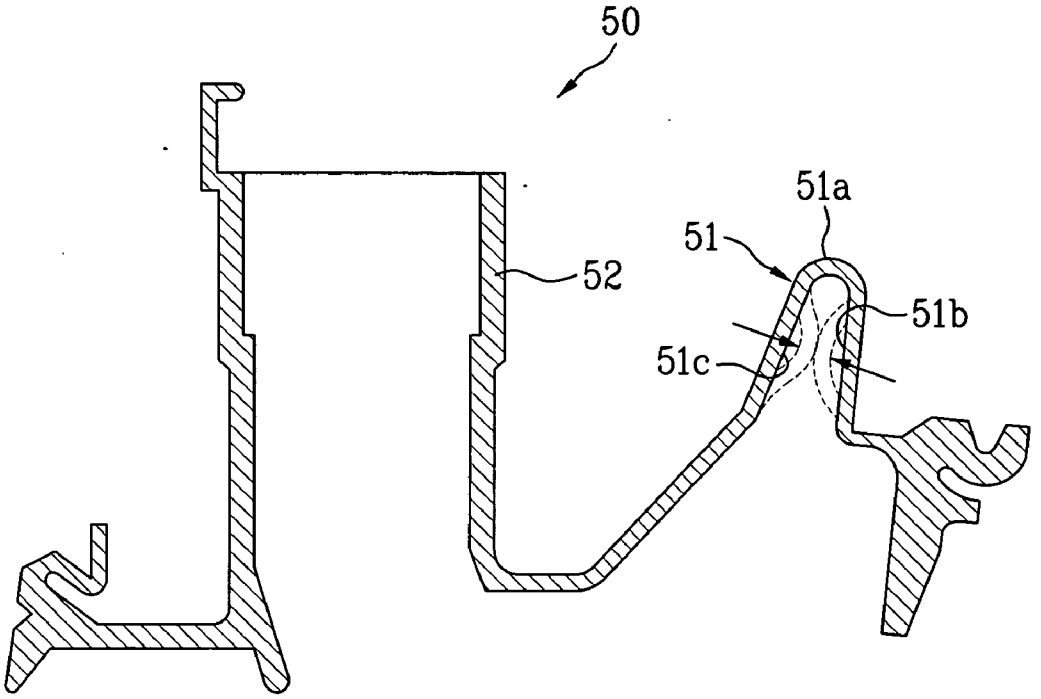


FIG. 3

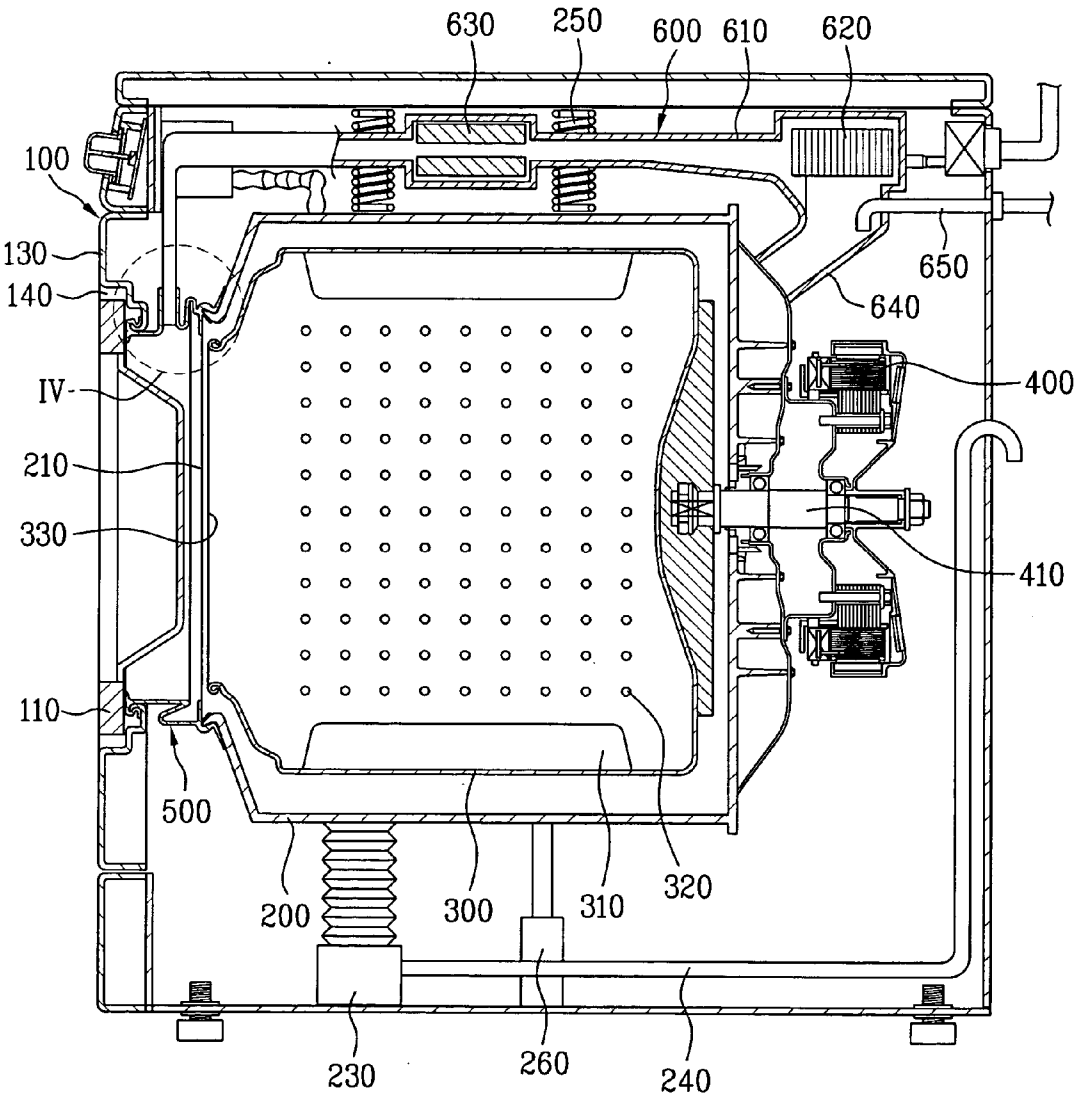

630
250
600
610
620
100
130
140
650
640
IV
400
210
330
410
110
500
200
300
310
320
230
260
240

FIG. 4

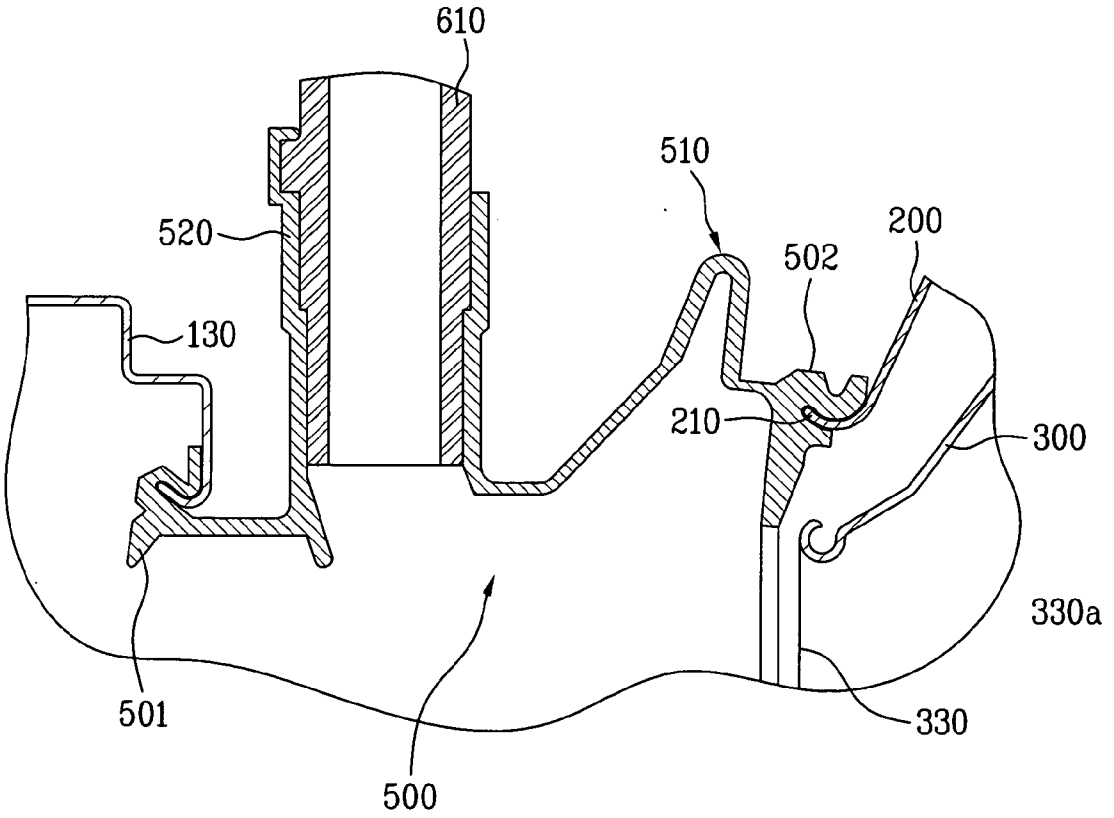


FIG. 5

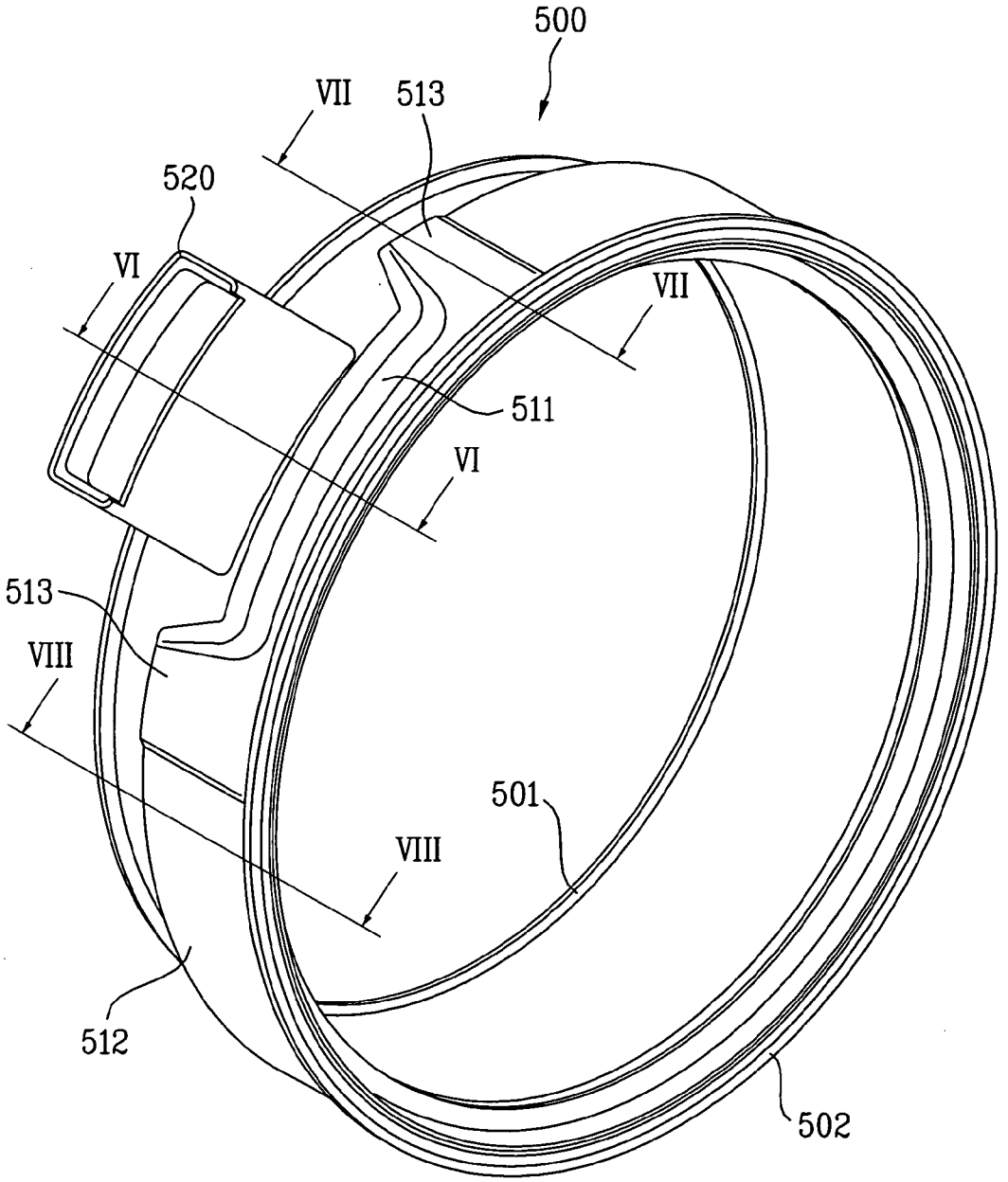


FIG. 6

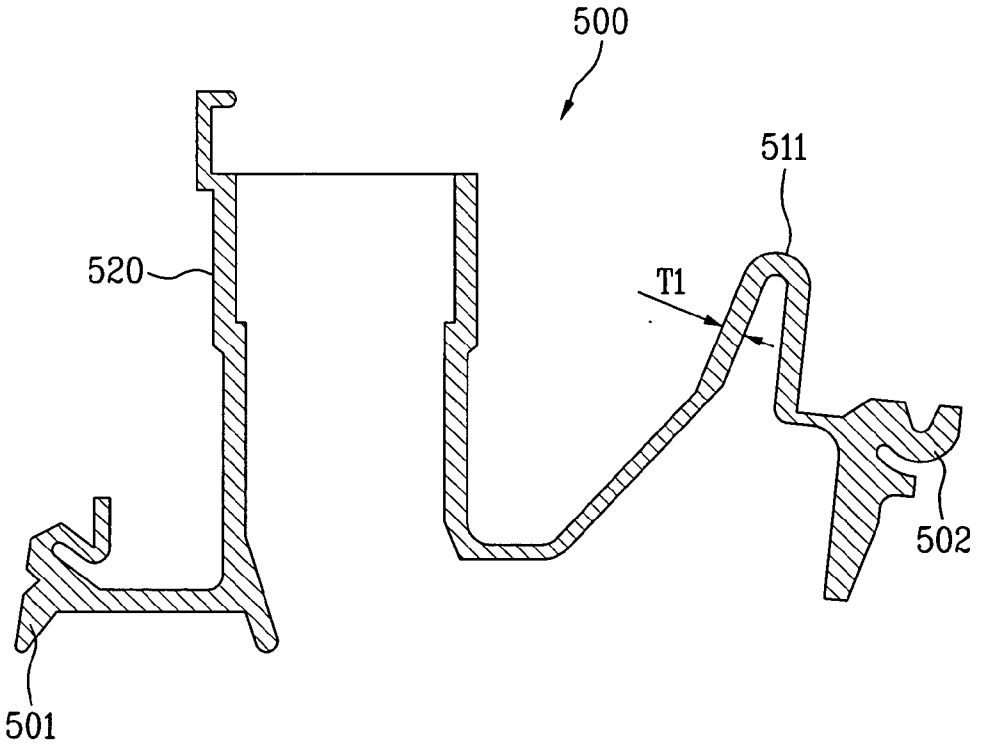


FIG. 7

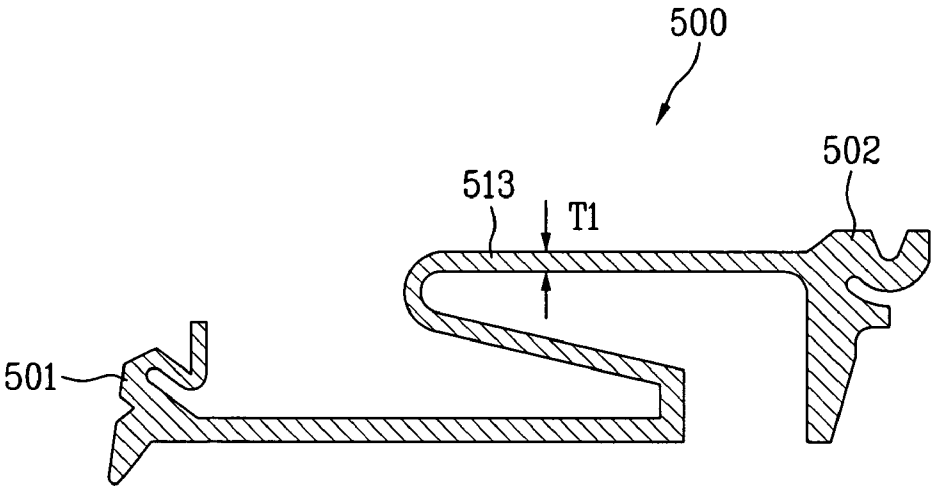
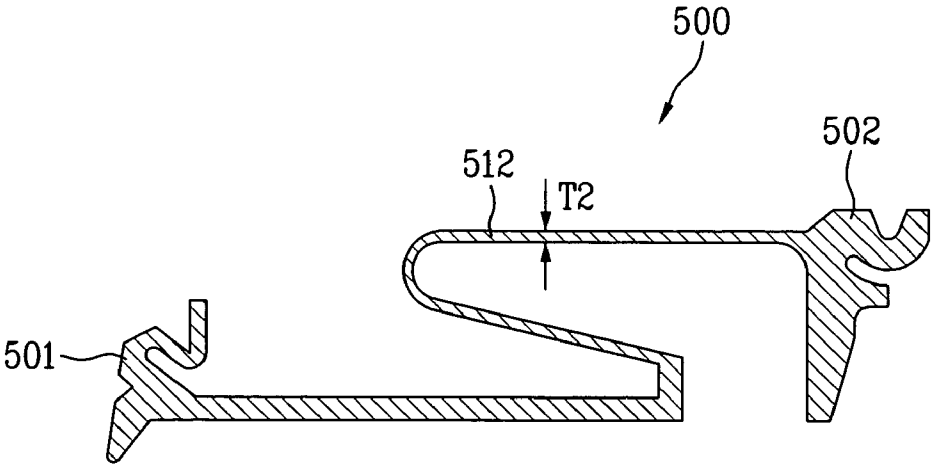


FIG. 8



GASKET AND DRUM-TYPE WASHING MACHINE HAVING THE SAME

[0001] This application claims the benefit of Korean Application No. P2004-009705 filed on Feb. 13, 2004, which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to drum-type washing machines, and more particularly, to a gasket for absorbing shocks generated from drum rotation while preventing water leakage from a tub, which employs two thicknesses respectively applied to predetermined portions of the gasket to prevent gasket deformation and damage, and to a washing machine having the same.

[0004] 2. Discussion of the Related Art

[0005] Generally speaking, a washing machine is an apparatus which uses detergent and an applied mechanical energy to remove dirt attached to laundry. A tub is provided to hold water and detergent, and laundry is placed in a drum for accommodating the laundry mixed with the water and detergent. The drum, which is installed within the tub, is rotated inside the tub by the drive force of a motor to perform washing, rinsing, and dewatering.

[0006] Meanwhile, drum-type washing machines, in which the drum and tub are disposed horizontally, tend to avoid damaging and raveling the laundry and consume less water while achieving a washing effect of beating and rubbing. A general drum-type washing machine is shown in **FIG. 1**.

