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(54) METAL CONTAINER AND MANUFACTURING METHOD FOR SAME

(57) Provided is a metal container having a shape with which it is possible to avoid a blocking phenomenon during transportation in a stacked state while being formed with a side wall portion having a sufficiently large surface on which it is easy to print, and a method for manufacturing a metal container with which such a metal container can be formed effectively. The metal container of the present invention has an opening portion, a side wall portion, and a bottom portion, and has a lower end outer diameter that is smaller than an upper end inner diameter, the metal container having a shape of a bottomed cup that is formed by subjecting a plate-shaped metal material to a drawing process and that is trimmed, wherein: the side wall portion is formed with a tapered contour by performing diameter reduction drawing on the bottom portion side of the opening portion of the bottomed cup; a bulging portion that bulges in a circumferential direction is formed in the side wall portion; and a continuous tapered surface in which tapered surfaces are continuously formed by performing diameter reduction drawing a plurality of times is formed below the bulging portion.

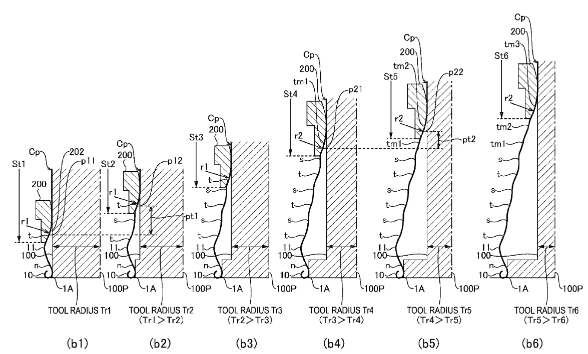

FIG. 4

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Description

Technical Field

[0001] The present invention relates to a metal container and a method for manufacturing the metal container.

Background Art

[0002] A metal container mainly made of aluminum, stainless steel, or the like includes a storage space for storing contents and an opening portion through which the contents are put in and taken out from the storage space. Examples of the form of the metal container include a can in which the opening portion is sealed with a lid body, and a cup with the opening portion opened.

[0003] In the related art, as such a metal container, a tapered metal container (hereinafter, also referred to as a "tapered container") is known. The metal container includes an upper opening portion, a sidewall portion, and a bottom portion, and has a tapered shape in which an inner diameter of the sidewall portion gradually decreases from the upper opening portion toward the bottom portion so that an outer diameter (lower end outer diameter) of the bottom portion becomes smaller than an inner diameter (upper end inner diameter) of the opening portion.

[0004] Such a tapered container is manufactured by a manufacturing method in which for example, a stock material is prepared, a cup is formed by punching and drawing, the cup is redrawn so that the cup has a predetermined height and a predetermined wall thickness, after that, the cup is cut so that the cup has the predetermined height, a tip portion of the cup is rounded, the cup is drawn to form a plurality of vertical wall sections, and after that, each of the plurality of vertical wall sections is expanded in diameter using a die in order to form a sidewall portion having a tapered profile (see Patent Document 1 described below).

Citation List

Patent Literature

[0005] Patent Document 1: JP 2021-142566 A

Summary of Invention

Technical Problem

[0006] Incidentally, as with other containers, there is an increasing demand for printing characters and images on the sidewall portion of the tapered container. Therefore, it is desired that the sidewall portion of the tapered container includes a relatively smooth surface of sufficient size, which serves as a display space where printing can be easily performed.

[0007] On the other hand, tapered containers manufactured by a conventional manufacturing method are transported in a stacked state in which a bottom portion of one container is inserted into an opening portion of another container, forming multiple tiers. However, when the metal containers each having the tapered sidewall portion as in the related art are transported in the stacked state, a phenomenon (so-called blocking phenomenon) is likely to occur in which a container relatively on an upper side is inserted into a container on a lower side due to vibration or impact during the transportation, and separation of a container from the stacked state cannot be easily performed, and this phenomenon is considered problematic. Therefore, the tapered container is also desired to have a shape that allows for easy separation after transportation.

