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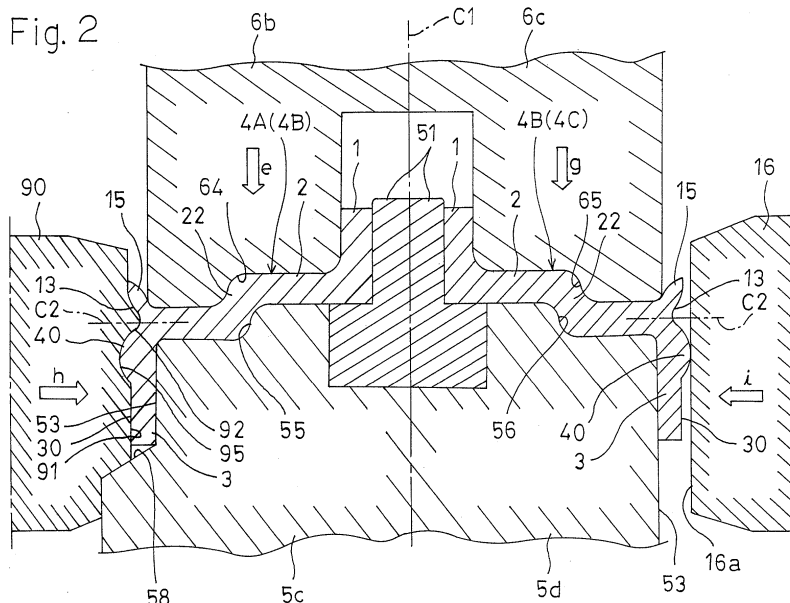
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(54) **METHOD OF MANUFACTURING SHEET METAL BACK FACE PULLEY**

(57) In the invention, a sheet metal-made cup-shaped material (4) comprising: a circular base plate portion (2); and a cylindrical portion (3) which extends from an outer peripheral edge portion of the base plate portion (2) in one direction along the axis of the base plate portion (2) is prepared, an annular expansion (40) that is radially outward expanded is formed in the cylindrical portion (3), and the annular expansion (40) and the cylindrical portion

(3) are clampingly pressed by a rotary lower mold (5) and a flat-face forming rolling roller (16) to a degree at which the annular expansion (40) disappears, whereby the outer circumferential face (30) of the cylindrical portion (3) is flatly formed. Therefore, the axial length (h4) of a sheet metal-made back face pulley (11) is increased, and the increased axial length (h4) can be used as the effective length.



Description

Technical Field

[0001] The present invention relates to a method of producing a back face pulley made of a sheet metal, and more particularly to a method of producing a sheet metal-made back face pulley in which the effective length of a cylindrical portion that is to be in contact with the back face of a belt to support the back face of the belt can be increased.

Background Art

[0002] Conventionally, a sheet metal-made back face pulley which causes a cylindrical portion to be in contact with the back face of a belt to function as, for example, a tensioner is known. The applicant of the present application has disclosed a production method in which the length of the cylindrical portion is increased (elongated) (Patent Literature 1).

[0003] In the production method in which the length of the cylindrical portion is increased (elongated), as shown in the left half of Fig. 8, a sheet metal-made cup-shaped material 4 comprising: a circular base plate portion 2 from which a boss portion 1 is projected; and a cylindrical portion 3 which extends from an outer peripheral portion of the base plate portion 2 in one direction along the axis C1 of the base plate portion 2 is prepared. A rotary lower mold 5 is fitted from a lower open-end portion of the cup-shaped material 4, and a shaft portion 51 of the mold is fitted into the boss portion 1. A downward expansion 21 which is formed in the base plate portion 2 is fitted into a recess 52 of the rotary lower mold 5, so that the cup-shaped material 4 is set to the rotary lower mold 5 so as to be radially immovable, and a rotary upper mold 6 is opposed to the upper side of the rotary lower mold 5 via the base plate portion 2.

[0004] Then, the rotary upper mold 6 is lowered as indicated by the arrow e in the right half of Fig. 8, and a downward expansion 61 of the mold is fitted to the upper face of the downward expansion 21 of the base plate portion 2, so that the base plate portion 2 of the cup-shaped material 4 is clampingly held by the upper end face of the rotary lower mold 5 and the lower end face of the rotary upper mold 6. Thereafter, at least one of the rotary lower mold 5 and the rotary upper mold 6 is rotated about the axis C1 to rotate the rotary lower mold 5, the rotary upper mold 6, and the cup-shaped material 4 about the axis C1. In this way, while rotating the cup-shaped material 4, a first roll-forming roller 7 is moved in the direction of the arrow f, and a portion corresponding to an approximately lower half of the cylindrical portion 3 is clampingly pressed by a pressing face 71 which protrudes radially outward, and the outer circumferential face 53 of the rotary lower mold 5. This causes the portion corresponding to the approximately lower half of the cylindrical portion 3, to be downward drawn as indicated

by the reference numeral 8 while the approximately lower half of the cylindrical portion 3 is thinned.

[0005] As shown in the left half of Fig. 9, next, the cup-shaped material 4 in which the portion 8 corresponding to the approximately lower half of the cylindrical portion 3 is downward drawn while being thinned is set to a rotary lower mold 5a so as to be radially immovable, and a rotary upper mold 6a is opposed to the upper side of the rotary lower mold 5a via the base plate portion 2. In this case, the rotary lower mold 5a which is slightly smaller in diameter than the rotary lower mold 5 used in Fig. 8 is used. Therefore, a small gap s is formed between the outer circumferential face 53a of the rotary lower mold 5a and the cylindrical portion 3. A cutaway 62 which allows ingress of an outer peripheral edge of an upper end portion of a second roll-forming roller that will be described later is formed in an outer peripheral edge portion of the rotary upper mold 6a. In the rotary lower mold 5a and rotary upper mold 6a which are shown in Fig. 9, portions corresponding to those of the rotary lower mold 5 and rotary upper mold 6 which are shown in Fig. 8 are denoted by the same reference numerals.

[0006] Then, the rotary upper mold 6a is lowered as indicated by the arrow g in the right half of Fig. 9, and a downward expansion 61 of the mold is fitted to the upper face of the downward expansion 21 of the base plate portion 2, so that the base plate portion 2 of the cup-shaped material 4 is clampingly held by the upper end face of the rotary lower mold 5a and the lower end face of the rotary upper mold 6a. Thereafter, at least one of the rotary lower mold 5a and the rotary upper mold 6a is rotated about the axis C1 to rotate the rotary lower mold 5a, the rotary upper mold 6a, and the cup-shaped material 4 about the axis C1. In this way, while rotating the cup-shaped material 4, a second roll-forming roller 9 is moved in the direction of the arrow h, and a thick portion 3a (see the left half of Fig. 9) corresponding to an approximately upper half of the cylindrical portion 3 is clampingly pressed by a pressing face 91 which is recessed radially inward, and the outer circumferential face 53a of the rotary lower mold 5a. This causes the thick portion 3a to be downward drawn as indicated by the reference numeral 10 in the right half of Fig. 9 while being thinned, with the result that the cylindrical portion 3 in which the outer circumferential face is flat can be produced.

[0007] Namely, by the cup-shaped material 4 in which the thickness t1 of the cylindrical portion 3 shown in Fig. 10 is large and the axial length h1 of the cylindrical portion 3 is small, the cylindrical portion 3 in which, as shown in Fig. 11, the thickness t2 is small and the axial length h2 is larger than the axial length h1 in Fig. 9 can be produced.