[0007] Referring to **FIG. 1**, a cabinet **10** forms an exterior of the washing machine and has a forward opening **14**, formed in a front panel **13** of the cabinet, for loading and retrieving laundry via a door **11**. A tub **20**, suspended within the cabinet **10**, has an entrance **21** for communicating with the forward opening **14** of the front panel **13**. A drum **30**, rotatably installed within the tub and provided with a multitude of perforations **32** to let water pass from the tub to the drum, has a cylindrical shape with an entrance **33** at its front end to communicate with the tub entrance **21**. Thus, the forward opening **14**, tub entrance **21**, and drum entrance **33** compose a laundry opening through which laundry can be loaded into and retrieved from the drum **30**. To wash a load of laundry, washing water is supplied to the tub **20**, which is then drained using a drain pump **23** and drain hose **24** installed under the tub.

[0008] A rotating means **40**, such as an induction or BLDC motor for rotating the drum **30** and including a rotational shaft **41** centrally coupled to the rear of the drum, is installed behind the tub **20** and rotates the drum forward and reversely according to the motor's rotational direction. At least one lifter **31** is provided to an inner wall of the drum **30** to assist the washing action by repeatedly lifting the laundry to a predetermined height as the drum is rotated and then allowing the lifted laundry to fall from the predetermined height.

[0009] As the drum **30** rotates within the tub **20** under the drive force of the rotating means **40**, the drum and tub assembly vibrates. To attenuate the vibration, the tub **20** is supported by an elastic means, including a spring **25** disposed above the tub and a damper **26** disposed below the tub.

[0010] A gasket **50** having an essentially annular shape is provided between the cabinet **10** and the tub **20** for preventing water leakage while the door **11** is closed. To achieve leakage prevention, the gasket **50** includes a front rim coupled to the front panel **13** of the cabinet **10** and a rear rim coupled to the entrance **21** of the tub **20**, to thereby close the gap between the cabinet and tub. Meanwhile, when operating the drum-type washing machine, vibration appearing in the tub **20** may be transferred to the cabinet **10**, specifically, to the front panel **13**. Therefore, the gasket **50** also serves to compensate for movement in the tub **20** caused by the rotation of the drum **30** and to prevent a transfer of the resulting vibration. To achieve vibration prevention, the gasket **50** includes a shock absorber **51** having an annular shape corresponding to that of the gasket, in which a bent portion **51***a* is formed between the front and rear rims of the gasket by shaping an excess length of the gasket material into a U-shaped bend.

[0011] A contemporary drum-type washing machine is typically provided with a drying device **60** for drying the laundry after washing. The drying device **60** comprises a drying duct **61** and a condensation duct **64** and achieves drying using an air circulation mechanism, by which hot air is supplied via the drying duct to the interior of the tub **20**. A blower **62** and a heater **63**, for circulating heated air, are installed in the drying duct **61**. Moisture present in the circulating air is condensed by a condensing means **65** provided in the condensation duct **64**, one end of which communicates with the drying duct **61** and the other end of which communicates with the rear of the tub **20**. Therefore, a duct receptacle **52** for coupling with the drying duct **61** is provided at an upper part of the gasket **50**, typically forward of the shock absorber **51**, to receive one end of the drying duct so that the hot air of the drying duct is guided into the gasket under the force of the blower **62** to be supplied to the tub **20** and the drum **30**.

[0012] In a drum-type washing machine having the gasket **50** according to the related art, the coupling of the gasket **50** to the drying duct **61** causes one portion of the shock absorber **51** to receive a greater incidence of vibration than the remainder receives. That is, the portion of the shock absorber **51** adjacent the duct receptacle **52** is most directly affected by vibration transferred from the tub **20**, resulting in excessive deformation in the gasket material at or near the duct receptacle. Over time, the gasket **50** of the related art may become damaged and thereby lose its leakage prevention properties or may collapse and thereby lose its vibration prevention properties. Specifically, vibration transferred from the tub **20** to the gasket **50** via the drying duct **61** may cause friction to develop between inner walls **51***b* and **51***c* of the shock absorber **51**, whereby the gasket becomes damaged or broken down as indicated by dotted lines in **FIG. 2**.

SUMMARY OF THE INVENTION

[0013] Accordingly, the present invention is directed to a gasket and drum-type washing machine having the same that substantially obviate one or more of the problems due to limitations and disadvantages of the related art.

[0014] An object of the present invention, which has been devised to solve the foregoing problems, lies in providing a gasket for absorbing shocks generated from rotation of a drum while preventing water leakage from a tub, which prevents excessive deformation of and damage to the gasket.

[0015] Another object of the present invention is to provide a gasket for use in a drum-type washing machine, which retains its leakage prevention and vibration compensation properties over time.

[0016] A further object of the present invention is to provide a drum-type washing machine having the above gaskets.

[0017] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent to those having ordinary skill in the art upon examination of the following or may be learned from a practice of the invention. The objectives and other advantages of the invention will be realized and attained by the subject matter particularly pointed out in the specification and claims hereof as well as in the appended drawings.