[0008] In the aforementioned manufacturing method of the related art, the process of forming the sidewall portion having the tapered profile is complicated and it is difficult to cope with diverse shapes, both of which are considered problematic. Therefore, it is difficult to easily manufacture a tapered container having a shape satisfying the above-described requirements.

[0009] The present invention has been made in view of the above circumstances, and an object thereof is to solve the above problems. That is, an example of an object of the present invention is to provide a metal container having a shape capable of avoiding a blocking phenomenon during transportation of the metal container in a stacked state while forming a sidewall portion having a surface of sufficient size, on which printing can be easily performed, and a method for manufacturing a metal container capable of effectively forming such a metal container.

Solution to Problem

[0010] A metal container according to the present invention is a metal container including an opening portion, a sidewall portion, and a bottom portion and having a lower end outer diameter smaller than an upper end inner diameter, wherein the metal container has a shape of a bottomed cup formed by drawing a plate-like metal material and subjected to trimming, the sidewall portion has a tapered profile formed by performing diameter reduction drawing on the bottom portion side with respect to the opening portion of the bottomed cup, the sidewall portion is formed with a bulging portion bulging in a circumferential direction and a continuous tapered surface where tapered surfaces are formed in a continuous manner by performing diameter reduction drawing a plurality of times on a lower side with respect to the bulging portion.

[0011] A method for manufacturing a metal container according to the present invention is a method for manufacturing a metal container including an opening portion, a sidewall portion, and a bottom portion and having a lower end outer diameter smaller than an upper end inner diameter, the method including: forming a bottomed cup by drawing a plate-like metal material, trimming the bottomed cup, and forming the sidewall portion having a tapered profile by performing diameter reduction drawing on the bottom portion side with respect to the opening portion of the bottomed cup, wherein in the forming the sidewall portion, a bulging portion bulging in a circumferential direction is formed, and a continuous tapered surface where tapered surfaces are formed in a continuous manner is formed by performing diameter reduction drawing a plurality of times on a lower side with respect to the bulging portion.

Advantageous Effects of Invention

[0012] According to the present invention, it is possible to provide a metal container having a shape capable of avoiding a blocking phenomenon during transportation of the metal container in a stacked state while forming a sidewall portion having a surface of sufficient size, on which printing can be easily performed, and a method for manufacturing a metal container capable of effectively forming such a metal container.

Brief Description of Drawings

[0013]

FIG. 1 is an external view illustrating an example of a metal container according to an embodiment of the present invention.

FIG. 2 is an explanatory view illustrating steps of a method for manufacturing a metal container according to an embodiment of the present invention.

FIG. 3 is an explanatory view of a sidewall portion forming step (a processing procedure of the step is illustrated in order of (a) → (b) → (c)).

FIG. 4 is an explanatory view of the sidewall portion forming step ((b1) to (b6) illustrate first to sixth stages).

FIG. 5 is an explanatory view illustrating metal containers in a stacked state.

FIG. 6 is an explanatory view illustrating another example of metal containers in a stacked state.

Description of Embodiments

[0014] Embodiments of the present invention (present embodiment) will be described below with reference to the accompanying drawings. In the following description, the same reference signs in different drawings denote elements having the same function, and redundant descriptions with regard to each drawing will be omitted as appropriate.

[0015] In an embodiment of the present invention, a metal container 1 illustrated in FIG. 1 is manufactured. As illustrated in FIG. 1, the metal container 1 includes an opening portion 1A, a sidewall portion 1B, and a bottom portion 1C, and is a cup-shaped container that can be substituted for a known disposable paper cup or plastic cup. Although FIG. 1 illustrates an example in which the opening portion 1A is provided with a curl 10 that is curved outward and the opening portion 1A is used in an open state, no such limitation is intended, and the opening portion 1A may be provided with a curved flange to which an outer peripheral edge portion of a lid body is wound and tightened so that the metal container 1 is used as a can container. Note that the terms "above" and "below" in this specification and the like are based on an assumption that the opening portion 1A is located above and the bottom portion 1C is located below. Therefore, the "up-down direction" is a vertical direction from the opening portion 1A toward the ground surface portion with which the bottom portion 1C is in contact.