[0008] Patent Literature 1: WO98/05447

Disclosure of the Invention

Problems to be Solved by the Invention

[0009] However, the conventional method of enlarging a cylindrical portion merely provides a method of simply clampingly pressing a portion corresponding to an approximately lower half of the cylindrical portion 3 which extends in one direction along the axis C1 of the base plate portion 2, thereby downward extending the portion while being thinned. In a first step of downward extending while thinning, work hardening is caused in the portion which has been thinned and downward extended. In a second step, however, the thick portion 3a corresponding to the approximately upper half of the cylindrical portion 3 must be extended toward the portion where work hardening is caused in the first step, while being thinned. Therefore, molding in which the thick portion 3a is extended is relatively troublesome.

[0010] Furthermore, an effective length h_3 of the cylindrical portion 3 with which the back face of a belt can be in contact is limited to a value which is obtained by subtracting the axial length Δh of the upper-end curved portion 11b of the cylindrical portion 3 from the axial length h_2 of the cylindrical portion 3.

[0011] The invention solves these problems. It is an object of the invention to provide a method of producing a sheet metal-made back face pulley in which the effective length of a cylindrical portion that can be contacted with the back face of a belt can be increased, molding is easily conducted, and accurate flatness and dimensionality can be obtained by a reduced number of steps.

Means for Solving the Problems

[0012] The method of producing a sheet metal-made back face pulley according to the invention is characterized in that a sheet metal-made cup-shaped material comprising: a circular base plate portion; and a cylindrical portion which extends from an outer peripheral edge portion of the base plate portion in one direction along an axis of the base plate portion is prepared, an annular expansion is formed in the cylindrical portion, and the annular expansion is clampingly pressed by a rotary inner mold and a flat-face forming rolling roller to a degree at which at least the annular expansion disappears, whereby an outer circumferential face of the cylindrical portion is flatly formed.

Effects of the Invention

[0013] According to the production method, the annular expansion is clampingly pressed by the rotary inner mold and the flat-face forming rolling roller to a degree at which at least the annular expansion disappears, whereby the expanding volume amount of the annular expansion is converted into the extended distance by which the cylindrical portion is axially extended. There-

fore, the axial length of the sheet metal-made cup-shaped material is larger than the original length (original dimension) correspondingly with the expanding volume amount, and it is possible to provide a sheet metal-made back face pulley in which the increased axial length can be used as the effective length.

[0014] Furthermore, since the annular expansion is clampingly pressed by the rotary inner mold and the flat-face forming rolling roller to a degree at which the annular expansion disappears, to flatten the outer circumferential face of the cylindrical portion, molding can be conducted by a clamping press force which is smaller as compared with the case where the whole outer circumferential face of the cylindrical portion is clampingly pressed to be flatly formed. Therefore, molding is facilitated, and accurate flatness and dimensionality can be obtained by a reduced number of steps.

[0015] Moreover, the cylindrical portion is not work-hardened or is low in degree of work hardening. Therefore, the conversion of the expanding volume amount of the annular expansion into the axial extended distance of the cylindrical portion is smoothly performed, and the production efficiency can be enhanced.

[0016] Since the whole of the increased axial length can be used as the effective length, for example, it is possible to attain an effect that a small positional displacement in the width direction of a belt is absorbed, and a stable contact state with the back face of the belt can be maintained.

[0017] In the production method of the invention, preferably, the annular expansion is formed by expansion in a radially outward direction of the cylindrical portion.

[0018] When the annular expansion is formed by expansion in a radially outward direction of the cylindrical portion in this way, only the annular expansion can be pressed by the flat-face forming rolling roller, and the annular expansion can be efficiently extended for a short time period to disappear.

[0019] In the production method of the invention, preferably, an upper end portion of the cylindrical portion is pressed by a groove-forming protrusion disposed in a roll-forming roller, to form an annular groove in the upper end portion of the cylindrical portion, and an annular projection that projects in a direction opposite to a direction along which the cylindrical portion extends is formed above the annular groove.

[0020] When an upper end portion of the cylindrical portion is pressed by the groove-forming protrusion disposed in the roll-forming roller, to form the annular groove as described above, the annular projection that projects in the direction opposite to the direction along which the cylindrical portion extends is formed in the cylindrical portion. Therefore, the axial length of the sheet metal-made cup-shaped material can be further increased correspondingly with the projection distance of the annular projection.

Brief Description of the Drawings

[0021]

[Fig. 1] Fig. 1 is a longitudinal sectional view showing a step of forming a small valley-shaped groove in a sheet metal-made cup-shaped material which is applied to an embodiment of the invention.

[Fig. 2] Fig. 2 is a longitudinal sectional view showing a step of forming an annular expansion in a cylindrical portion of the sheet metal-made cup-shaped material which is worked in Fig. 1.

[Fig. 3] Fig. 3 is a half-cutaway longitudinal sectional view showing a step of flattening the outer circumferential face of the cylindrical portion of the sheet metal-made cup-shaped material which is worked in Fig. 2.

[Fig. 4] Fig. 4 is a longitudinal sectional view showing an example of the sheet metal-made cup-shaped material which is applied to the embodiment of the invention.

[Fig. 5] Fig. 5 is a longitudinal sectional view showing a sheet metal-made back face pulley which is produced by the sheet metal-made cup-shaped material of Fig. 4.

[Fig. 6] Fig. 6 is a longitudinal sectional view showing another example of the sheet metal-made cup-shaped material.

[Fig. 7] Fig. 7 is a longitudinal sectional view showing a sheet metal-made back face pulley which is produced by the sheet metal-made cup-shaped material of Fig. 6.

[Fig. 8] Fig. 8 is a longitudinal sectional view showing a first working stage of extending a cylindrical portion of a conventional sheet metal-made cup-shaped material.

[Fig. 9] Fig. 9 is a longitudinal sectional view showing a second working stage of further extending the cylindrical portion of the conventional sheet metal-made cup-shaped material which is worked in Fig. 8.

[Fig. 10] Fig. 10 is a longitudinal sectional view of a sheet metal-made cup-shaped material which is used in a conventional production method.

[Fig. 11] Fig. 11 is a longitudinal sectional view showing a state where a cylindrical portion of the sheet metal-made cup-shaped material of Fig. 10 is extended in one direction.

Description of Reference Numerals

[0022]

- 2 circular base plate portion
- 3 cylindrical portion
- 4 sheet metal-made cup-shaped material
- 15 projection
- 15a outer circumferential face of projection 15
- 40 expansion

Best Mode for Carrying Out the Invention

[0023] Hereinafter, a preferred embodiment of the method of producing a sheet metal-made back face pulley according to the invention will be described with reference to the drawings. In the embodiment, the components which are identical with those of the conventional example that has been described with reference to Fig. 8, Fig. 9, Fig. 10, and Fig. 11 will be described by denoting them with same reference numerals.

As shown in the left half of Fig. 1 and Fig. 4, the embodiment uses the cup-shaped material 4 comprising: the circular base plate portion 2 from which the boss portion 1 where the axis C1 is set as the center axis is projected; and the cylindrical portion 3 which extends from an outer peripheral portion of the base plate portion 2 in one direction along the axis C1 of the base plate portion 2 is used. In the circular base plate portion 2, a higher portion on the side of the boss portion 1 is continuous to a lower portion on the side of the cylindrical portion 3 via an annular stepped portion 22.