[0018] To achieve these objects and other advantages in accordance with the present invention, as embodied and broadly described herein, a gasket coupled between a cabinet of a drum-type washing machine including a drying duct for providing a drying function and a tub disposed inside the cabinet, including a duct receptacle for receiving the drying duct, and a shock absorber having a bent shape for preventing a vibration appearing in the tub from being transferred to the cabinet, the shock absorber including a first portion that is adjacent the duct receptacle and has a first thickness and a second portion that is not adjacent the duct receptacle and has a second thickness, wherein the first thickness is greater than the second thickness. The first portion has an inner wall facing inward and an outer wall facing outward, and the second portion has an inner wall facing inward and an outer wall facing outward. The increased thickness of the first portion is achieved by augmenting the outer wall of the first portion only, without augmenting the inner wall of the shock absorber. Preferably, the first thickness is at least twice the second thickness.

[0019] The first portion extends over a predetermined distance of a circumference of the shock absorber, and the second portion includes a pair of margin portions respectively formed on the sides of the duct receptacle. Preferably, each margin portion has a thickness equal to the first thickness.

[0020] In another aspect of the present invention, a washing machine includes a cabinet having a front panel in which a forward opening is centrally formed for loading and retrieving laundry, the cabinet forming an exterior of the washing machine, a tub, disposed behind the front panel, having a tub entrance for communicating with the forward opening, a drum, rotatably installed within the tub, having a drum entrance disposed with respect to the tub entrance, and a drying device for drying laundry by supplying hot air to the tub. The drying device is disposed above the tub, so that the duct receptacle extends upwardly from the gasket.

[0021] It is to be understood that both the foregoing explanation and the following detailed description of the present invention are exemplary and illustrative and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiments of the invention and together with the description serve to explain the principle of the invention. In the drawings:

[0023] **FIG. 1** is a cross-sectional diagram of a general drum-type washing machine equipped with a drying function;

[0024] **FIG. 2** is an enlarged view of a section II in **FIG. 1**;

[0025] **FIG. 3** is a cross-sectional diagram of a drum-type washing machine having a gasket according to the present invention;

[0026] **FIG. 4** is an enlarged view of a section IV in **FIG. 3**;

[0027] **FIG. 5** is a perspective diagram of a gasket according to the present invention for use in a drum-type washing machine having a drying device;

[0028] **FIG. 6** is a cross-sectional view taken along line VI-VI of **FIG. 5**;

[0029] **FIG. 7** is a cross-sectional view taken along line VII-VII of **FIG. 5**; and

[0030] **FIG. 8** is a cross-sectional view taken along line VIII-VIII of **FIG. 5**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0031] Reference will now be made in detail to the preferred embodiment of the present invention, examples of which are illustrated in the accompanying drawings. Throughout the drawings, like elements are indicated using the same or similar reference designations where possible.

[0032] Referring to **FIG. 3**, a drum-type washing machine according to the present invention comprises a cabinet **100** forming an exterior of the washing machine and having a forward opening **140**, formed in a front panel **130** of the cabinet, for loading and retrieving laundry via a door **110**; a tub **200**, suspended within the cabinet **100**, having an entrance **210** for communicating with the forward opening of the front panel; and a drum **300**, rotatably installed within the tub and provided with a multitude of perforations **320** to let water pass from the tub to the drum, having a cylindrical shape with an entrance **330** at its front end to communicate with the tub entrance. A laundry opening, through which laundry can be loaded into and retrieved from the drum **300**, is thus formed by a combination of the forward opening **140**, tub entrance **210**, and drum entrance **330**. A drain pump **230** and a drain hose **240** are installed under the tub **200** for draining washing water supplied to the tub.

[0033] A rotating means **400**, such as an induction or BLDC motor for rotating the drum **300** and including a rotational shaft **410** centrally coupled to the rear of the drum, is installed behind the tub **200** and rotates the drum forward and reversely according to the motor's rotational direction. At least one lifter **310** is provided to an inner wall of the drum **300** to assist the washing action by repeatedly lifting the laundry to a predetermined height as the drum is rotated and then allowing the lifted laundry to fall from the predetermined height.

[0034] To attenuate vibration generated during operation of the drum-type washing machine, the tub **200** is supported by an elastic means, including a spring **250** disposed above the tub and a damper **260** disposed below the tub.

[0035] To perform a drying function, the drum-type washing machine according to the present invention further comprises a drying device **600** for drying the laundry after washing. The drying device **600** comprises a drying duct **610** and a condensation duct **640** and achieves drying using an air circulation mechanism, by which hot air is supplied via the drying duct to the interior of the tub **200**. A blower **620** and a heater **630**, for circulating heated air, are installed in the drying duct **610**. Moisture present in the circulating air is condensed by a condensing means **650** provided in the condensation duct **640**, one end of which communicates with the drying duct **610** and the other end of which communicates with the rear of the tub **200**.

