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(54) **SUSPENSION MEMBER AND LAUNDRY TREATMENT DEVICE**

(57) A suspension member and a laundry treatment device are provided. The suspension member includes a first suspension portion (1), a connecting portion (2), and a second suspension portion (3) arranged along a first direction; the first suspension portion is configured to suspend a first drum of a laundry treatment device, the second suspension portion is configured to suspend a second drum of the laundry treatment device, and the

connecting portion is connected to the first suspension portion and the second suspension portion; and a minimum length of the connecting portion in a second direction is less than a length of the first suspension portion in the second direction and/or less than a length of the second suspension portion in the second direction, and the first direction and the second direction are perpendicular to each other.

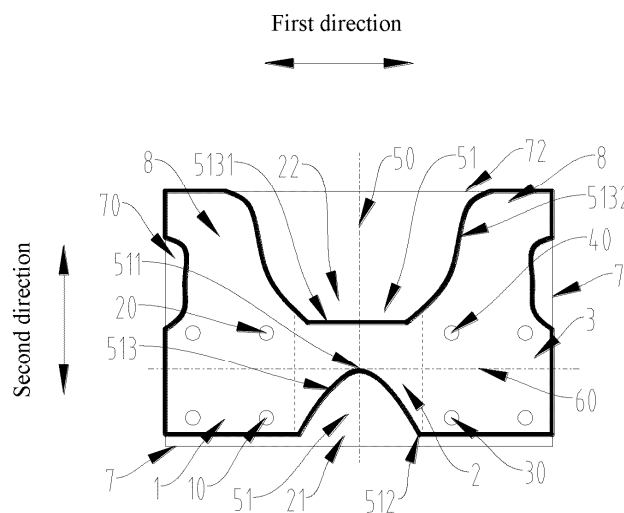


FIG. 2

## Description

### FIELD

[0001] The present invention relates to the field of laundry treatment devices, and more particularly to a suspension member and a laundry treatment device.

### BACKGROUND

[0002] In a related art, to meet users' needs for partitioned washing, some laundry treatment devices are equipped with double drums or more drums.

### SUMMARY

[0003] The purpose of the present invention is to provide a suspension member that may reduce or even avoid resonance between itself and a drum.

[0004] In order to achieve the above purpose, the present invention provides a suspension member. The suspension member includes a first suspension portion, a connecting portion, and a second suspension portion. The first suspension portion, the connecting portion, and the second suspension portion are arranged along a first direction. The first suspension portion is configured to suspend a first drum of a laundry treatment device, the second suspension portion is configured to suspend a second drum of the laundry treatment device, and the connecting portion is connected to the first suspension portion and the second suspension portion. A minimum length of the connecting portion in a second direction is less than a length of the first suspension portion in the second direction and/or less than a length of the second suspension portion in the second direction, in which the first direction and the second direction are perpendicular to each other.

[0005] Optionally, at least one vibration damping opening is formed at the connecting portion.

[0006] Optionally, the at least one vibration damping opening is formed only at the connecting portion.

[0007] Optionally, the at least one vibration damping opening extends across the first suspension portion, the connecting portion, and the second suspension portion.

[0008] Optionally, the connecting portion has a first centerline extending along the second direction, the first drum and the second drum are axisymmetrically arranged with respect to the first centerline, and each vibration damping opening itself is axisymmetrically arranged with respect to the first centerline.

Optionally, the first suspension portion has a first connection point and a second connection point arranged along a second direction, the first suspension portion is configured to be connected to the first drum through the first connection point and the second connection point, the second suspension portion has a third connection point and a fourth connection point arranged along the second direction, and the second suspension portion is

configured to be connected to the second drum through the third connection point and the fourth connection point; the first connection point and the second connection point are symmetrically arranged with respect to a second centerline, and the third connection point and the fourth connection point are symmetrically arranged with respect to the second centerline; and each vibration damping opening has an outer end and an inner end opposite to the outer end in the second direction, and the inner end is flush with or located at an outer side of the second centerline.

[0009] Optionally, the at least one vibration damping opening has a width in the first direction, and the width of the at least one vibration damping opening ranges from 240 mm to 250 mm.

[0010] Optionally, the connecting portion has a first side and a second side opposite to the first side in the second direction, and the at least one vibration damping opening is formed at the first side and/or the second side.

[0011] Optionally, the at least one vibration damping opening has a width in the first direction, and has an outer end and an inner end opposite to the outer end in the second direction; a width of the outer end of at least one of the at least one vibration damping opening is greater than a width of the inner end.

[0012] Optionally, a projection of the at least one vibration damping opening in an up-down direction has a contour line; the first direction, the second direction, and the up-down direction are mutually perpendicular; at least part of the contour line of at least one of the at least one vibration damping opening is configured as a curve.

[0013] Optionally, the contour line of the at least one of the at least one vibration damping opening is configured as a curve.

[0014] Optionally, the contour line configured as the curve is shaped as a crest or a trough of a sine wave.

[0015] Optionally, the contour line of at least one of the at least one vibration damping opening includes a first sub-contour line and a second sub-contour line, and two sides of the first sub-contour line in the first direction are each connected to the second sub-contour line; and the first sub-contour line is configured as a straight line, and the second sub-contour line is configured as a curve.

[0016] Optionally, at least one of the at least one vibration damping opening is configured as a rectangular opening.

[0017] Optionally, the vibration damping opening is formed at each of the first side and the second side; a projection of the vibration damping openings in an up-down direction has a contour line, and the first direction, the second direction, and the up-down direction are mutually perpendicular; and at least part of the contour line of the vibration damping opening at the first side is configured as a curve, and the vibration damping opening at the second side is configured as the rectangular opening.

[0018] Optionally, two vibration damping openings are formed at the first side and the second side respectively, a

minimum spacing between the two vibration damping openings in the second direction is a minimum length of the connecting portion, and the minimum length ranges from 160 mm to 180 mm.

**[0019]** Optionally, the at least one vibration damping opening has a depth in the second direction, and a maximum depth of the vibration damping opening at the first side ranges from 65 mm to 75 mm.

**[0020]** Optionally, the vibration damping opening on the second side has a depth in the second direction, and a maximum depth of the vibration damping opening at the second side ranges from 140 mm to 160 mm.

**[0021]** Optionally, the laundry treatment device includes a cabinet, each of the first suspension portion and the second suspension portion has a mounting portion, and each mounting portion is configured to be connected to at least one wall panel of the cabinet.

**[0022]** Optionally, the vibration damping opening is formed at the second side of the connecting portion, and the mounting portions are configured to enclose the vibration damping opening at the second side.

**[0023]** Optionally, the cabinet includes a side wall panel and a rear wall panel, and the mounting portion is configured to be connected to at least one of the side wall panel and the rear wall panel.

**[0024]** Optionally, the mounting portion encloses an avoidance opening together with the first suspension portion or the second suspension portion.

**[0025]** Optionally, the suspension member is configured to have a plate shape and has a width in the first direction, a width of the connecting portion ranges from 170 mm to 190 mm, and/or a width of the first suspension portion and a width of the second suspension portion each range from 170 mm to 190 mm.

**[0026]** Optionally, the suspension member is integrally formed.

Optionally, the first suspension portion has a first connection point and a second connection point arranged along a second direction, the first suspension portion is configured to be connected to the first drum through the first connection point and the second connection point, the second suspension portion has a third connection point and a fourth connection point arranged along the second direction, the second suspension portion is configured to be connected to the second drum through the third connection point and the fourth connection point, and the first direction and the second direction are perpendicular to each other; and a part of the suspension member located between the first connection point and the third connection point, and between the second connection point and the fourth connection point is configured as the connecting portion.

**[0027]** According to a second aspect of the present invention, a laundry treatment device is provided, which includes the suspension member as described above.

**[0028]** Optionally, the laundry treatment equipment includes a cabinet and a third drum, the suspension member is arranged at a top of the cabinet, and the first

drum and the second drum are located above the third drum.

**[0029]** Through the above technical solution, in the suspension member provided by the present invention, since the first suspension portion suspends the first drum and the second suspension portion suspends the second drum. That is, the suspension member suspends at least two drums. This causes the drum to easily resonate with the suspension member when rotating, such as during drying or washing operations. Moreover, since the connecting portion is arranged between the first drum and the second drum, the connecting portion is a part of the suspension member with a largest vibration amplitude when the suspension member oscillates up and down during resonance. The present invention configures the minimum length of the connecting portion to be less than the length of the first suspension portion. Compared to a scenario where the minimum length of the connecting portion is equal to the length of the first suspension portion, configuring the minimum length of the connecting portion to be less than the length of the first suspension portion may reduce an area of the connecting portion, and lower a stiffness of the connecting portion. Similarly, compared to a scenario where the minimum length of the connecting portion is equal to the length of the second suspension portion, configuring the minimum length of the connecting portion to be less than the length of the second suspension portion may reduce the area of the connecting portion and lower the stiffness of the connecting portion, thus reducing a natural frequency of the connecting portion. Consequently, the natural frequency of the connecting portion may be made far from vibration frequencies of the drums suspended on the suspension member, thereby reducing or even avoiding resonance between the connecting portion and the drums. That is, the suspension member of the present invention may reduce or even prevent itself from resonating with the drums.