[0024] As shown in the left half of Fig. 1, the cup-shaped material 4 is fitted from the lower open end portion of the material onto a rotary lower mold 5b, the boss portion 1 of the cup-shaped material 4 is fitted onto a shaft 51 of the rotary lower mold 5b, and an annular stepped face 54 of the rotary lower mold 5b is fitted to the inner face of the annular stepped portion 22 disposed in the base plate portion 2, so that the cup-shaped material 4 is set to the rotary lower mold 5b so as to be radially immovable. Thereafter, the rotary upper mold 6a is opposed to the upper side of the rotary lower mold 5b via the base plate portion 2.

[0025] Then, the rotary upper mold 6a is lowered as indicated by the arrow e in the right half of Fig. 1, and the annular stepped portion 22 of the base plate portion 2 is fitted to an annular stepped face 63 formed in the lower end of the rotary upper mold 6a, so that the base plate portion 2 of the cup-shaped material 4 is clampingly held by the upper end face of the rotary lower mold 5b and the lower end face of the rotary upper mold 6a. Thereafter, at least one of the rotary lower mold 5b and the rotary upper mold 6a is rotated about the axis C1 to rotate the rotary lower mold 5b, the rotary upper mold 6a, and the cup-shaped material 4 about the axis C1.

[0026] While rotating the cup-shaped material 4 in this way, a first roll-forming roller 70 is moved in the direction of the arrow f, so that a first groove-forming protrusion 72 having a mountain-like section shape which is protruded radially outward in the vicinity of an upper end portion of the first roll-forming roller 70 is pressed radially inward into an upper end portion of the cylindrical portion 3, and the cylindrical-portion pressing face 71 of the first roll-forming roller 70 is caused to butt against the outer circumferential face 30 of the cylindrical portion 3. While the first roll-forming roller 70 reversely rotates with following the rotation of the cup-shaped material 4, therefore, an annular first groove 12 that is opened in a valley-

like shape is formed in an outer peripheral edge of the upper end portion of the cylindrical portion 3.

[0027] By a pushing-up action of an upper inclined face of the first groove-forming protrusion 72 which is generated when the annular first groove 12 that is opened in a valley-like shape is formed in the outer peripheral edge of the upper end portion of the cylindrical portion 3 as described above, the upper side of the annular first groove 12 in the cylindrical portion 3 is upward pushed up, so that an annular projection 14 that projects in a direction opposite to a direction along which the cylindrical portion 3 extends is formed in an upper end portion of the cylindrical portion 3. By a pushing-down action of an lower inclined face of the first groove-forming protrusion 72, the lower side of the annular first groove 12 in the cylindrical portion 3 is downward pushed down, so that a cup-shaped material 4A in which the cylindrical portion 3 is extended slightly and downward is molded.

[0028] As shown in the left half of Fig. 2, next, the cup-shaped material 4A in which the annular first groove 12 and the annular projection 14 are formed is fitted from a lower open end portion of the material onto a rotary lower mold 5c, and the boss portion 1 of the cup-shaped material 4A is fitted onto the shaft 51 of the rotary lower mold 5c. An annular stepped face 55 of the rotary lower mold 5c is fitted to the inner face of the annular stepped portion 22 disposed in the base plate portion 2, so that the cup-shaped material 4A is set to the rotary lower mold 5c so as to be radially immovable. Then, the rotary upper mold 6b is lowered as indicated by the arrow e, and the annular stepped portion 22 of the base plate portion 2 is fitted to an annular stepped face 64 formed in the lower end of the rotary upper mold 6b, so that the base plate portion 2 of the cup-shaped material 4 is clampingly held by the upper end face of the rotary lower mold 5c and the lower end face of the rotary upper mold 6b. At least one of the rotary lower mold 5c and the rotary upper mold 6b is rotated about the axis C1 to rotate the rotary lower mold 5c, the rotary upper mold 6b, and the cup-shaped material 4A about the axis C1.

[0029] A second roll-forming roller 90 is moved in the direction of the arrow h with respect to the cup-shaped material 4A which rotates about the axis C1 together with the rotary lower mold 5c and the rotary upper mold 6b as described above, whereby a second groove-forming protrusion 92 which is protruded radially outward in the vicinity of an upper end portion of the second roll-forming roller 90 is fitted into the annular first groove 12 (see the right half of Fig. 1) which has been already opened in a valley-like shape, to be pressed radially inward, and the cylindrical-portion pressing face 91 is caused to butt against the outer circumferential face 30 of the cylindrical portion 3. Namely, the second groove-forming protrusion 92 having a mountain-like section shape in which a mountain peak portion is rounder than the first groove-forming protrusion 72 is fitted into the annular first groove 12 to be pressed radially inward, and the cylindrical-portion pressing face 91 is caused to butt against the outer cir-

cumferential face 30 of the cylindrical portion 3.

[0030] While the second roll-forming roller 90 reversely rotates with following the rotation of the cup-shaped material 4A, therefore, the annular first groove 12 that has been already formed is pressed open by the second groove-forming protrusion 92 to form an annular second groove 13 that is largely opened in a valley-like shape. By a pushing-up action of an upper inclined face of the second groove-forming protrusion 92 which is generated when the annular second groove 13 that is largely opened in a valley-like shape is formed in the upper end portion of the cylindrical portion 3 as described above, an annular projection 15 that projects more largely than the annular projection 14 in a direction opposite to a direction along which the cylindrical portion 3 extends is formed in the cylindrical portion 3.

[0031] By a pushing-down action of an lower inclined face of the second groove-forming protrusion 92, the lower side of the annular second groove 13 in the cylindrical portion 3 is downward pushed down, so that the lower end of the cylindrical portion 3 butts against a restriction face 58 of the rotary lower mold 5b, thereby restricting the downward extension of the cylindrical portion 3. Therefore, the lower side of the annular second groove 13 of the cylindrical portion 3 is pushed into an annular recess 95 which is formed immediately below the second groove-forming protrusion 92 of the second roll-forming roller 90, thereby forming a cup-shaped material 4B in which an expansion 40 that is radially outward expanded is formed.

[0032] As shown in the right half of Fig. 2, next, the cup-shaped material 4B in which the annular second groove 13, the annular projection 15, and the expansion 40 that is radially outward expanded are formed is fitted from a lower open end portion of the material onto a rotary lower mold 5d, and the boss portion 1 of the cup-shaped material 4B is fitted onto the shaft 51 of the rotary lower mold 5d. An annular stepped face 56 of the rotary lower mold 5d is fitted to the inner face of the annular stepped portion 22 disposed in the base plate portion 2, so that the cup-shaped material 4B is set to the rotary lower mold 5d so as to be radially immovable. Then, the rotary upper mold 6c is lowered as indicated by the arrow g, and the annular stepped portion 22 of the base plate portion 2 is fitted to an annular stepped face 65 formed in the lower end of the rotary upper mold 6c, so that the base plate portion 2 of the cup-shaped material 4B is clampingly held by the upper end face of the rotary lower mold 5d and the lower end face of the rotary upper mold 6c. At least one of the rotary lower mold 5d and the rotary upper mold 6c is rotated about the axis C1 to rotate the rotary lower mold 5d, the rotary upper mold 6c, and the cup-shaped material 4B about the axis C1.