[0016] The metal container 1 illustrated in FIG. 1 includes the sidewall portion 1B having a generally tapered profile so that an outer diameter of the bottom portion 1C (lower end outer diameter) becomes smaller than an inner diameter of the opening portion 1A (upper end inner diameter). As a result, a plurality of the metal containers 1 can be in a stacked state in which the bottom portion 1C of the upper metal container 1 is inserted into the opening portion 1A of the lower metal container 1, and when the metal containers 1 are not yet used, the plurality of metal containers 1 can be transported in the stacked state.

[0017] In the metal container 1, a ratio of the inner diameter of the opening portion 1A (upper end inner diameter) to the outer diameter of the bottom portion 1C (lower end outer diameter) may be appropriately set in accordance with the use of the metal container 1 and is not particularly limited, but can be set to, for example, from 1.2:1 to 2:1. For example, when the upper end inner diameter is 80 mm, the lower end outer diameter may be 50 mm.

[0018] A process (manufacturing method) of manufacturing the metal container 1 illustrated in FIG. 1 will be described with reference to a flowchart of FIG. 2. First, a plate-like metal material is prepared by, for example, cutting a plate material wound in a coil shape (S0: plate-like metal material preparation step), and the plate-like metal material is punched and subjected to drawing and/or ironing to form a cup-shaped intermediate member (hereinafter, referred to as a bottomed cup) (S1: cupping step).

[0019] Subsequently, the formed bottomed cup is subjected to drawing and/or ironing again and processing for forming a bottom portion (step S1') as necessary, and then a tip portion of the bottomed cup having a predetermined outer diameter, a predetermined height, and a predetermined plate thickness is subjected to trimming (S2: trimming step). By the trimming, the height of the tip of the bottomed cup, which has become uneven due to the redrawing and/or ironing, is uniformly cut around the central axis, and after the trimming, the height of the tip of the bottomed cup becomes constant.

[0020] Subsequently, the tip portion of the trimmed bottomed cup is subjected to tip diameter reduction drawing (S3: tip diameter reduction drawing step). The diameter reduction drawing performed on the tip portion is so-called necking, in which a diameter of a tip opening of the bottomed cup is reduced to form a necking portion n whose diameter is gradually reduced toward the tip, and a portion to be subsequently processed into a curl or a flange is formed.

[0021] After the tip diameter reduction drawing step S3, an opening portion including a curl or a flange is formed at the tip portion of the bottomed cup (the portion to be processed into a curl or a flange) (S4: opening portion forming step). By forming the curl or flange at the tip portion in this manner, the rigidity of the tip opening can be increased, and a deterioration in roundness when forming a sidewall portion 1B at a next step can be suppressed.

[0022] In formation of a sidewall portion 1B (S5: sidewall portion forming step) after the opening portion forming step S4, a sidewall portion 1B having a generally tapered profile is formed by performing gradual diameter reduction drawing on the bottom portion 1C side with respect to the portion that has been subjected to the tip diameter reduction drawing. That is, a tapered surface t (inclined wall portion) and a vertical surface s (vertical wall portion) are alternately formed on the bottom portion 1C side of the necking portion n where the tip diameter reduction drawing has been performed, whereby a sidewall portion 1B having a generally tapered profile is formed.