**[0030]** Additionally, the present invention reduces the stiffness of the connecting portion to lower the natural frequency of the connecting portion. That is, a first-order natural frequency and a second-order natural frequency of the connecting portion are each lowered. This may allow the first-order natural frequency of the connecting portion to be far from the vibration frequency of the drum during low-speed rotation, thereby preventing the drum from resonating with the connecting portion during low-speed rotation.

**[0031]** Other features and advantages of the present invention will be explained in detail in the following specific embodiments section

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0032]** The drawings are intended to provide a further understanding of the present invention, form a part of the specification, and are used to explain the present invention together with the specific embodiments below, but do

not constitute a limitation of the present invention.

FIG. 1 is a front view of a laundry treatment device according to an embodiment of the present invention.

FIG. 2 is a top view of a laundry treatment device according to an embodiment of the present invention, showing a first embodiment of a suspension member.

FIG. 3 is a top view of a laundry treatment device according to an embodiment of the present invention, showing a second embodiment of a suspension member.

FIG. 4 is a top view of a laundry treatment device according to an embodiment of the present invention, showing a third embodiment of a suspension member.

FIG. 5 is a top view of a laundry treatment device according to an embodiment of the present invention, showing a fourth embodiment of a suspension member.

FIG. 6 is a top view of a laundry treatment device according to an embodiment of the present invention, showing a fifth embodiment of a suspension member.

FIG. 7 is a top view of a laundry treatment device according to an embodiment of the present invention, showing a sixth embodiment of a suspension member.

FIG. 8 is a top view of a laundry treatment device according to an embodiment of the present invention, showing a seventh embodiment of a suspension member.

FIG. 9 is a top view of a laundry treatment device in FIG. 8 with dimensions annotated.

## DETAILED DESCRIPTION

**[0033]** Specific embodiments of the present invention are described in detail below with reference to the drawings. It should be understood that the specific embodiments described herein are intended to illustrate and explain the present invention, but not to limit the present invention.

**[0034]** In the present invention, unless otherwise expressly defined, directional terms used, such as "up", "down", "front", "rear", "left", and "right", are defined based on a laundry treatment device. An up-down direction may refer to a gravity direction of the laundry treatment device or a gravity direction of a suspension member, a left-right direction may refer to a width direction of the laundry treatment device, and for a front-rear direction, the front may be understood as a side of the laundry treatment device facing a user, while the rear is a side of the laundry treatment device facing away from the user. A drum door of the laundry treatment device is usually arranged at the front side of the laundry treatment device. In addition, a first direction and a second direction may

refer to directions shown in FIGS. 1 to 9. When a suspension member of the present invention is applied to the laundry treatment device, the first direction may correspond to the left-right direction of the laundry treatment device, the second direction may correspond to the front-rear direction of the laundry treatment device, a first side may correspond to the front side of the laundry treatment device, and a second side may correspond to the rear side of the laundry treatment device. "Inner" and "outer" refer to inner and outer of a contour of each component. Terms such as "first" and "second" used are intended to distinguish one element from another and do not imply sequence or importance. In addition, in the following description, when referring to the drawings, the same references sign in different drawings indicates the same or similar element, which is not repeated in the present invention.

**[0035]** In some laundry treatment devices, the drums are suspended by a suspension member. When the suspension member suspends at least two drums, the drums are prone to resonate with the suspension member during operation.

**[0036]** According to some embodiments of the present invention, a suspension member is provided. As shown in FIGS. 1 to 9, the suspension member 100 includes a first suspension portion 1, a connecting portion 2, and a second suspension portion 3. The first suspension portion 1, the connecting portion 2, and the second suspension portion 3 are arranged along a first direction. The first suspension portion 1 is configured to suspend a first drum 4 of the laundry treatment device, and the second suspension portion 3 is configured to suspend a second drum 6 of the laundry treatment device. The connecting portion 2 connects the first suspension portion 1 and the second suspension portion 3. A minimum length of the connecting portion 2 in a second direction is less than a length of first suspension portion 1 in the second direction and/or less than a length of the second suspension portion 3 in the second direction. The first direction and the second direction are perpendicular to each other.

**[0037]** In the suspension member 100 provided by the present invention, since the first suspension portion 1 suspends the first drum 4 and the second suspension portion 3 suspends the second drum 6. That is, the suspension member 100 suspends at least two drums, which causes the drum to easily resonate with the suspension member 100 when rotating, such as during drying or washing operations. Moreover, since the connecting portion 2 is arranged between the first drum 4 and the second drum 6, the connecting portion 2 is a part of the suspension member 100 with a largest vibration amplitude when the suspension member 100 oscillates up and down during resonance.

**[0038]** Through the above technical solution, the present invention sets the minimum length of the connecting portion 2 to be less than the length of the first suspension portion 1. Compared to a scenario where the minimum length of the connecting portion 2 is equal to the length of

the first suspension portion 1, configuring the minimum length of the connecting portion 2 to be less than the length of the first suspension portion 1 may reduce an area of the connecting portion 2, and lower a stiffness of the connecting portion 2. Similarly, compared to a scenario where the minimum length of the connecting portion 2 is equal to the length of the second suspension portion 3, configuring the minimum length of the connecting portion 2 to be less than the length of the second suspension portion 3 may reduce the area of the connecting portion 2 and lower the stiffness of the connecting portion 2, thus reducing a natural frequency of the connecting portion 2. Consequently, the natural frequency of the connecting portion 2 may be far from vibration frequencies of the drums suspended by the suspension member, thereby reducing or even preventing resonance between the connecting portion 2 and the drums. That is, the suspension member 100 of the present invention may reduce or even prevent itself from resonating with the drums.

**[0039]** Additionally, the present invention reduces the stiffness of the connecting portion 2 to lower the natural frequency of the connecting portion 2. That is, a first-order natural frequency and a second-order natural frequency of the connecting portion 2 are both lowered. This may allow the first-order natural frequency of the connecting portion 2 to be far from the vibration frequency of the drum during low-speed rotation, thereby preventing the drum from resonating with the connecting portion 2 during low-speed rotation.

**[0040]** It should be noted that it is well known to those skilled in the art that reducing a stiffness of a component may lower a natural frequency of the component. That is, when the stiffness of the connecting portion 2 is reduced, the natural frequency of the connecting portion 2 will also decrease. The natural frequency may include a first-order frequency to an Nth-order frequency, and the higher the order, the higher the natural frequency. For example, the first-order natural frequency is lower than the second-order natural frequency. Furthermore, when the drum rotates at a low speed, and a rotation speed of the drum ranges from 400 RPM to 600 RPM, e.g., 500 RPM, the above configuration may effectively make the natural frequency of the connecting portion 2 away from the vibration frequency of the drum. That is, when the rotation speed of the drum ranges from 500 RPM to 700 RPM, the above configuration may effectively avoid resonance between the drum and the connecting portion 2 or even the suspension member 100.

**[0041]** It should also be noted that the above-mentioned drum refers to the drum suspended by the suspension member 100, which may be the first drum 4, and may also be the second drum 6.

**[0042]** In some embodiments, as shown in FIGS. 8 and 9, the minimum length of the connecting portion 2 may be L3, while the length of the first suspension portion 1 or the length of the second suspension portion 3 may be a sum of L1, L2, and L3, i.e.,  $L1 + L2 + L3$ .

**[0043]** In some embodiments of the present invention, as shown in FIGS. 2 to 9, the connecting portion 2 may form at least one vibration damping opening 51, and at least part of the vibration damping opening 51 is formed at the connecting portion 2. Here, by forming the at least part of the vibration damping opening 51 at the connecting portion 2, the minimum length of the connecting portion 2 may be made less than the length of the first suspension portion 1 or the length of the second suspension portion 3. Additionally, a solid structure of the connecting portion 2 corresponding to the vibration damping opening 51 may be removed from the connecting portion 2, thereby further reducing the area of the connecting portion 2 by altering a geometric shape of the connecting portion 2, so as to further lower the stiffness of the connecting portion 2. Removing the solid structure of the connecting portion 2 corresponding to the vibration damping opening 51 may prevent that the solid structure part from resonating with the drums. Thus, by reducing the stiffness of the connecting portion 2 and removing the solid structure of the connecting portion 2 corresponding to the vibration damping opening 51, resonance between the connecting portion 2 and the drums may be effectively reduced or even avoided. During low-speed rotation of the drums, this configuration may ensure that the first-order natural frequency of the connecting portion 2 is far from the vibration frequency of the drums when rotating at a low speed, thus enhancing the stability of the laundry treatment device during low-speed operation of the drum and reducing noise during operation of the laundry treatment device.