[0033] After an outer circumferential face 16a of a flat-face forming rolling roller 16 is caused to butt against the outer circumferential face of the expansion 40, the flat-face forming rolling roller 16 is moved in the direction of the arrow i with respect to the cup-shaped material 4B

which rotates about the axis C1 together with the rotary lower mold 5c and the rotary upper mold 6b as described above, so that the annular expansion 40 is clampingly pressed by the outer circumferential face 16a of the flat-face forming rolling roller 16, and the outer circumferential face 53 of the rotary lower mold 5d, and the expansion 40 is caused to disappear, thereby flattening the outer circumferential face 30 of the cylindrical portion 3 as shown in Fig. 3. As a result, the expanding volume amount of the annular expansion 40 is converted into the extended distance by which the cylindrical portion 3 is axially extended. Therefore, the axial length of the sheet metal-made cup-shaped material 4C is larger than the original length (original dimension) correspondingly with the distance corresponding to the expanding volume amount. Furthermore, the outer circumferential face 15a of the annular projection 15, and the outer circumferential face 30 of the cylindrical portion 3 are formed to be flush with each other, and the annular projection 15 is upward extended while being thinned so that the projection distance of the projection is larger than that shown in the right half of Fig. 2. Therefore, a sheet metal-made back face pulley 11 in which the axial length is further increased can be produced.

[0034] As described above, the annular expansion 40 that is radially outward expanded is clampingly pressed by the rotary lower mold 5d and the flat-face forming rolling roller 16 to a degree at which the annular expansion 40 disappears, whereby the outer circumferential face 30 of the cylindrical portion 3 is flatly formed. As compared with the case where the whole outer circumferential face 30 of the cylindrical portion 3 is clampingly pressed to be flatly formed, therefore, molding can be conducted by a smaller clamping press force. Therefore, molding is facilitated, and accurate flatness and dimensionality can be obtained by a reduced number of steps. Since the cylindrical portion 3 is not work-hardened in the preceding stage in which the annular expansion 40 is clampingly pressed, the conversion of the expanding volume amount of the annular expansion 40 into the axial extended distance of the cylindrical portion 3 is smoothly performed, and the production efficiency can be enhanced.

[0035] Namely, the sheet metal-made back face pulley 11 in which, as shown in Fig. 3 and Fig. 5, the thickness t2 of the cylindrical portion 3 is small, the axial length h4 is increased more than the axial length h1 of Fig. 4, and the whole of the increased axial length h4 can be used as the effective length can be produced by the sheet metal-made cup-shaped material 4 in which the thickness t1 of the cylindrical portion 3 shown in the left half of Fig. 1 and Fig. 4 is large and the axial length h1 is small. Since the whole of the increased axial length h4 can be used as the effective length, for example, an effect that a small positional displacement in the width direction of a belt is absorbed, and a stable contact state with the back face of the belt can be maintained is attained.

[0036] When, as shown in the left half of Fig. 2, the

annular second groove 13 is formed within the range of the thickness t1 of the cylindrical portion 3 of the cup-shaped material 4, the annular second groove 13 does not enter the base plate portion 2, and it is possible to prevent an disadvantage that the base plate portion 2 is thinned to reduce its strength, from occurring. Therefore, reduction of the buckling strength of the base plate portion 2 can be avoided.

[0037] When, in the first roll-forming roller 70, the first groove-forming protrusion 72 having a mountain-like section shape is used as shown in the right half of Fig. 1, and the first groove-forming protrusion 72 is pressed radially inward, the bottom of the annular first groove 12 is positioned approximately on the center line C2 of the axial thickness of the base plate portion 2. Thereafter, when, in the second roll-forming roller 90, the second groove-forming protrusion 92 having a mountain-like section shape in which a mountain peak portion is rounded is used as shown in the left half of Fig. 2, and the second groove-forming protrusion 92 is pressed into the annular first groove 12, so that the bottom of the annular second groove 13 is positioned on the center line C2, whereby, in the cylindrical portion 3, a large thickness of a portion which is upper than the center line C2 is ensured. The portion in which a large thickness is ensured is projected in the direction opposite to the direction along which the cylindrical portion 3 extends, and the annular projection 15 can be formed. Therefore, the projection distance in the direction opposite to the direction along which the cylindrical portion 3 extends can be sufficiently ensured while preventing the annular projection 15 from being thinned, and the length h4 (see Fig. 5) from the upper end of the base plate portion 2 of the sheet metal-made back face pulley 11 to the lower end of the cylindrical portion 3 can be increased.

[0038] In the embodiment, the method in which the sheet metal-made back face pulley 11 shown in Fig. 5 is produced by the sheet metal-made cup-shaped material 4 comprising: the circular base plate portion 2 from which the boss portion 1 shown in Fig. 4 is projected; and the cylindrical portion 3 which extends from the outer peripheral portion of the base plate portion 2 in one direction along the axis C1 of the base plate portion 2 has been described. When rotary lower molds different from the rotary lower molds 5b, 5c, 5d, 5e used in the embodiment are used, and rotary upper molds different from the rotary upper molds 6a, 6b, 6c, 6d used in the embodiment are used, for example, the sheet metal-made back face pulley 11 in which, as shown in Fig. 7, the thickness t2 of the cylindrical portion 3 is small, the axial length h4 is larger than the axial length h1 in Fig. 6, and the increased axial length h4 can be used as the effective length can be produced as shown in, for example, Fig. 6 by the sheet metal-made cup-shaped material 4 comprising: the circular base plate portion 2 from which the boss portion 1 (see Fig. 4) is omitted; and the cylindrical portion 3 which extends from the outer peripheral portion of the base plate portion 2 in one direction along the axis C1 of the

base plate portion 2. Industrial Applicability

[0039] As described above, the invention is the technique in which, in a sheet metal-made cup-shaped material comprising: a circular base plate portion; and a cylindrical portion which extends from an outer peripheral edge portion of the base plate portion in one direction along an axis of the base plate portion, an annular expansion which is expanded radially outward is formed in the cylindrical portion, and the annular expansion is clampingly pressed by a rotary inner mold and a flat-face forming rolling roller to a degree at which at least the annular expansion disappears, whereby an outer circumferential face of the cylindrical portion is flatly formed, so that the axial length of the cylindrical portion is increased, and the increased axial length can be used as the effective length, whereby a small positional displacement in the width direction of a belt is absorbed, and a stable contact state with the back face of the belt can be maintained.

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Claims

1. A method of producing a sheet metal-made back face pulley wherein a sheet metal-made cup-shaped material comprising: a circular base plate portion; and a cylindrical portion which extends from an outer peripheral edge portion of said base plate portion in one direction along an axis of said base plate portion is prepared, an annular expansion is formed in said cylindrical portion, and said annular expansion is clampingly pressed by a rotary inner mold and a flat-face forming rolling roller to a degree at which at least said annular expansion disappears, whereby an outer circumferential face of said cylindrical portion is flatly formed.
2. A method of producing a sheet metal-made back face pulley according to claim 1, wherein said annular expansion is formed by expansion in a radially outward direction of said cylindrical portion.
3. A method of producing a sheet metal-made back face pulley according to claim 1 or claim 2, wherein an upper end portion of said cylindrical portion is pressed by a groove-forming protrusion disposed in a roll-forming roller, to form an annular groove in an upper end portion of said cylindrical portion, and an annular projection that projects in a direction opposite to a direction along which said cylindrical portion extends is formed above said annular groove.