[0023] A continuous tapered surface tm where tapered surfaces t are formed in a continuous manner is formed in the vicinity of the center of the sidewall portion 1B in the vertical direction. The continuous tapered surface tm is the longest tapered surface (longest inclined wall portion) in the sidewall portion 1B. As illustrated in FIG. 1, assuming that a vertical height H from a ground contact portion D to an upper end E of the metal container 1 is 100%, the continuous tapered surface tm has a vertical height H1 of at least from 20 to 30% with respect to the vertical height H. In the metal container 1, the continuous tapered surface tm having such a vertical height H1 is formed entirely in a circumferential direction. Such a continuous tapered surface tm has a sufficient size to serve as a display space, and is a relatively smooth surface on which printing can be easily performed.

[0024] Here, an example of the sidewall portion forming step S5 will be described in detail. First, as illustrated in FIG. 3(a), after the tip diameter reduction drawing, an inner tool 100 is disposed inside a bottomed cup Cp in which the opening portion 1A including a curl 10 (or a flange 20 in FIG. 6) is formed, an outer tool 200 is disposed on the bottom portion 1C side of the bottomed cup Cp, and a pressing tool 300 is brought into contact with the bottom portion 1C of the bottomed cup Cp.

[0025] The inner tool 100 is a cylindrical tool having a diameter smaller than an inner diameter of the bottomed cup Cp. The outer tool 200 has, on an inner surface thereof, a drawing surface 201 for performing drawing while sandwiching a sidewall of the bottomed cup Cp between an outer peripheral surface of the inner tool 100 and itself, and an inclination forming surface 202 for forming the sidewall of the bottomed cup Cp into an inclined shape. The inclination forming surface 202 of the outer tool 200 has a curved surface (r surface) inclined to spread outward with respect to a central axis 100P of the inner tool 100.

[0026] At a first stage of the sidewall portion forming step S5, as illustrated in FIG. 3(b), from the state illustrated in FIG. 3(a), the outer tool 200 is moved from the bottom portion 1C toward the opening portion 1A with respect to the fixed inner tool 100 in a direction indicated by the arrow in FIG. 3(b) in order to perform the diameter reduction drawing on the sidewall of the bottomed cup Cp, and further, the inclination forming surface 202 of the outer tool 200 is brought into contact with the bottom portion 1C side of the necking portion n, which has been subjected to the tip diameter reduction drawing, in order to form the tapered surface t. After that, as illustrated in FIG. 3(c), when the outer tool 200 is returned to the bottom portion 1C side, on the tip side of the bottomed cup Cp, a bulging portion 11 constituted by the necking portion n and the tapered surface t is formed on the bottom portion 1C side of the curl 10. Note that as a method for forming the bulging portion 11, for example, the bulging portion 11 can be formed by a method in which a tool (not illustrated) is brought into contact with an inner surface of the bottomed cup Cp to impress and expand it in a circumferential direction, a method in which a stepped portion is formed on the sidewall of the bottomed cup Cp by diameter reduction drawing, or the like.

[0027] A next stage of the sidewall portion forming step S5 will be described with reference to FIG. 4. While the inner tool 100 with a tool radius Tr1 is used in the above-described diameter reduction drawing at the first stage, the inner tool 100 with a tool radius Tr2 (Tr1 > Tr2) is used to perform diameter reduction drawing at a second stage on the sidewall of the bottomed cup Cp. At this time, the inner diameters of the drawing surface 201 and the inclination forming surface 202 of the outer tool 200 are set in accordance with the tool diameter of the inner tool 100.

[0028] In the diameter reduction drawing at the first stage (see FIG. 4(b1)), a moving stroke St1 of the outer tool 200 is a stroke length required to form the tapered surface t of the bulging portion 11. In contrast, in diameter reduction drawing at a second stage (see FIG. 4(b2)), a moving stroke St2 of the outer tool 200 is set to be shorter than the moving stroke St1 at the first stage, and a vertical portion s and a tapered surface t following the vertical surface s are formed on the bottom portion 1C side of the tapered surface t of the bulging portion 11.