**[0044]** It should be noted that the vibration damping opening 51 in the present invention may be understood as a mouth-shaped structure with only one side open, that is, a circumference of the vibration damping opening 51 is unenclosed, i.e., a contour line 513 enclosing the vibration damping opening 51 does not form a closed loop.

**[0045]** It should also be noted that at least part of the vibration damping opening 51 being formed at the connecting portion 2 may be understood that in some embodiments, as shown in FIG. 5, the vibration damping opening 51 is formed only at the connecting portion 2. An advantage of this configuration is that by defining the entire vibration damping opening 51 at the connecting portion 2, the stiffness of the connecting portion 2 may be effectively reduced, thus further preventing the drum from resonating with the connecting portion 2 or even the suspension member 100 when the drum rotates at a low speed. When at least two vibration damping openings 51 are provided, at least one vibration damping opening 51 may be formed only at the connecting portion 2. In other embodiments, as shown in FIG. 2, a further vibration damping opening 51 extends across the first suspension portion 1, the connecting portion 2, and the second suspension portion 3. That is, partial vibration damping openings 51 are formed at the first suspension portion 1, the connecting portion 2, and the second

suspension portion 3 respectively. In this way, on one hand, the stiffness of the suspension member 100 may be further reduced, thereby further reducing the stiffness of the connecting portion 2. In other words, when the overall stiffness of the suspension member 100 is reduced, the stiffness of the connecting portion 2 will also decrease accordingly, which helps to make the first-order natural frequency of the connecting portion 2 away from the vibration frequency of the drum when rotating at a low speed. On the other hand, the vibration damping opening 51 configured in this way has a larger area, which is beneficial for avoiding other components of the laundry treatment device. Here, when at least two vibration damping openings 51 are provided, at least one vibration damping opening 51 may extend across the first suspension portion 1, the connecting portion 2, and the second suspension portion 3.

**[0046]** In some embodiments, as shown in FIGS. 2 to 4, 5, and 8, the connecting portion 2 has a first side 21 and a second side 22 opposite to the first side 21 in a second direction. The second direction is perpendicular to the first direction. The first side and the second side may be both provided with a vibration damping opening 51. In this way, the minimum length of the connecting portion 2 may be further reduced. The vibration damping opening 51 at the first side 21 may be formed only at the connecting portion 2, while the vibration damping opening 51 at the second side 22 may extend across the first suspension portion 1, the connecting portion 2, and the second suspension portion 3, which is not limited in the present invention.

**[0047]** It should be noted that when the suspension member 100 is applied to the laundry treatment device, the first side 21 may be the front side, and the second side 22 may be the rear side.

**[0048]** In some embodiments of the present invention, as shown in FIGS. 2 to 9, the connecting portion 2 has a first centerline 50 extending in the second direction. The first drum 4 and the second drum 6 may be arranged axisymmetrically with respect to the first centerline 50. The vibration damping opening 51 itself may also be arranged axisymmetrically with respect to the first centerline 50. In this way, through the symmetrical arrangement of the vibration damping opening 51 with respect to the first centerline 50, the stiffness of the connecting portion 2 may be symmetrically distributed with respect to the first centerline 50. In this way, when any drum rotates at low speeds, the above arrangement may reduce or even prevent resonance between the drum and the connecting portion 2.

**[0049]** In some embodiments of the present invention, as shown in FIGS. 2 to 8, the first suspension portion 1 has a first connection point 10 and a second connection point 20 arranged along the second direction. The first drum 4 may be connected to the first suspension portion 1 via the first connection point 10 and the second connection point 20, i.e., the first suspension portion 1 is configured to be connected to the first drum 4 through the first

connection point 10 and the second connection point 20. The second suspension portion 3 has a third connection point 30 and a fourth connection point 40 arranged along the second direction. The second drum 6 may be connected to the second suspension portion 3 via the third connection point 30 and the fourth connection point 40, i.e., the second suspension portion 3 is configured to be connected to the second drum 6 through the third connection point 30 and the fourth connection point 40. The first connection point 10 and the second connection point 20 may be symmetrically arranged with respect to a second centerline 60, and the third connection point 30 and the fourth connection point 40 may also be symmetrically arranged with respect to the second centerline 60.

**[0050]** The vibration damping opening 51 has an outer end 512 and an inner end 511 opposite to the outer end 512 in the second direction. The inner end 511 may be flush with the second centerline 60 or located outside of the second centerline 60. Here, the vibration damping opening 51 has a depth in the second direction, and the inner end 511 is located outside of the second centerline 60, which may be understood as that the second centerline 60 is positioned more inward than the inner end 511, and there is a solid part of the connecting portion 2 between the second centerline 60 and the inner end 511. In this way, this arrangement may prevent the depth of the vibration damping opening 51 from being excessive and causing the connecting portion 2 to break when the drum rotates. In other words, this arrangement may ensure both the reduction in the stiffness of the connecting portion 2 and the stability of the connecting portion 2.

**[0051]** In some embodiments of the present invention, as shown in FIGS. 2 to 9, the vibration damping opening 51 has a width in the first direction. The width of the vibration damping opening 51 may range from 240 mm to 250 mm, for example, it may be 245 mm. This may prevent a scenario where if the width of the vibration damping opening 51 is too small, the impact on the stiffness of the connecting portion 2 is limited; or if the width of the vibration damping opening 51 is too large, the stiffness of the connecting portion 2 is excessively reduced. That is, this arrangement may ensure both the reduction in the stiffness of the connecting portion 2 and the stability of the connecting portion 2. Here, as shown in FIGS. 8 and 9, when the first side 21 of the connecting portion 2 is provided with the vibration damping opening 51, the width of this vibration damping opening 51 at the first side 21 may be D1; and when the second side 22 of the connecting portion is provided with the vibration damping opening 51, the width of this vibration damping opening 51 at the second side 22 may be D2.

**[0052]** In some embodiments of the present invention, and as shown in FIGS. 2 to 8, the connecting portion 2 has a first side 21 and a second side 22 opposite to the first side 21 in the second direction. The first side 21 and/or the second side 22 is provided with the vibration damping opening 51. That is, at least one of the first side 21 and the second side 22 is provided with the vibration damping

opening 51. In some embodiments, the vibration damping opening 51 may be formed only at the first side 21 of the connecting portion 2. In other embodiments, the vibration damping opening 51 may be formed only at the second side 22 of the connecting portion 2.

**[0053]** In some embodiments, as shown in FIGS. 1 to 9, when the suspension member 100 is applied to the laundry treatment device, a front portion of the first suspension portion 1 may be connected with the first drum 4, and a front portion of the second suspension portion 3 may be connected with the second drum 6. The vibration damping opening 51 may be formed at the first side 21 of the connecting portion 2, i.e., the vibration damping opening 51 may be formed at a front side of the connecting portion 2. Since the drum is arranged at the front, a part of the connecting portion 2 at the first side 21 is prone to resonance with the drum. Therefore, by forming the vibration damping opening 51 on the first side 21 of the connecting portion 2, the probability of resonance between the drum and the connecting portion 2 during the low-speed rotation may be further reduced. Here, in some embodiments, when the vibration damping opening 51 may only be formed at the first side 21 of the connecting portion 2. This may ensure effective reduction of the stiffness of the connecting portion 2. Alternatively, the vibration damping openings 51 may be formed at both the first side 21 and the second side 22 of the connecting portion 2 respectively, which may further reduce the stiffness of the connecting portion 2, thereby lowering the natural frequency of the connecting portion 2. The above-mentioned configuration may appropriately reduce the stiffness of the connecting portion 2, and the stiffness of the connecting portion 2 is greater than or equal to a preset stiffness value to prevent the stiffness of the connecting portion 2 from being too low.

**[0054]** In some embodiments of the present invention, as shown in FIGS. 2 and 8, the vibration damping opening 51 has a width in the first direction, and has an outer end 512 and an inner end 511 arranged opposite to the outer end 512 in the second direction. A width of the outer end 512 of at least one vibration damping opening 51 is greater than a width of the inner end 511 thereof, so that the at least one vibration damping opening 51 has a design with a wider outer end and a narrower inner end. An advantage of this configuration is that since the outer end 512 is arranged relatively outward, designing the outer end 512 to be wider may, on the one hand, help reduce the stiffness of the connecting portion 2, and on the other hand, reduce the impact on the stability of the connecting portion 2. Since the inner end 511 is arranged inward, designing the inner end 511 to be narrower may ensure the stiffness of an inner side of the connecting portion 2 and improve the stability and reliability of the connecting portion 2.