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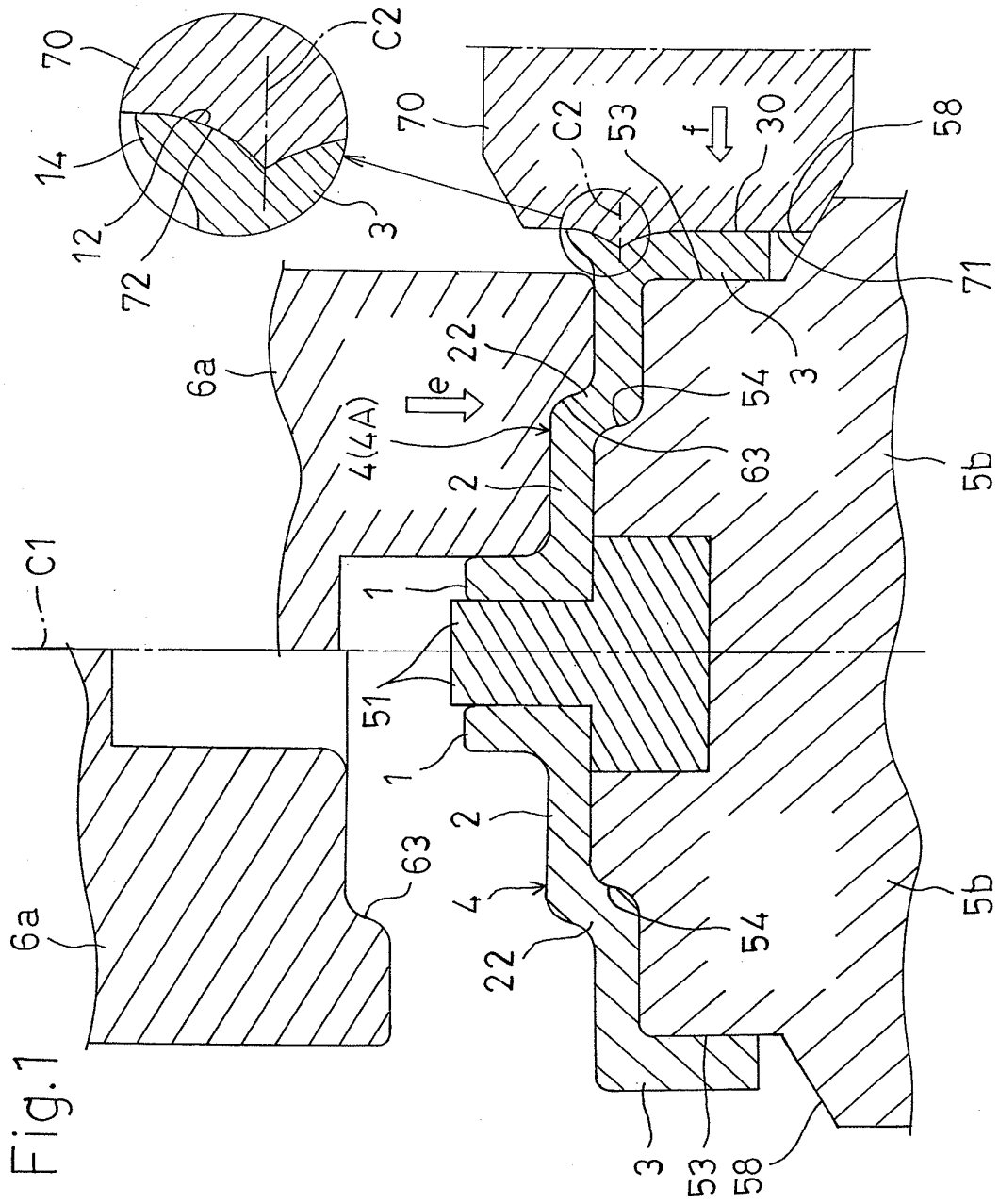