[0036] According to the present invention, a drum-type washing machine as described above is provided with a gasket **500**, as shown in **FIG. 4**. The gasket, having an essentially annular shape, is provided between the cabinet **100** having a front panel **130** and the tub **200** installed behind the front panel, essentially connecting the entrance **210** of the tub to the front panel **130**. The gasket of the present invention prevents gasket damage, which may be caused by the vibration of the tub **200**, and is multipurpose.

[0037] To prevent water leakage, the gasket **500** has a front rim **501** coupled to the front panel **130** of the cabinet **100** and a rear rim **502** coupled to the entrance **210** of the tub **200**, thus closing the gap between the cabinet and tub. To prevent a transfer of vibration to the cabinet **100**, the gasket **500** includes a shock absorber **510** having an annular shape corresponding to that of the gasket, in which a bent portion **511** is formed between the front and rear rims **501** and **502** of the gasket by shaping a predetermined length of the gasket material into a U-shaped bend. The shock absorber **510** is preferably formed of a soft, pliable material to absorb vibration appearing in the tub **200**, by contracting, expanding, and twisting accordingly.

[0038] Meanwhile, a duct receptacle **520** for coupling with (or receiving) the drying duct **610** is provided at an upper part of the gasket **500**, preferably forward of the shock absorber **510**, to receive one end of the drying duct so that the hot air of the drying duct is guided into the gasket under the force of the blower **620** to be supplied to the tub **200** and the drum **300**. The coupling of the gasket **500** to the drying duct **610** causes an adjacent portion of the shock absorber **510** to receive a greater incidence of vibration than that received by the remainder of the shock absorber **510**.

[0039] Therefore, as shown in **FIG. 5**, the shock absorber **510** of the gasket of the present invention includes a duct-adjacent portion **511**, which extends over a predetermined distance of the circumference of the shock absorber, coinciding with the proximity of the duct receptacle **520**. The shock absorber **510** preferably protrudes outwardly from its annular shape and is typically directed forward along a duct-distant portion **512**, which includes a pair of margin portions **513** respectively formed on the sides of the duct receptacle. Meanwhile, along the duct-adjacent portion **511**, the shock absorber **510** is preferably directed upwardly or rearwardly, to be clear from the drying duct **610**, and is arranged to secure a sufficient space for the duct receptacle **520**.

[0040] In the operation of a contemporary drum-type washing machine having a drying function, the vibration appearing in the tub and present in the gasket tends to be greatest at or near the duct connection. Such vibration may lead to excessive deformation or collapse of the shock absorber, particularly along the length of the duct-adjacent portion. In the event of a collapse such that the inner walls of the shock absorber **510** come into contact with each other, excessive rubbing may occur, which over time would damage the gasket. Therefore, according to the present invention, the duct-adjacent portion **511** has a thickness greater than all other portions of the shock absorber **510**.

[0041] That is, as shown in FIGS. **6** to **8**, the shock absorber **510** preferably has a thickness T1 along the duct-adjacent portion **511**, which is at least two times a thickness T2 present at all other portions, namely, the duct-distant portion **512**, to reinforce rigidity of the duct-adjacent portion. The thickness T1 of the duct-adjacent portion **511** preferably extends to include the formation of a portion of the shock absorber **510** beyond the duct receptacle **520**, for example, the portion extending along the circumference of gasket **500** and coinciding with the margin portions **513**. The value of thickness T1 and the differential of thicknesses T1 and T2 can be individually adjusted according to design environment. Preferably, the increased thickness of the duct-adjacent portion **511** is achieved by augmenting its outer walls only, to maintain the interval between its inner walls.

[0042] 1Accordingly, the augmented thickness of the duct-adjacent portion **511** extends over the predetermined distance of the circumference of the shock absorber **510**. The original vibration preventing properties imparted by the shock absorber **510** are retained in the duct-distant portion **512**. Thus, the predetermined distance is based on the size of the duct receptacle **520**, and the augmented thickness of the duct-adjacent portion **511** may extend beyond the duct receptacle to provide a margin of benefit but should not unduly affect the vibration preventing properties of the shock absorber **510**.

[0043] By the above construction, the rigidity of the duct-adjacent portion **511** is reinforced by an augmented outer-wall thickness of a portion of the shock absorber **510**, to prevent excessive deformation of the shock absorber **510** adjacent the duct receptacle **520**, thereby minimizing a degradation in the vibration preventing properties of the gasket **500** and preventing inner-wall friction and the damage or collapse of the gasket. During washing and drying, the gasket **500** prevents water leakage and the transfer of vibration and prohibits laundry and foreign matter from entering or becoming lodged in the space tub **200** and drum **300**.

[0044] Therefore, by adopting the gasket according to the present invention, excessive gasket deformation due to tub vibration transferred through a drying duct is prevented by forming the shock absorber of the gasket to have an augmented thickness along a duct-adjacent portion, and augmenting the outer walls of the duct-adjacent portion guards against prevents friction between its inner walls. By preventing such friction, gasket damage is prevented. By preventing gasket damage and minimizing deformation, a gasket according to the present invention can prevent water leakage and maintain the gasket's vibration prevention capability in a drum-type washing machine adopting the gasket.