[0029] While the inner tool 100 with a tool radius Tr2 is used in the above-described diameter reduction drawing at the second stage, the inner tool 100 with a tool radius Tr3 (Tr2 > Tr3) is used in subsequent diameter reduction drawing at a third stage (see FIG. 4(b3)). Further, in the diameter reduction drawing at the third stage, a moving stroke St3 of the outer tool 200 is set to be shorter than the moving stroke St2 at the second stage, and a vertical surface s and a tapered surface t following the vertical surface s are formed on the bottom portion 1C side of the tapered surface t formed in the diameter reduction drawing at the second stage.

[0030] In the diameter reduction drawing at the first to third stages, the outer tool 200 in which a radius of curvature r of the curved surface (r surface) constituting the inclination forming surface 202 is r1 is used, and the inclination forming surface 202 having the radius of curvature r1 in the outer tool 200 is brought into contact with the sidewall of the bottomed cup Cp to form the sidewall into an inclined shape, thereby forming the tapered surface t.

[0031] In contrast, in subsequent diameter reduction drawing at fourth to sixth stages (see FIGS. 4(b4) to (b6)), the diameter reduction drawing is performed on the sidewall of the bottomed cup Cp by using the outer tool 200 in which the radius of curvature r of the curved surface constituting the inclination forming surface 202 is a radius of curvature r2 larger than the radius of curvature r1.

[0032] While the inner tool 100 with a tool radius Tr3 is used in the diameter reduction drawing at the third stage, the inner tool 100 with a tool radius Tr4 (Tr3 > Tr4) is used to perform diameter reduction drawing on the sidewall of the bottomed cup Cp in diameter reduction drawing at a fourth stage (see FIG. 4(b4)). In the diameter reduction drawing at the fourth stage, a moving stroke St4 of the outer tool 200 is set to be shorter than the moving stroke St3 at the third stage, and a vertical surface s, and a tapered surface tm1 of a first portion, which follows the vertical surface s, of the continuous tapered surface tm are formed on the bottom portion 1C side of the tapered surface t formed by the diameter reduction drawing at the third stage. The tapered surface tm1 is formed by bringing the inclination forming surface 202 with the radius of curvature r2 of the outer tool 200 into contact with the sidewall of the bottomed cup Cp to form the sidewall into an inclined shape.

[0033] While the inner tool 100 with a tool radius Tr4 is used in the diameter reduction drawing at the fourth stage, the inner tool 100 with a tool radius Tr5 (Tr4 > Tr5) is used to perform diameter reduction drawing on the sidewall of the bottomed cup Cp in diameter reduction drawing at a fifth stage (see FIG. 4(b5)). In the diameter reduction drawing at the fifth stage, a moving stroke St5 of the outer tool 200 is set to be shorter than the moving stroke St4 at the fourth stage and is brought close to the moving stroke St4, thereby forming a tapered surface tm2 of a second portion of the continuous tapered surface tm on the bottom portion 1C side of the tapered surface tm1 of the first portion of the continuous tapered surface tm formed by the diameter reduction drawing at the fourth stage. By bringing the moving stroke St5 close to the moving stroke St4, the tapered surface tm1 and the tapered surface tm2 are formed as continuous tapered surfaces with no vertical surface s interposed therebetween. The tapered surface tm2 is also formed by bringing the inclination forming surface 202 with the radius of curvature r2 of the outer tool 200 into contact with the sidewall of the bottomed cup Cp to form the sidewall into an inclined shape.