**[0055]** In some embodiments of the present invention, as shown in FIGS. 2 and 8, a projection of the vibration damping opening 51 in an up-down direction has a contour line 513. The first direction, the second direction, and

the up-down direction are mutually perpendicular. At least part of at least one contour line 513 may be configured as a curve. In this way, the design of the curve may improve the smoothness of the vibration damping opening 51, thereby avoiding stress concentration at the vibration damping opening 51 in the connecting portion 2.

**[0056]** In some embodiments, as shown in FIGS. 2 and 8, the contour line 513 of at least one vibration damping opening 51 may be configured as a curve. That is, the entire contour line 513 of this vibration damping opening 51 may be configured as a curve. This may further improve the smoothness of the vibration damping opening 51. Here, in some embodiments, when the entire contour line 513 of the vibration damping opening 51 is configured as the curve, a width of the vibration damping opening 51 at the inner end 511 may be 0 mm.

**[0057]** In some embodiments, as shown in FIGS. 2 and 8, the contour line 513 configured as the curve may be shaped like a crest or a trough of a sine wave. That is, the width of the vibration damping opening 51 may gradually decrease from a predetermined width to zero. This configuration may effectively improve the smoothness of the vibration damping opening 51 and realize a uniform reduction of the stiffness of the connecting portion 2 at the vibration damping opening 51. Here, when this vibration damping opening 51 is formed at the first side 21 of the connecting portion 2, this vibration damping opening 51 may be shaped like the trough of the sine wave; and when this vibration damping opening 51 is formed at the second side 22 of the connecting portion 2, this vibration damping opening 51 may be shaped like the crest of the sine wave. It should be noted that the shapes of the crest and the trough of the sine wave are well known to those skilled in the art, which will not be repeated herein. In other embodiments, the contour line 513 configured as the curve may also be a semicircular contour line, which is not limited in the present invention.

**[0058]** In some embodiments, a part of at least one contour line 513 is configured as a curve. For example, as shown in FIGS. 2 and 8, the at least one contour line 513 includes a first sub-contour line 5131 and a second sub-contour line 5132, two sides of the first sub-contour line 5131 in the first direction are each connected with the second sub-contour lines 5132. The first sub-contour line 5131 may be configured as a straight line, and the second sub-contour line 5132 may be configured as a curve. In this way, the first sub-contour line 5131 may be arranged at the inner end 511, where the width of the inner end 511 is greater than zero and may be the predetermined width. Thus, the design of the first sub-contour line 5131 may reduce the manufacturing difficulty of the suspension member 100 and avoid the stress concentration at the vibration damping opening 51 in the connecting portion 2.

**[0059]** In some embodiments, as shown in FIGS. 3 to 7, at least one vibration damping opening 51 may be configured as a rectangular opening, and such a rectangular opening design may reduce the manufacturing difficulty of the suspension member 100.

**[0060]** In some embodiments, as shown in FIGS. 3, 4, and 6, the vibration damping openings 51 are formed at both the first side 21 and the second side 22 respectively. A projection of the vibration damping opening 51 in an up-down direction has a contour line 513. The first direction, the second direction, and the up-down direction are mutually perpendicular. The contour line 513 of the vibration damping opening 51 at the first side 21 is at least partially configured as a curve, and the vibration damping opening 51 at the second side 22 is configured as the rectangular opening. Here, the contour line 513 of the vibration damping opening 51 at the first side 21 may be shaped like a crest or a trough of a sine wave. As shown in FIG. 3, when the suspension member 100 is applied to the laundry treatment device, a front portion of the first suspension portion 1 and a front portion of the second suspension portion 3 each may form a avoidance notch 80.

**[0061]** In some embodiments, as shown in FIGS. 2 and 8, the first side 21 and the second side 22 each may form a vibration damping opening 51. A projection of the vibration damping opening 51 in an up-down direction has a contour line 513, where the first direction, the second direction, and the up-down direction are mutually perpendicular. The contour line 513 of the vibration damping opening 51 at the first side 21 is at least partially configured as a curve, and the vibration damping opening 51 at the second side 22 may include the first sub-contour line 5131 and the second sub-contour line 5132 described above. Here, the contour line 513 of the vibration damping opening 51 at the first side 21 may be shaped like a crest or a trough of a sine wave.

**[0062]** In some embodiments, as shown in FIG. 5, the first side 21 and the second side 22 each may form a vibration damping opening 51, and the vibration damping opening 51 at the first side 21 and the vibration damping opening 51 at the second side 22 may each be configured as a rectangular openings.

**[0063]** In some embodiments of the present invention, as shown in FIG. 7, the second side 22 may form a vibration damping opening 51, and the vibration damping opening 51 may be configured as the rectangular opening.

**[0064]** In some embodiments of the present invention, as shown in FIGS. 8 and 9, both the first side 21 and the second side 22 are provided with the vibration damping openings 51. A minimum spacing between the two vibration damping openings 51 in the second direction is the minimum length of the connecting portion 2, and this minimum length ranges from 160 mm to 180 mm, for example, 170 mm. This may prevent the connecting portion 2 from being prone to fracture if the minimum spacing (i.e., the minimum length) is too small, and avoid excessively high stiffness of the connecting portion 2 if the minimum spacing (i.e., the minimum length) is too large. Here, as shown in FIG. 9, the minimum spacing described above may be L3. Additionally, as shown in FIG. 9, the length of the first suspension portion 1 or the

length of the second suspension portion 3 may be a sum of L1, L2, and L3, i.e.,  $L1 + L2 + L3$ .

**[0065]** In some embodiments of the present invention, as shown in FIGS. 8 and 9, the vibration damping opening 51 has a depth in the second direction, and a maximum depth of the vibration damping opening 51 at the first side 21 may range from 65 mm to 75 mm, for example, be 70 mm. This may prevent the connecting portion 2 from being prone to fracture if the depth of the vibration damping opening 51 at the first side 21 is too large, and avoid excessively high stiffness of the connecting portion 2 if the depth of the vibration damping opening 51 at the first side 21 is too small. Here, as shown in FIG. 9, the maximum depth of the vibration damping opening 51 at the first side 21 may be L1.

**[0066]** In some embodiments of the present invention, as shown in FIGS. 8 and 9, the vibration damping opening 51 at the second side 22 has a depth in the second direction, and a maximum depth of the vibration damping opening 51 at the second side 22 may range from 140 mm to 160 mm, for example, be 150 mm. This may prevent the connecting portion 2 from being prone to fracture if the depth of the vibration damping opening 51 at the second side 22 is too large, and avoid excessively high stiffness of the connecting portion 2 if the depth of the vibration damping opening 51 at the second side 22 is too small. Here, as shown in FIG. 9, the maximum depth of the vibration damping opening 51 at the second side 22 may be L2.

**[0067]** In some embodiments of the present invention, as shown in FIGS. 8 and 9, the first suspension portion 1 and the second suspension portion 3 may have a width in the first direction, and the width of the first suspension portion 1 and the width of the second suspension portion 3 may each range from 160 mm to 180 mm, for example, be 170 mm. The connecting portion 2 may have a width in the first direction, and the width of the connecting portion 2 may range from 160 mm to 180 mm, for example, be 170 mm.

**[0068]** In some embodiments of the present invention, as shown in FIG. 2, the laundry treatment device may include a cabinet 7, and each of the first suspension portion 1 and the second suspension portion 3 may be provided with a mounting portion 8, and the mounting portion 8 may be connected to at least one wall panel of the cabinet 7. In this way, the connection between the mounting portion 8 and the at least one wall panel may effectively improve the connection strength between the suspension member 100 and the cabinet 7, thereby effectively increasing the stiffness of the suspension member 100. This may prevent resonance between the suspension member 100 and the drum when the drum rotates at a high speed. When the suspension member 100 is applied to the laundry treatment device, a rear portion of the first suspension portion 1 and a rear portion of the second suspension portion 3 each may be provided with the above-mentioned mounting portion 8.

**[0069]** It should be noted that by connecting the mount-

ing portion 8 to the at least one wall panel of the cabinet 7, the stiffness of the suspension member 100 may be improved, thereby increasing the natural frequency of the suspension member 100. When the stiffness of the suspension member 100 is increased, the natural frequency of the suspension member 100 will also increase. At the same time, both the first-order natural frequency and the second-order natural frequency of the suspension member 100 will increase. Here, when the drum rotates at a high speed, the vibration frequency of the drum is relatively high. At this time, since the second-order natural frequency of the suspension member 100 is increased, this configuration may avoid resonance between the drums and the suspension member 100 during high-speed rotation of the drum. In addition, since the stiffness of the connecting portion 2 is reduced, that is, the first-order natural frequency of the connecting portion 2 is relatively low, during low-speed rotation of the drum, when the suspension member 100 oscillates up and down in resonance, the connecting portion 2 is a part of the suspension member with a largest vibration amplitude. Therefore, by effectively reducing the first-order natural frequency of the connecting portion 2, the present invention may effectively avoid resonance between the drums and the connecting portion 2 during low-speed rotation of the drum. Thus, through the above configuration, the laundry treatment device of the present invention may reduce or even avoid resonance between the drums and the connecting portion 2 during low-speed rotation of the drum, and also reduce or even avoid resonance between the drums and the suspension member 100 during high-speed rotation of the drum, thereby effectively improving the reliability of the laundry treatment device and reducing the noise generated by the laundry treatment device.