Fig. 2

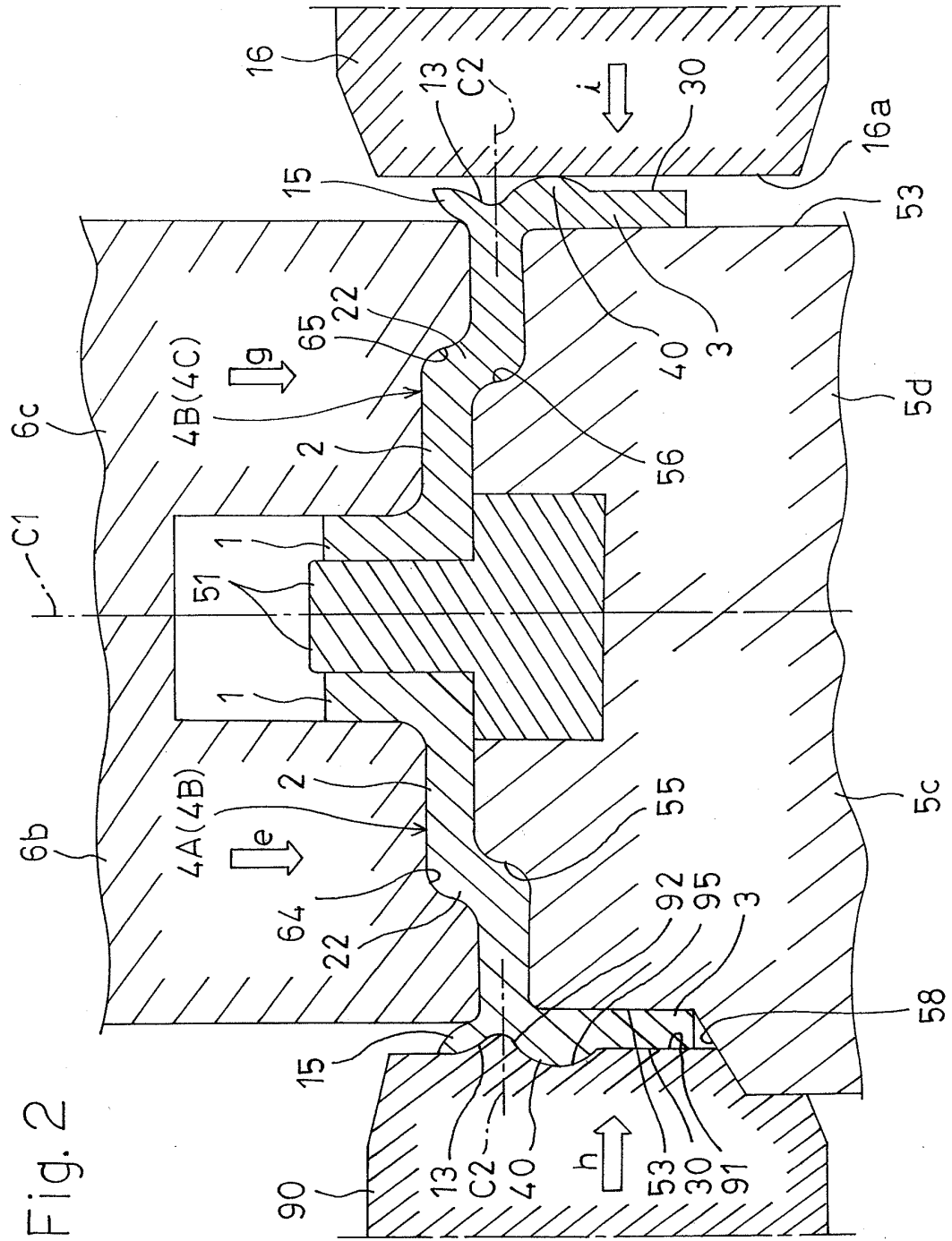


Fig. 3

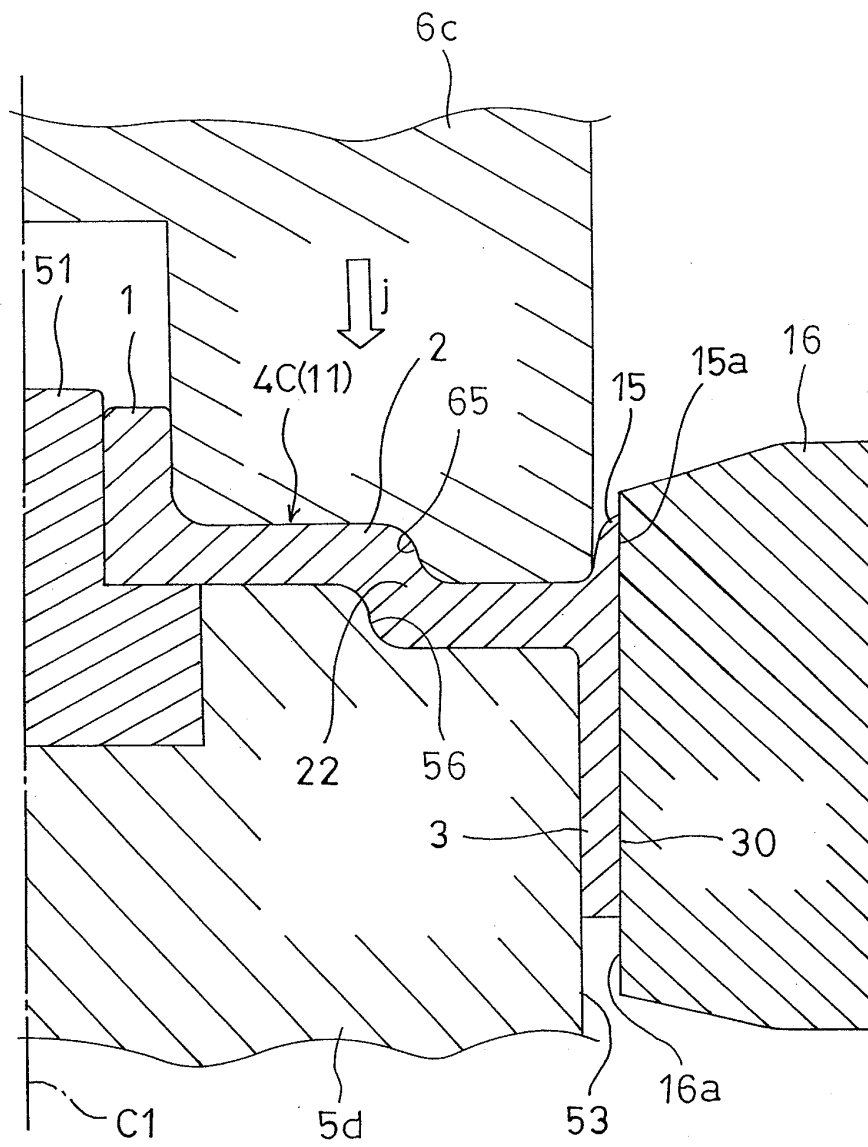


Fig. 4

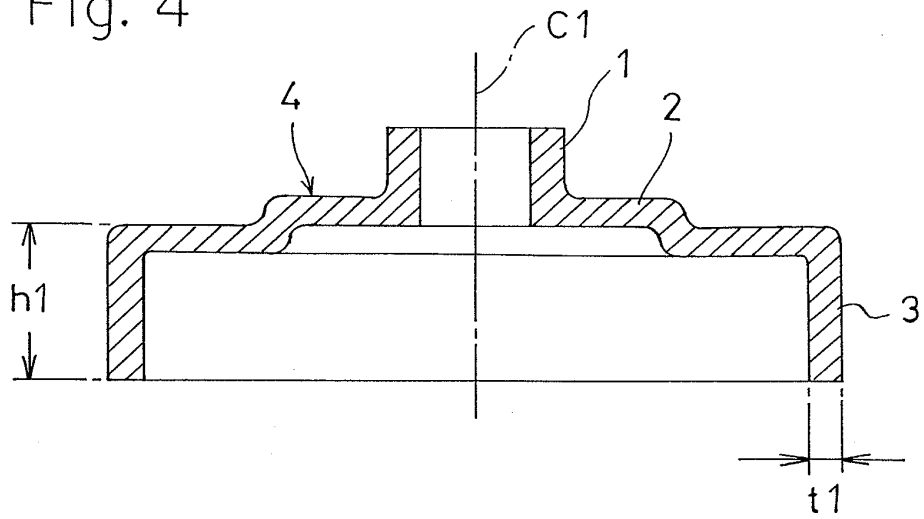


Fig. 5