[0034] While the inner tool 100 with a tool radius Tr5 is used in the diameter reduction drawing at the fifth stage, the inner tool 100 with a tool radius Tr6 (Tr5 > Tr6) is used to perform diameter reduction drawing on the sidewall of the bottomed cup Cp in diameter reduction drawing at a sixth stage (see FIG. 4(b6)). In the diameter reduction drawing at the sixth stage, a moving stroke St6 of the outer tool 200 is set to be shorter than the moving stroke St5 at the fifth stage and is brought close to the moving stroke St5, thereby forming a tapered surface tm3 of a third portion of the continuous tapered surface tm on the bottom portion 1C side of the tapered surface tm2 of the second portion of the continuous tapered surface tm formed by the diameter reduction drawing at the fifth stage. By bringing the moving stroke St6 close to the moving stroke St5, the tapered surface tm2 and the tapered surface tm3 are formed as continuous tapered surfaces with no vertical surface s interposed therebetween. The tapered surface tm3 is also formed by bringing the inclination forming surface 202 with the radius of curvature r2 of the outer tool 200 into contact with the sidewall of the bottomed cup Cp to form the sidewall into an inclined shape.

[0035] As such, in the diameter reduction drawing at the fourth to sixth stages, the process of bringing the inclination forming surface 202 with the radius of curvature r2 of the outer tool 200 into contact with the sidewall of the bottomed cup Cp to form the sidewall into an inclined shape is continuously performed three times to form the continuous tapered surface where the tapered surfaces tm1 to tm3 are formed in a continuous manner without interposing the vertical surface s therebetween.

[0036] As described above, the outer tool 200 in which the radius of curvature r of the inclination forming surface 202 (curved surface) is the radius of radius of curvature r2 larger than the radius of curvature r1 is used in the diameter reduction drawing at the fourth to sixth stages (see FIGS. 4(b4) to 4(b6)). Therefore, in each of the tapered surfaces tm1 to tm3 formed by the inclination forming surface 202 with the radius of curvature r2, a length in an inclination direction from the opening portion 1A toward the bottom portion 1C is longer than that of the tapered surface t formed by the inclination forming surface 202 (curved surface) with the radius of curvature r1. The continuous tapered surface tm where such tapered surfaces tm1 to tm3 are formed in a continuous manner is formed as a longest tapered surface (longest inclined wall portion) having the longest length in the inclination direction from the opening portion 1A toward the bottom portion 1C.

[0037] As such, in the diameter reduction drawing according to the present embodiment, when forming the continuous tapered surface tm, the outer tool 200 having the inclination forming surface 202 (curved surface) with the relatively large radius of curvature r2 is used. Thus, the continuous tapered surface tm of sufficient size can be formed by a small number of steps of diameter reduction drawing such as three times of the fourth to sixth stages. Such a continuous tapered surface tm has a sufficient size to serve as a display space, and is a relatively smooth surface on which printing can be easily performed.

[0038] It is also possible to form the continuous tapered surface tm by using the outer tool 200 having the inclination forming surface 202 (curved surface) with the radius of curvature r1 as in the formation of the tapered surface t. However, in this case, the number of steps of diameter reduction drawing necessary for forming the continuous tapered surface tm of sufficient size is significantly increased, and the manufacturing cost is also increased.

[0039] The radius of curvature r1 is not particularly limited as long as it is a value smaller than the radius of curvature r2, but may be set to from 5 to 20 mm, for example. The radius of curvature r2 is preferably from 20 to 100 mm, and may be set to r2 = 60 mm (also referred to as r2 = 60r), for example. When the radius of curvature r1 is smaller than a value within a predetermined range, it is difficult to form a predetermined taper angle. On the other hand, when the radius of curvature r1 is larger than a value within the predetermined range, wrinkles are likely to occur on the sidewall portion.

[0040] Here, a pitch Pt of the outer tool 200 will be described. A center point of the inclination forming surface 202 (curved surface) in the moving direction (direction parallel to the central axis 100P) when forming the tapered surface t of the bulging portion 11 illustrated in FIG. 4(b1) is defined as p11. In addition, a center point of the inclination forming surface 202 (curved surface) in the moving direction (direction parallel to the central axis 100P) when forming the tapered surface t on the bottom portion 1C side of the vertical surface s connecting to the bulging portion 11 illustrated in FIG. 4(b2) is defined as p12. When normal lines are extended from the center point p11 and the center point p12 to the central axis 100P of the inner tool 100, respectively, a distance between the two normal lines is defined as a pitch pt1.