**[0070]** In some embodiments, when the drum rotates at a high speed ranging from 800 RPM to 1200 RPM, the above design may effectively avoid resonance between the drums and the suspension member 100.

**[0071]** In some embodiments of the present invention, as shown in FIG. 2, the second side 22 of the connecting portion 2 may form the vibration damping opening 51. When the suspension member 100 is applied to the laundry treatment device, the second side 22 may be a front side of the connecting portion 2, that is, the front side of the connecting portion 2 may form the vibration damping opening 51, and the mounting portion 8 is configured to enclose the vibration damping opening 51 at the second side 22 or the front side of the connecting portion 2. This facilitates the formation of the vibration damping opening 51, and in this case, the vibration damping opening 51 may extend across the first suspension portion 1, the connecting portion 2, and the second suspension portion 3.

**[0072]** In some embodiments of the present invention, as shown in FIG. 2, the cabinet 7 includes a side wall panel 71 and a rear wall panel 72, and the mounting portion 8 may be connected to at least one of the side wall panel 71 and the rear wall panel 72, which may further

improve the stiffness of the suspension member 100, thereby increasing the natural frequency of the suspension member 100. In some embodiments, as shown in FIG. 2, the mounting portion 8 may be connected to the side wall panel 71 and the rear wall panel 72.

**[0073]** In some embodiments of the present invention, as shown in FIG. 2, the mounting portion 8 and the first suspension portion 1 or the second suspension portion 3 also enclose an avoidance opening 70. In this way, the avoidance opening 70 may be configured to avoid components inside the cabinet 7.

**[0074]** In some embodiments of the present invention, as shown in FIGS. 1 to 9, the first suspension portion 1 has a first connection point 10 and a second connection point 20 arranged along the second direction. The first drum 4 may be connected to the first suspension portion 1 via the first connection point 10 and the second connection point 20, i.e., the first suspension portion 1 is configured to be connected to the first drum 4 through the first connection point 10 and the second connection point 20. The second suspension portion 3 has a third connection point 30 and a fourth connection point 40 arranged along the second direction. The second drum 6 may be connected to the second suspension portion 3 via the third connection point 30 and the fourth connection point 40, i.e., the second suspension portion 3 is configured to be connected to the second drum 6 through the third connection point 30 and the fourth connection point 40.

**[0075]** A part of the suspension member 100 located between the first connection point 10 and the third connection point 30 and between the second connection point 20 and the fourth connection point 40 may be configured as the connecting portion 2. That is to say, a part of the suspension member 100 located at inner sides of the first connection point 10, the second connection point 20, the third connection point 30, and the fourth connection point 40 is configured as the connecting portion 2.

**[0076]** In some embodiments of the present invention, the suspension member 100 may be integrally formed. This may eliminate the need for connection between the connecting portion 2 and the first suspension portion 1 and the second suspension portion 3, reduces the number of components of the laundry treatment device, and facilitates assembly and maintenance of the laundry treatment device.

**[0077]** According to a second aspect of the present invention, a laundry treatment device is provided. The laundry treatment device includes the suspension member 100 as described above and has all the beneficial effects of the aforementioned suspension member 100, which will not be repeated herein.

**[0078]** In some embodiments of the present invention, as shown in FIG. 1, the laundry treatment device includes a cabinet 7 and a third drum 9. The suspension member 100 is arranged at a top of the cabinet 7, and the first drum 4 and the second drum 6 may be located above the third drum 9. In this way, the first drum 4 and the second drum 6

may be located at an upper left and an upper right of the third drum 9 respectively, so that the first drum 4, the second drum 6 and the third drum 9 may be configured to wash different types of laundry.

**[0079]** In some embodiments of the present invention, as shown in FIG. 1, the third drum 9 may have a larger volume than the first drum 4 and the second drum 6. In this way, the third drum 9 may be configured to wash larger or heavier laundry, while the first drum 4 and the second drum 6 may be configured to wash smaller or lighter laundry.

**[0080]** In some embodiments of the present invention, as shown in FIG. 1, the first suspension portion 1 may be connected to a side wall panel 71 on a left side of the cabinet 7, and the second suspension portion 3 may be connected to a side wall panel 71 on a right side of the cabinet 7.

**[0081]** Example embodiments of the present invention is described in detail above in conjunction with the drawings, however, the present invention is not limited to the specific details in the above embodiments, a variety of simple variants of the technical solution of the present invention may be made within the scope of the technical conception of the present invention, and these simple variants all fall within the protection scope of the present invention.

**[0082]** In addition, it should be noted that the specific technical features described in the specific embodiments, without contradiction, may be combined in any appropriate way, and in order to avoid unnecessary repetition, the various possible combinations are not separately stated in the present invention.

## Claims

1. A suspension member (100), comprising a first suspension portion (1), a connecting portion (2), and a second suspension portion (3) arranged along a first direction, wherein the first suspension portion (1) is configured to suspend a first drum (4) of a laundry treatment device, the second suspension portion (3) is configured to suspend a second drum (6) of the laundry treatment device, and the connecting portion (2) is connected to the first suspension portion (1) and the second suspension portion (3); and a minimum length of the connecting portion (2) in a second direction is less than a length of the first suspension portion (1) in the second direction and/or less than a length of the second suspension portion (3) in the second direction, wherein the first direction and the second direction are perpendicular to each other.
2. The suspension member (100) according to claim 1, wherein at least one vibration damping opening (51) is formed at the connecting portion (2).
3. The suspension member (100) according to claim 2,

wherein the at least one vibration damping opening (51) is formed only at the connecting portion (2).

4. The suspension member (100) according to claim 2, wherein the at least one vibration damping opening (51) extends across the first suspension portion (1), the connecting portion (2), and the second suspension portion (3).
5. The suspension member (100) according to claim 2, wherein the connecting portion (2) has a first centerline (50) extending along the second direction, the first drum (4) and the second drum (6) are axisymmetrically arranged with respect to the first centerline (50), and each vibration damping opening (51) itself is axisymmetrically arranged with respect to the first centerline (50).
6. The suspension member (100) according to claim 2, wherein the first suspension portion (1) has a first connection point (10) and a second connection point (20) arranged along the second direction, the first suspension portion (1) is configured to be connected to the first drum (4) through the first connection point and the second connection point, the second suspension portion (3) has a third connection point (30) and a fourth connection point (40) arranged along the second direction, and the second suspension portion (3) is configured to be connected to the second drum (6) through the third connection point and the fourth connection point;

the first connection point and the second connection point are symmetrically arranged with respect to a second centerline (60), and the third connection point and the fourth connection point are symmetrically arranged with respect to the second centerline (60); and each vibration damping opening (51) has an outer end (512) and an inner end (511) opposite to the outer end (512) in the second direction, and the inner end (511) is flush with or located at an outer side of the second centerline (60).

7. The suspension member (100) according to claim 2, wherein the at least one vibration damping opening (51) has a width in the first direction, and the width of the at least one vibration damping opening (51) ranges from 240 mm to 250 mm.
8. The suspension member (100) according to any one of claims 2 to 7, wherein the connecting portion (2) has a first side (21) and a second side (22) opposite to the first side in the second direction, and the at least one vibration damping opening (51) is formed at the first side and/or the second side; optionally, the at least one vibration damping opening (51) has a width in the first direction, and has an

outer end (512) and an inner end (511) opposite to the outer end in the second direction, wherein a width of the outer end of at least one of the at least one vibration damping opening (51) is greater than a width of the inner end.