[0045] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover such modifications and variations, provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A gasket coupled between a cabinet of a drum-type washing machine including a drying duct for providing a drying function and a tub disposed inside the cabinet, the gasket comprising:

a duct receptacle for receiving the drying duct; and

a shock absorber having a bent shape for preventing a vibration appearing in the tub from being transferred to the cabinet, the shock absorber including a first portion that is adjacent the duct receptacle and has a first thickness and a second portion that is not adjacent the duct receptacle and has a second thickness,

wherein the first thickness is greater than the second thickness.

2. The gasket as claimed in claim 1, wherein the first portion has an inner wall facing inward and an outer wall facing outward and wherein the second portion has an inner wall facing inward and an outer wall facing outward, the increased thickness of the first portion being achieved by augmenting the outer wall of the first portion only.

3. The gasket as claimed in claim 1, wherein the first portion has an inner wall facing inward and an outer wall facing outward and wherein the second portion has an inner wall facing inward and an outer wall facing outward, the increased thickness of the first portion being achieved without augmenting the inner wall of the shock absorber.

4. The gasket as claimed in claim 1, wherein the first thickness is at least twice the second thickness.

5. The gasket as claimed in claim 1, further comprising a front rim for coupling the gasket to the cabinet, the cabinet including a front panel in which a forward opening is centrally formed, wherein the gasket is coupled to the cabinet at the forward opening.

6. The gasket as claimed in claim 5, wherein the duct receptacle is disposed between the cabinet and the shock absorber.

7. The gasket as claimed in claim 6, further comprising a rear rim for coupling the gasket to the tub, the tub being disposed behind the front panel and having a tub entrance for communicating with the forward opening, wherein the gasket is coupled to the tub at the tub entrance.

8. The gasket as claimed in claim 7, wherein the gasket closes a gap existing between the front panel and the tub and prevents water leakage during washing machine operation.

9. The gasket as claimed in claim 1, wherein the shock absorber is made of a pliant material.

10. The gasket as claimed in claim 9, wherein the shock absorber includes a bent portion formed in the gasket by shaping a predetermined length of the pliant material into a U-shaped bend.

11. The gasket as claimed in claim 1, wherein the shock absorber has an annular shape.

12. The gasket as claimed in claim 11, wherein the shock absorber protrudes outwardly from its annular shape.

13. The gasket as claimed in claim 12, wherein the shock absorber protrudes forward along the second portion.

14. The gasket as claimed in claim 12, wherein the shock absorber protrudes toward the tub along the first portion.

15. The gasket as claimed in claim 1, wherein the first portion extends over a predetermined distance of a circumference of the shock absorber.

16. The gasket as claimed in claim 1, wherein the second portion includes a pair of margin portions respectively formed on the sides of the duct receptacle.

17. The gasket as claimed in claim 16, wherein the pair of margin portions each have a thickness equal to the first thickness.

18. A washing machine comprising:

a cabinet having a front panel in which a forward opening is centrally formed for loading and retrieving laundry, the cabinet forming an exterior of the washing machine;

a tub, disposed behind the front panel, having a tub entrance for communicating with the forward opening;

a drying device for drying laundry by supplying hot air to the tub; and

a gasket coupled between the cabinet and the tub, the gasket comprising:

a duct receptacle connected to the drying duct; and

a shock absorber having a bent shape for preventing a vibration appearing in the tub from being transferred to the cabinet, the shock absorber including a first portion that is adjacent the duct receptacle and has a first thickness and a second portion that is not adjacent the duct receptacle and has a second thickness,

wherein the first thickness is greater than the second thickness.

19. The washing machine as claimed in claim 18, wherein the first portion has an inner wall facing inward and an outer wall facing outward and wherein the second portion has an inner wall facing inward and an outer wall facing outward, the increased thickness of the first portion being achieved by augmenting the outer wall of the first portion only.

20. The washing machine as claimed in claim 18, wherein the first thickness is at least twice the second thickness.

21. The washing machine as claimed in claim 18, wherein the duct receptacle is disposed between the cabinet and the shock absorber.

22. The washing machine as claimed in claim 18, further comprising a drum, rotatably installed within the tub, having a drum entrance disposed with respect to the tub entrance.

23. The washing machine as claimed in claim 18, the gasket further comprising a front rim for coupling the gasket to the cabinet, wherein the gasket is coupled to the cabinet at the forward opening.

24. The washing machine as claimed in claim 23, the gasket further comprising a rear rim for coupling the gasket

to the tub, wherein the gasket is coupled to the tub at the tub entrance.

25. The washing machine as claimed in claim 18, wherein the gasket closes a gap existing between the front panel and the tub and prevents water leakage during washing machine operation.

26. The washing machine as claimed in claim 18, wherein the drying device is disposed above the tub.

27. The washing machine as claimed in claim 26, wherein the duct receptacle extends upwardly from the gasket.

* * * * *