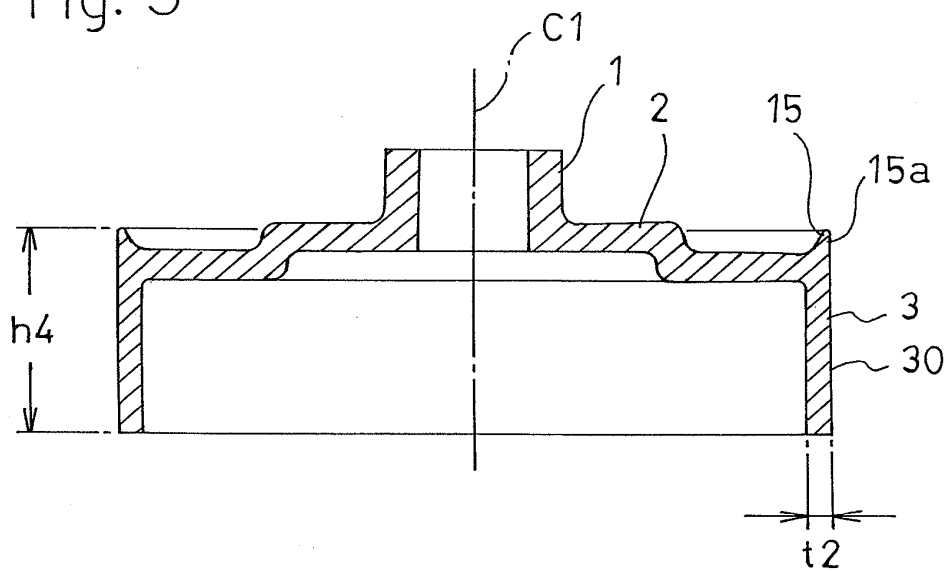


Fig. 6

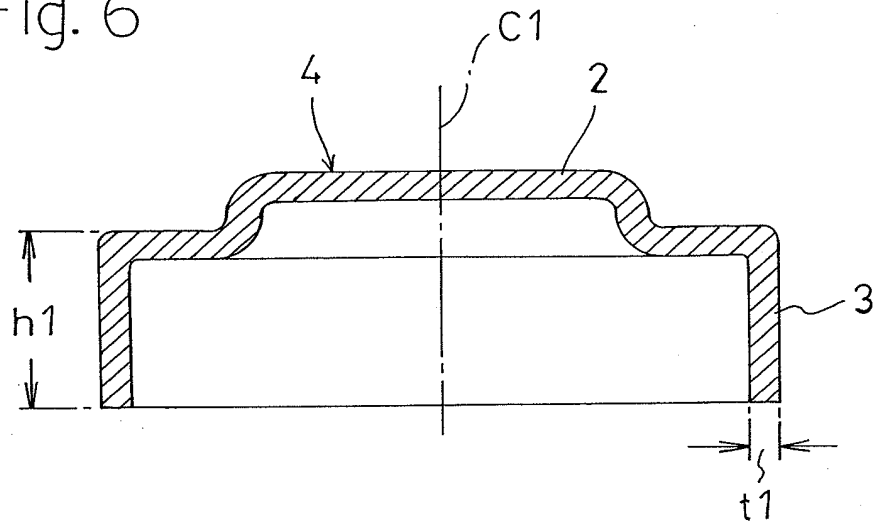
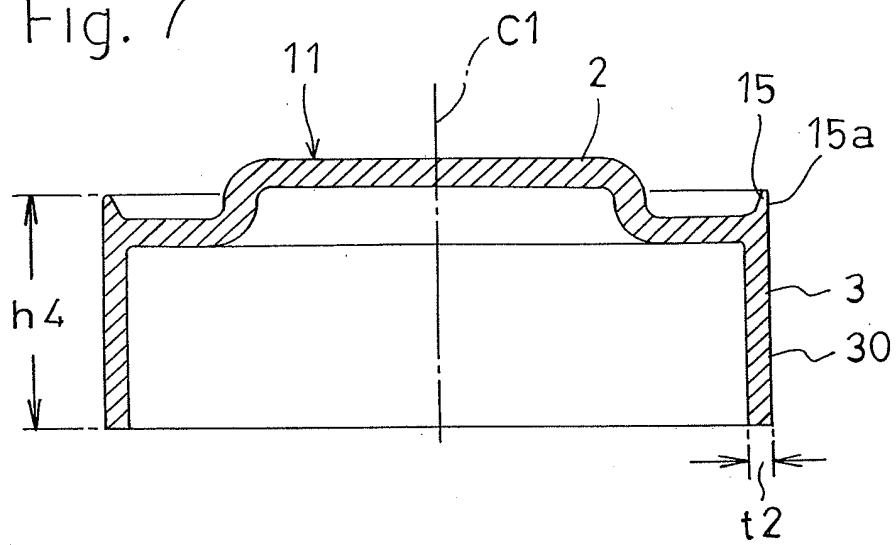
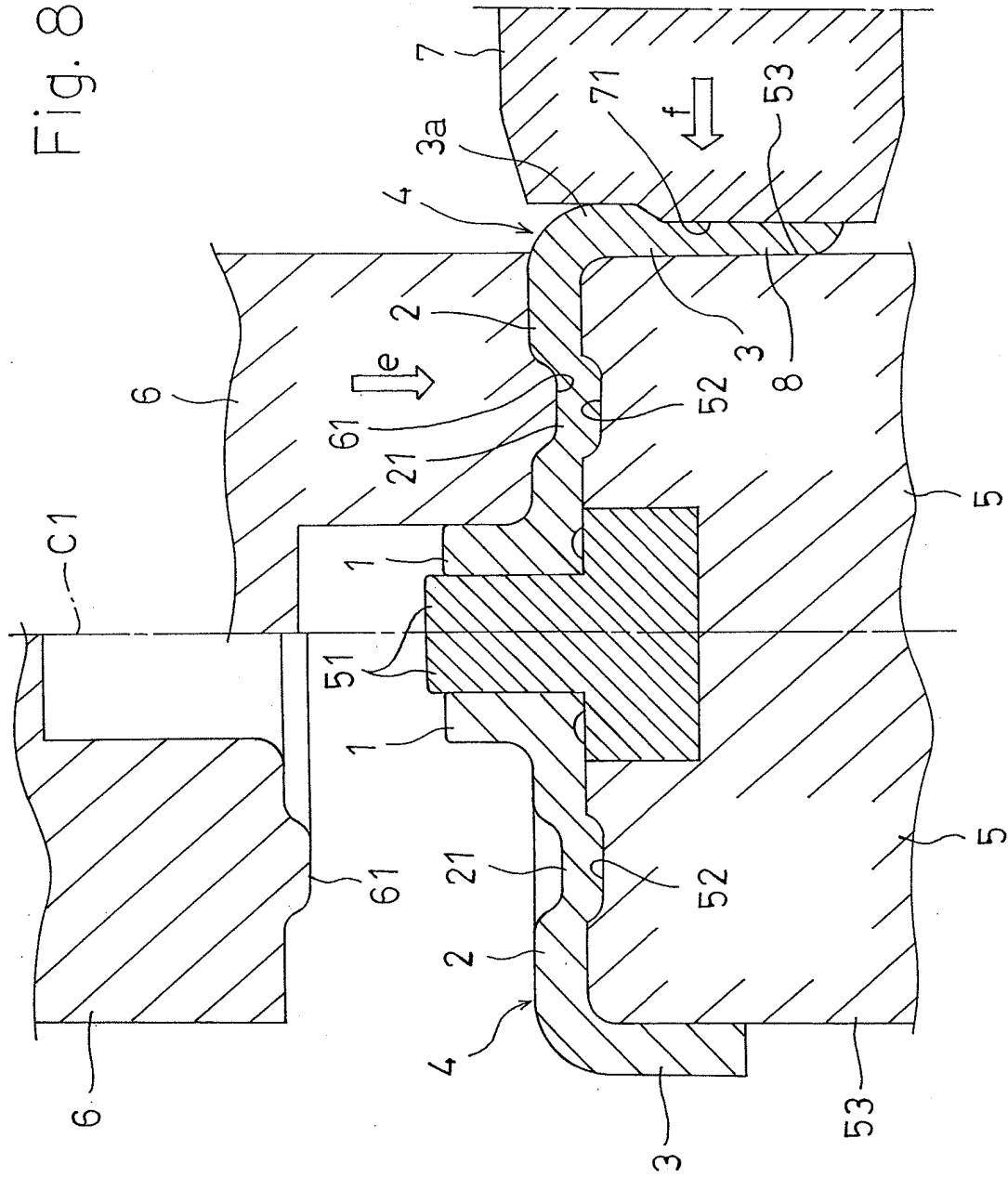