9. The suspension member (100) according to claim 8, wherein a projection of the at least one vibration damping opening (51) in an up-down direction has a contour line (513), the first direction, the second direction and the up-down direction are mutually perpendicular, and at least part of the contour line (513) of at least one of the at least one vibration damping opening (51) is configured as a curve; optionally, the contour line (513) of at least one of the at least one vibration damping opening (51) comprises a first sub-contour line (5131) and a second sub-contour line (5132), and two sides of the first sub-contour line (5131) in the first direction are each connected to the second sub-contour line (5132), wherein the first sub-contour line (5131) is configured as a straight line, and the second sub-contour line (5132) is configured as a curve.
10. The suspension member (100) according to claim 8, wherein at least one of the at least one vibration damping opening (51) is configured as a rectangular opening; optionally, the vibration damping opening (51) is formed at each of the first side and the second side; a projection of the vibration damping opening (51) in an up-down direction has a contour line (513), wherein the first direction, the second direction, and the up-down direction are mutually perpendicular; and at least part of the contour line of the vibration damping opening (51) at the first side is configured as a curve, and the vibration damping opening (51) at the second side is configured as the rectangular opening.
11. The suspension member (100) according to claim 8, wherein two vibration damping openings (51) are formed at the first side and the second side respectively, a minimum spacing between the two vibration damping openings (51) in the second direction is a minimum length of the connecting portion (2), and the minimum length ranges from 160 mm to 180 mm; and/or
 

the at least one vibration damping opening (51) has a depth in the second direction, and a maximum depth (L1) of the vibration damping opening (51) at the first side ranges from 65 mm to 75 mm; and/or

the vibration damping opening (51) at the second side has a depth in the second direction, and a maximum depth (L2) of the vibration damping opening (51) at the second side ranges from 140

mm to 160 mm.

12. The suspension member (100) according to claim 8, wherein the laundry treatment device comprises a cabinet (7), each of the first suspension portion (1) and the second suspension portion (3) has a mounting portion (8), and each mounting portion is configured to be connected to at least one wall panel of the cabinet;
 

optionally, the vibration damping opening (51) is formed at the second side of the connecting portion (2), and the mounting portions are configured to enclose the vibration damping opening (51) at the second side;

optionally, the cabinet (7) comprises a side wall panel (71) and a rear wall panel (72), and the mounting portion is configured to be connected to at least one of the side wall panel and the rear wall panel;

optionally, the mounting portion encloses an avoidance opening (70) together with the first suspension portion (1) or the second suspension portion (3).
13. The suspension member (100) according to claim 1, wherein the suspension member (100) is configured to have a plate shape and has a width in the first direction, and a width of the connecting portion (2) ranges from 170 mm to 190 mm; and/or a width of the first suspension portion (1) and a width of the second suspension portion (3) each range from 170 mm to 190 mm; and/or
 

the first suspension portion (1) has a first connection point (10) and a second connection point (20) arranged along the second direction, the first suspension portion (1) is configured to be connected to the first drum (4) through the first connection point and the second connection point, the second suspension portion (3) has a third connection point (30) and a fourth connection point (40) arranged along the second direction, and the second suspension portion (3) is configured to be connected to the second drum (6) through the third connection point and the fourth connection point; and

a part of the suspension member (100) located between the first connection point (10) and the third connection point (30) and between the second connection point (20) and the fourth connection point (40) is configured as the connecting portion (2).
14. A laundry treatment device, comprising the suspension member (100) according to any one of claims 1 to 13.

15. The laundry treatment device according to claim 14, comprising a cabinet (7) and a third drum (9), wherein the suspension member (100) is arranged at a top of the cabinet (7), and the first drum (4) and the second drum (6) are located above the third drum (9). 5

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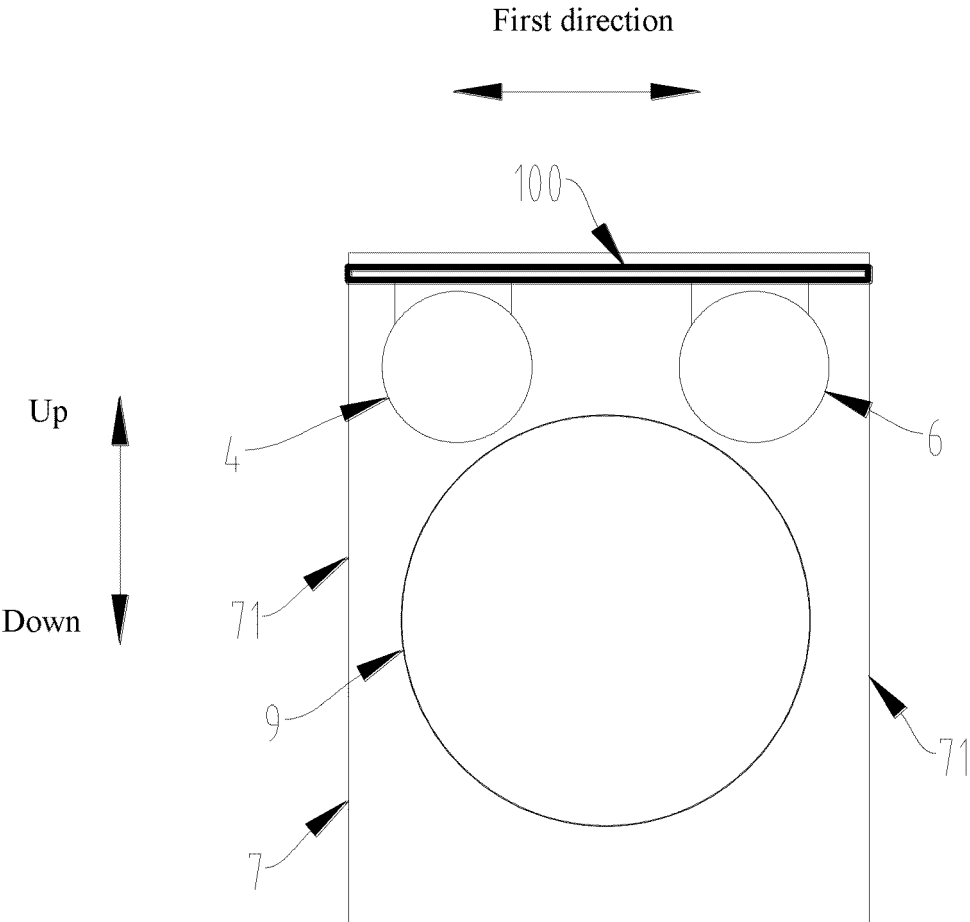