[0041] In addition, a center point of the inclination forming surface 202 (curved surface) in the moving direction (direction parallel to the central axis 100P) when forming the tapered surface tm1 of the first portion of the continuous tapered surface tm of the bulging portion 11 illustrated in FIG. 4(b4) is defined as p21. Additionally, a center point of the inclination forming surface 202 (curved surface) in the moving direction (direction parallel to the central axis 100P) when forming the tapered surface tm2 of the second portion of the continuous tapered surface tm illustrated in FIG. 4(b5) is defined as p22. When normal lines are extended from the center point p21 and the center point p22 to the central axis 100P of the inner tool 100, respectively, a distance between the two normal lines is defined as a pitch pt2.

[0042] In this case, a magnitude relationship between the pitch pt1 and the pitch pt2 may be pt2 < pt1. The pitch pt1 is not particularly limited, but may be set to, for example, from 5 to 15 mm. The pitch pt2 is preferably from 3 to 10 mm. For example, pt1 = 10 mm and pt2 = 8 mm. When the pitches pt1 and pt2 are small, it is easy to form a desired shape, but the number of forming steps increases and the forming apparatus becomes large. On the other hand, when the pitches pt1 and pt2 are large, the number of forming steps is reduced and the forming apparatus can be made compact, but the formable shape is limited.

[0043] In diameter reduction drawing (not illustrated) at seventh and subsequent stages following the diameter reduction drawing at the sixth stage, the outer tool 200 having the inclination forming surface 202 (curved surface) with the radius of curvature r1 is used again to perform diameter reduction drawing on the sidewall of the bottomed cup Cp. In diameter reduction drawing (not illustrated) after the seventh stage, the tool radius of the inner tool 100 is made smaller than the tool radius in the previous stage, the moving stroke of the outer tool 200 is set to be shorter than the moving stroke in the previous stage, and the same drawing as the diameter reduction drawing at the second and third stages is repeated. As a result, the vertical surfaces s and the tapered surfaces t are alternately formed on the bottom portion 1C side of the tapered surface tm3 of the third portion in the continuous tapered surface tm formed by the diameter reduction drawing at the sixth stage.

[0044] By such diameter reduction drawing, the sidewall portion 1B as illustrated in FIG. 1 is formed. In the sidewall portion 1B, the tapered surfaces t and the vertical surfaces s are repeatedly and alternately formed below the bulging portion 11, and the continuous tapered surface tm is formed in the vicinity of the center in the vertical direction, and as a result, the sidewall portion 1B has a generally tapered profile.

[0045] In the diameter reduction drawing at the second stage and thereafter, an inner surface of the curl 10 is arranged so as to be in contact with an outer surface of the inner tool 100 (see FIG. 4(b2)). This is to inhibit the curl 10 (mouth portion) from becoming an oval shape, and this also makes it possible to suppress an occurrence of blocking when the metal containers 1 are stacked.

[0046] The metal container 1 illustrated in FIG. 1 has the bulging portion 11 below the opening portion 1A having the curl 10. Thus, in the stacked state, as illustrated in FIG. 5, an inner surface contact portion F2 on the inner surface of the opening portion 1A of the lower metal container 1 (bottom) is stacked in contact with an outer surface contact portion F1 on the outer surface of the sidewall portion 1B of the upper metal container 1 (top), and in one of the metal containers 1, the above-described bulging portion 11 is provided between the outer surface contact portion F1 and the inner surface contact portion F2.

[0047] As illustrated in FIG. 5, at the bulging portion 11 of one of the metal containers 1, a maximum width between a normal line Lp connecting the outer surface contact portion F1 and the inner surface contact portion F2 and the outer surface of the bulging portion 11 is defined as a holding width f. Further, an angle of the tapered surface t extending toward the outer surface contact portion F1 with respect to the normal line Lp is defined as an inclination angle α.