Fig. 7



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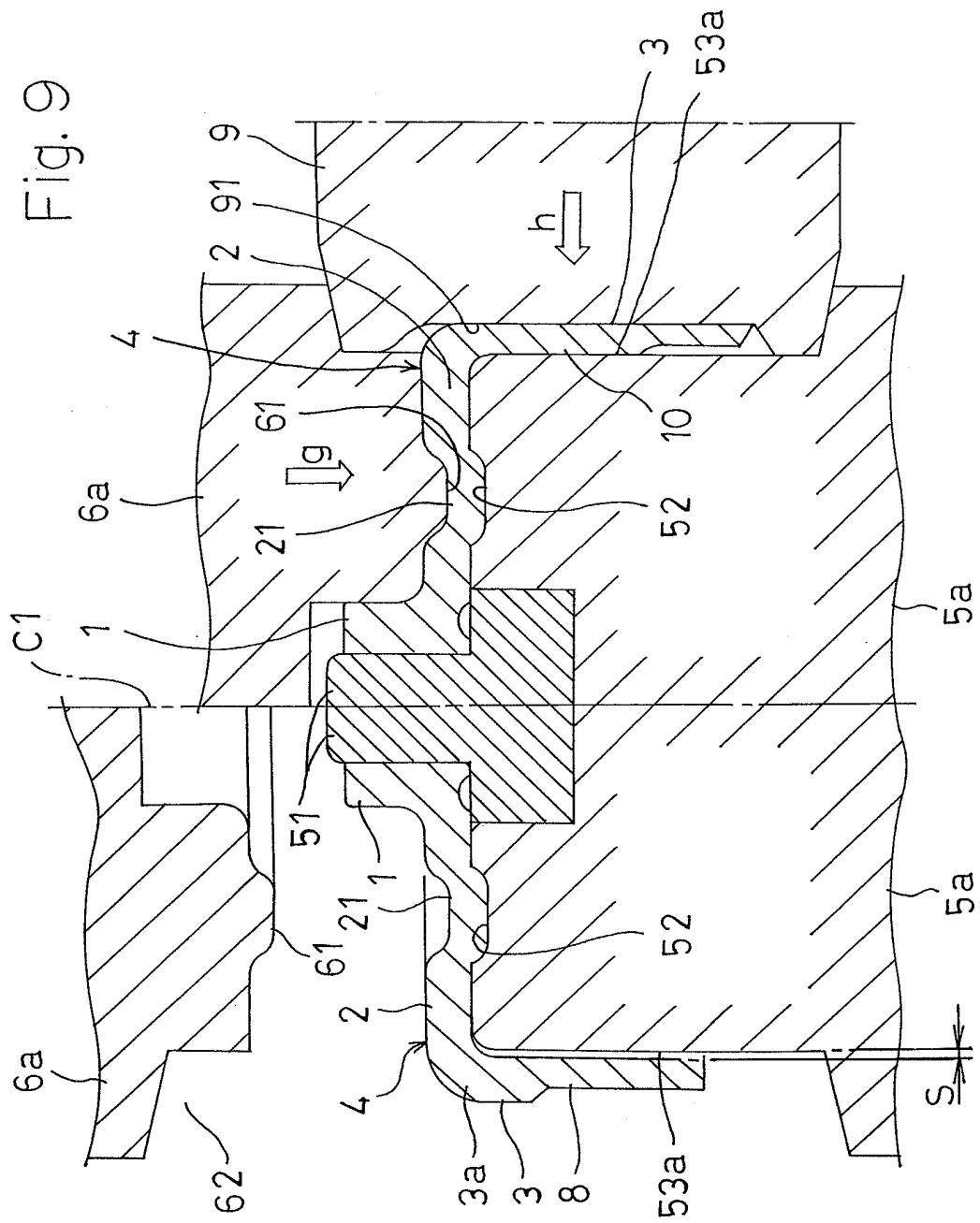


Fig. 10

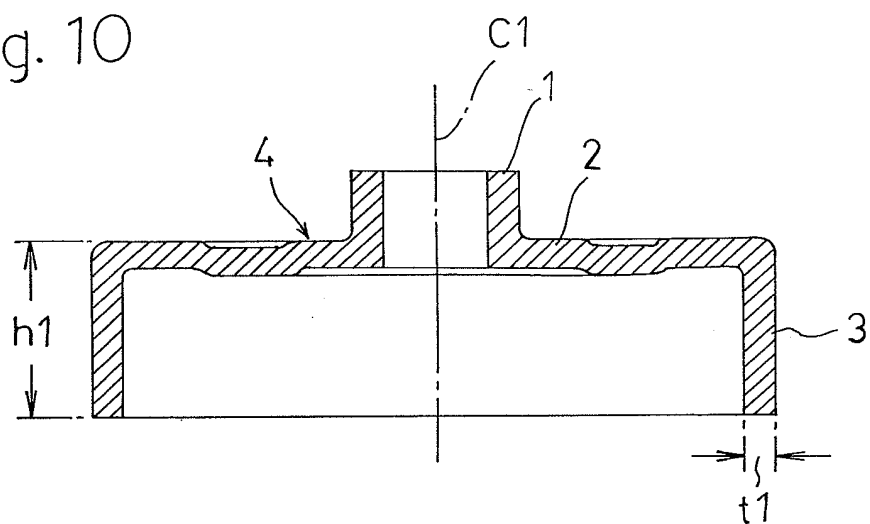
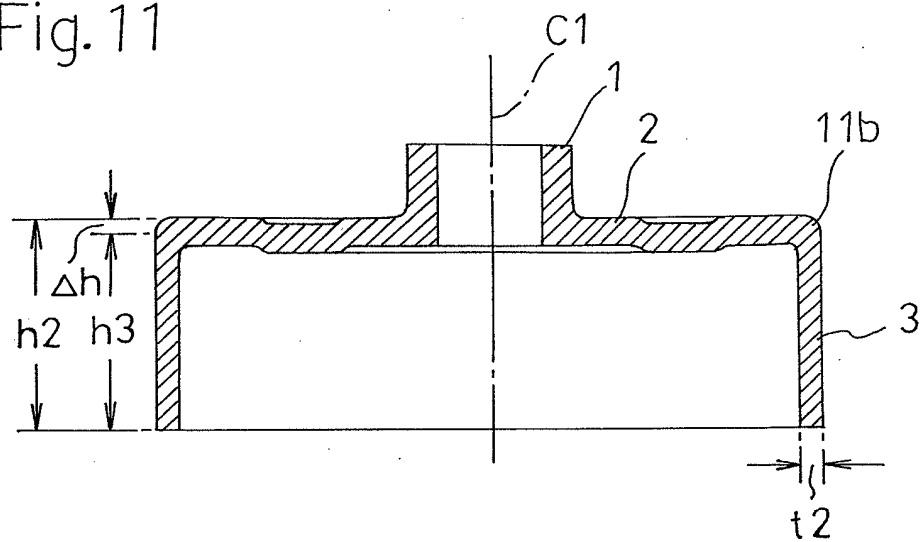


Fig. 11



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/018471

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁷ B21H1/04		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) Int.Cl. ⁷ B21H1/04, B21D53/26		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2005 Kokai Jitsuyo Shinan Koho 1971-2005 Toroku Jitsuyo Shinan Koho 1994-2005		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 98/05447 A (Kabushiki Kaisha Kanemitsu), 12 February, 1998 (12.02.98), Full text & GB 2319975 A & DE 19681588 T & US 5941113 A	1-3
A	JP 64-87020 A (Asahi Malleable Iron Co., Ltd), 31 March, 1989 (31.03.89), Full text (Family: none)	1-3
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 31 January, 2005 (31.01.05)		Date of mailing of the international search report 15 February, 2005 (15.02.05)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (January 2004)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 9805447 A [0008]