FIG. 1

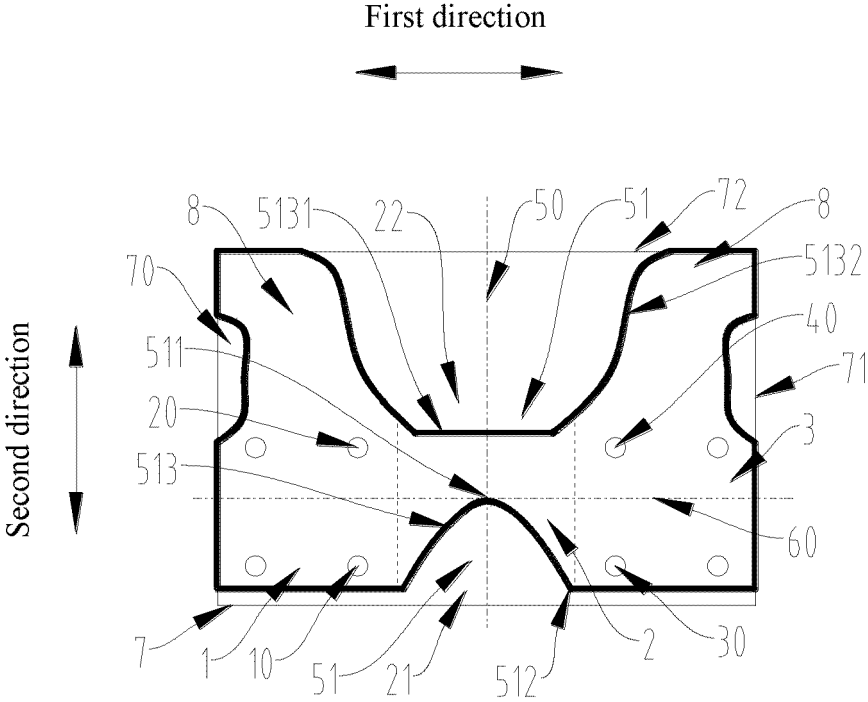
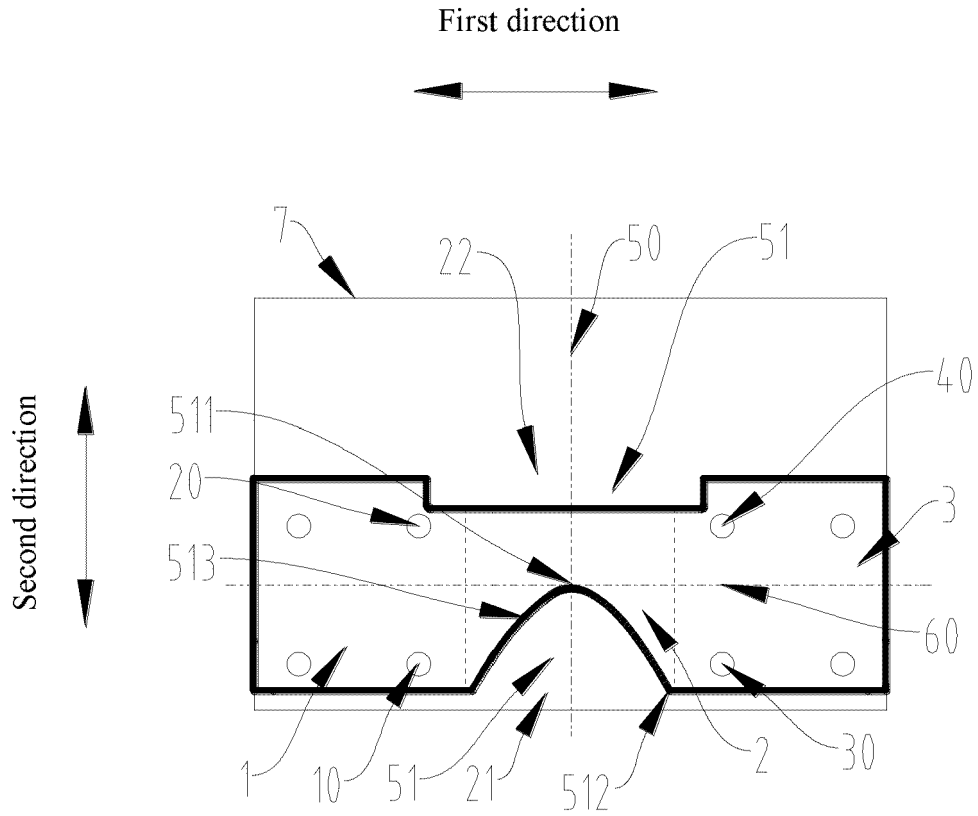
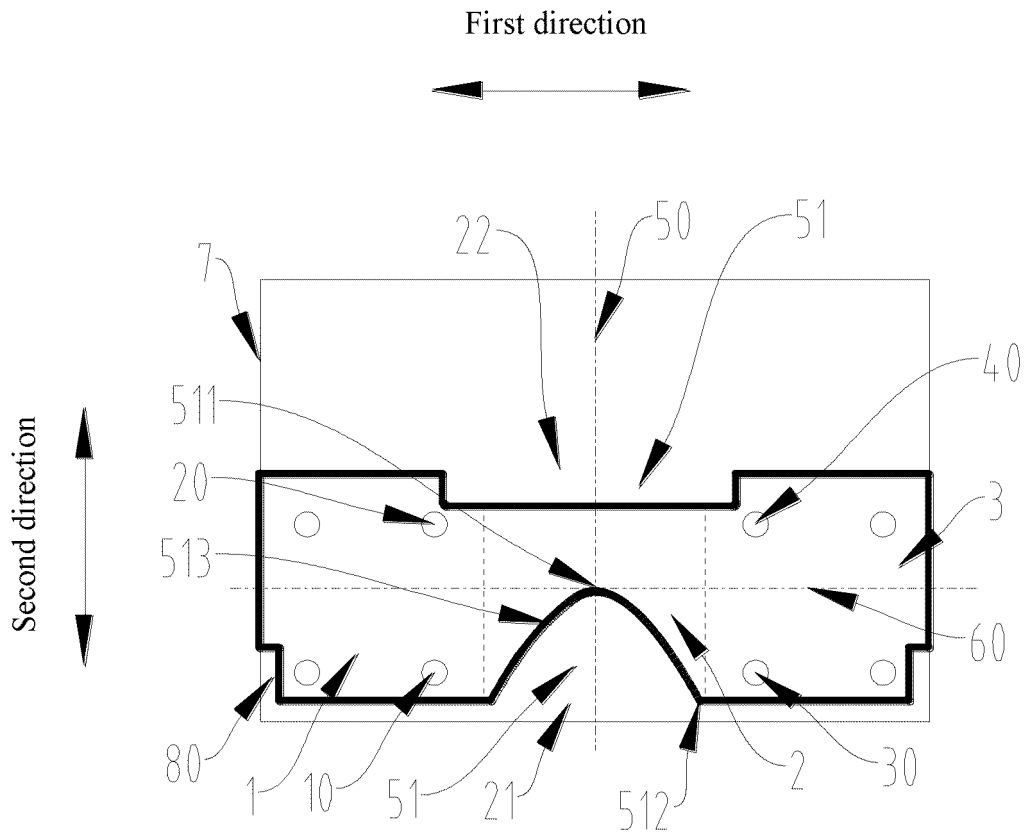


FIG. 2



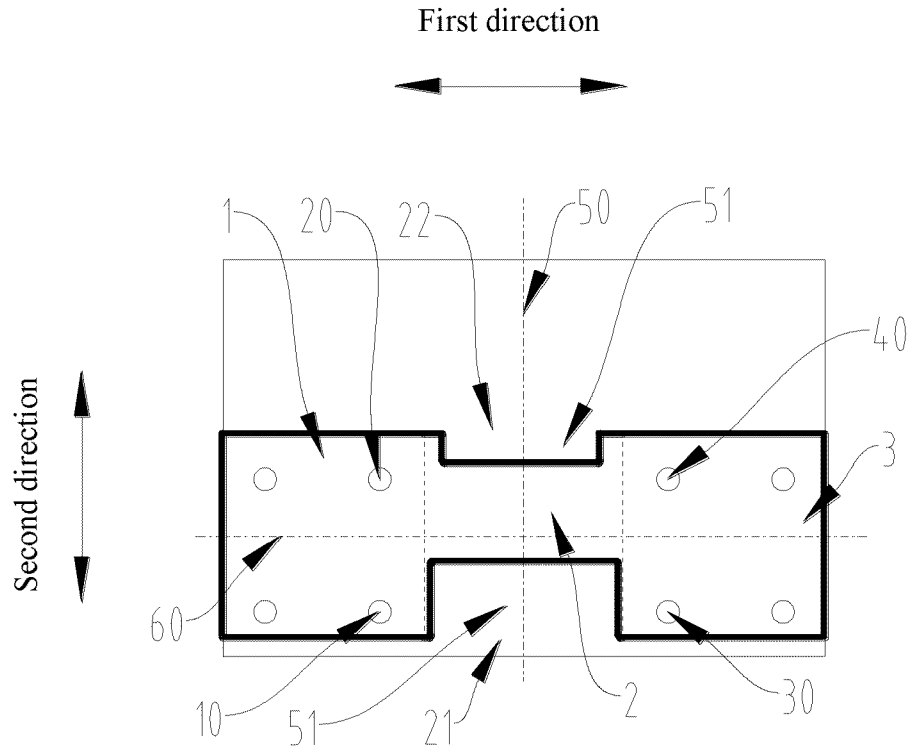


FIG. 5

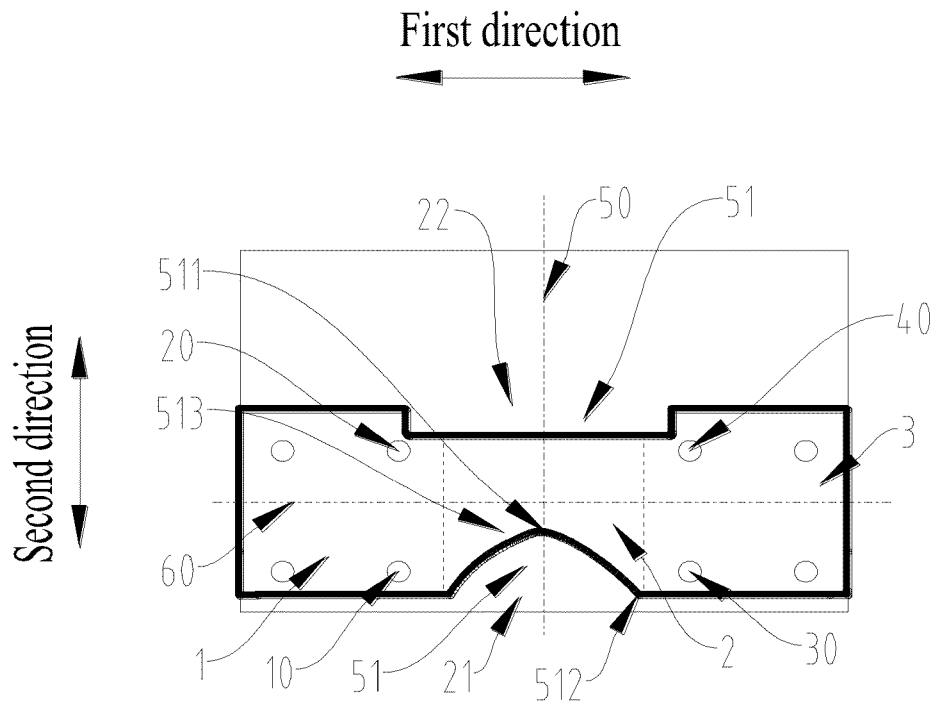


FIG. 6

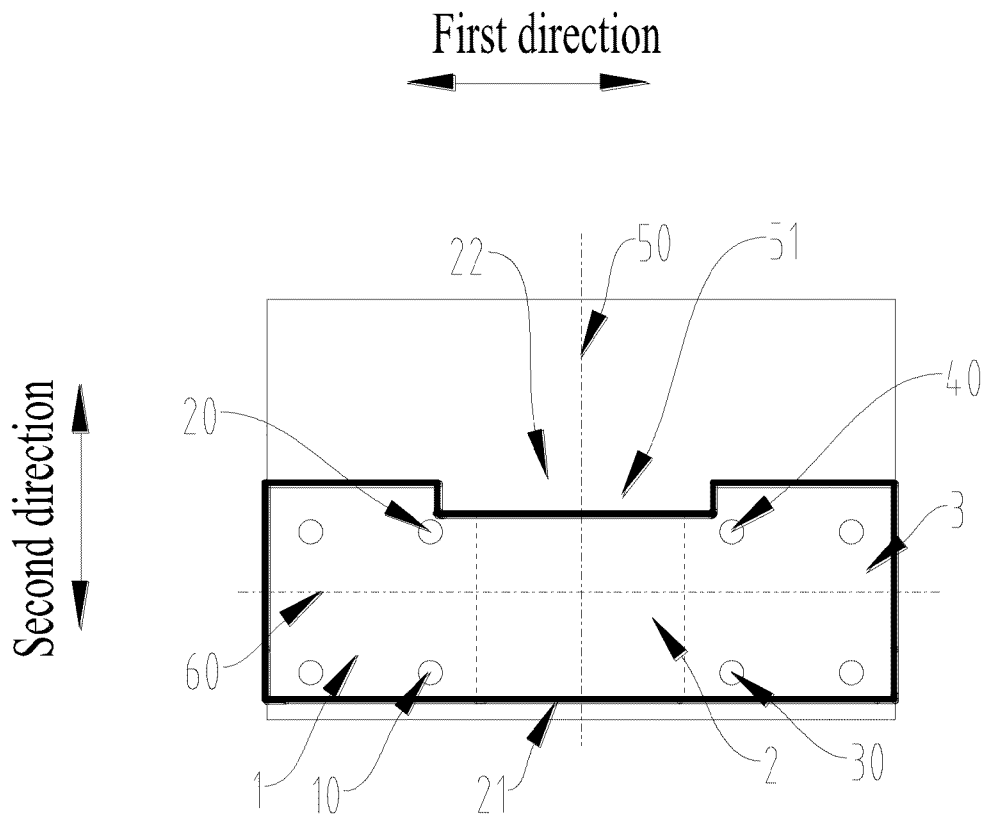


FIG. 7

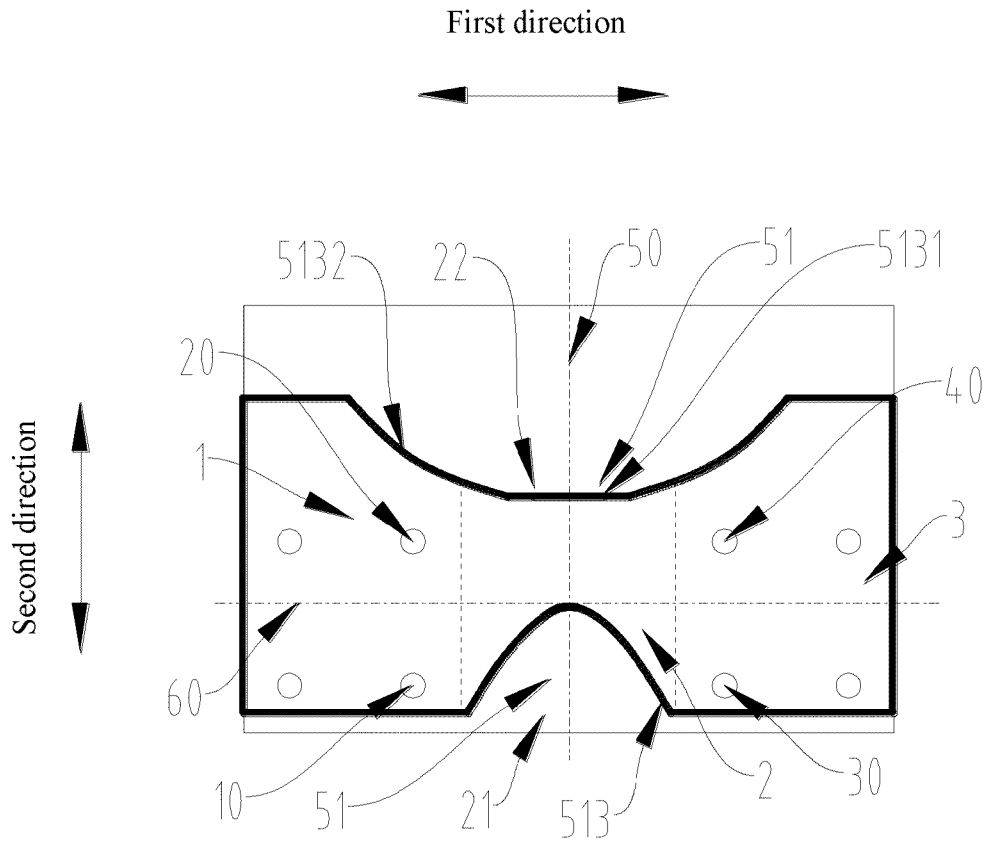


FIG. 8

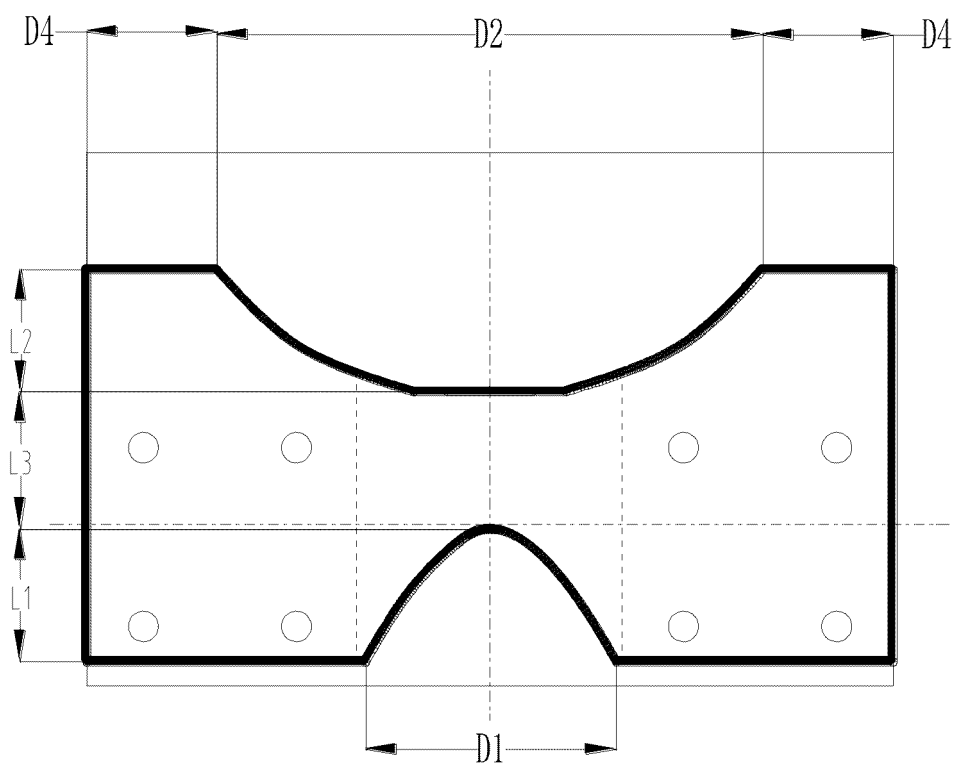


FIG. 9



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Application Number

EP 26 15 8286

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| Category                                                                                                                                                                                                                                                                     | Citation of document with indication, where appropriate, of relevant passages                                       | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (IPC) |
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| The present search report has been drawn up for all claims                                                                                                                                                                                                                   |                                                                                                                     |                                  |                                         |
| Place of search                                                                                                                                                                                                                                                              |                                                                                                                     | Date of completion of the search | Examiner                                |
| Munich                                                                                                                                                                                                                                                                       |                                                                                                                     | 30 June 2026                     | Stroppa, Giovanni                       |
| CATEGORY OF CITED DOCUMENTS                                                                                                                                                                                                                                                  |                                                                                                                     |                                  |                                         |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document                                                      |                                                                                                                     |                                  |                                         |
| T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                                     |                                  |                                         |

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