[0048] In order to prevent the above-described blocking phenomenon, it is preferable that the holding width f be 0.3 mm or more, and more preferably 0.8 mm or more. If the holding width f is smaller than this, the opening portion 1A is likely to bite into the bulging portion 11, and when vibration or impact is applied to the metal containers 1 in the stacked state during the transportation, the biting becomes larger, and the above-described blocking phenomenon is likely to occur.

[0049] One factor for determining the upper limit of the holding width f is an outer diameter R11 of the bulging portion 11 including the holding width f. The outer diameter R11 of the bulging portion 11 is preferably smaller than an outer diameter R10 of the curl 10 (opening portion 1A). If the outer diameter R11 of the bulging portion 11 is larger than the outer diameter R10 of the curl 10, when the metal containers 1 are stored side by side, the bulging portions 11 protrude laterally beyond the curls 10, and a storage space is increased by an amount of the protrusion, which results in a deterioration in storage efficiency.

[0050] Further, in order to prevent the blocking phenomenon, the inclination angle α is preferably set to be within a range from 10°to 50°. If the inclination angle α becomes smaller, the same situation as that in the above-described case in which the holding width f is made smaller arises, and the frictional resistance at a time of separating the metal container 1 from the stacked state becomes larger, and thus the blocking phenomenon is more likely to occur. Note that the holding width f and the inclination angle α are adjustment factors that are related to each other, and a countermeasure against the blocking phenomenon becomes more effective by combining the conditions of the two factors.

[0051] Further, in the stacked state of the metal containers 1, as illustrated in FIG. 5, a distance between the upper end of the opening portion 1A of the upper metal container 1 (top) and the upper end of the opening portion 1A of the lower metal container 1 (bottom) is a stacking height hs. The stacking height hs affects the storage space in the height direction in the stacked state. By causing the stacking height hs to be smaller, the storage efficiency in the height direction in the state in which the metal containers 1 are stacked is increased.

[0052] In the sidewall portion 1B of the metal container 1 illustrated in FIG. 1, the vertical surfaces s and the tapered surfaces t are alternately formed while including the above-described bulging portion 11, and as a result, the entire sidewall portion 1B has a tapered profile. In the vicinity of the center of the sidewall portion 1B in the vertical direction, the continuous tapered surface tm (longest inclined wall portion) is formed in which the taper length of the tapered surface t is the longest.

[0053] By alternately forming the vertical surfaces s and the tapered surfaces t on the sidewall portion 1B in this manner, when the metal container 1 is used as a beverage cup, steps formed by the vertical surfaces s and the tapered surfaces t function as a slip stopper when the metal container 1 is held by hand. In addition, the continuous tapered surface tm in the vicinity of the center of the sidewall portion 1B can be effectively used as a display space by including a printing step for printing a display such as an image on the continuous tapered surface tm.

[0054] As a material of a base material constituting the metal container 1, aluminum, an aluminum alloy, stainless steel, steel, or the like can be used. However, by adopting aluminum, an aluminum alloy, or steel, it is possible to obtain the metal container 1, suitable for a beverage container, which is light in weight, has a gloss appearance, and allows a user to easily feel the temperature of contents (for example, cold water) by hand. Further, as a material of the metal container 1, a plate-like metal material can be used that is obtained by coating both surfaces of the base material made of aluminum, an aluminum alloy, or steel with a single layer or multiple layers of a resin film such as a PET film.

[0055] When the above-described resin-coated base material is used, it is preferable to include a step of locally heating a portion to be processed into a curl or a flange, as a step preceding the opening portion forming step S4, illustrated in FIG. 2, in which the curl or the flange is formed. In the local heating, for example, high-frequency heating is used to locally heat the portion to be processed on the tip side of the necking portion n, at a target temperature of 200°C $\pm$ 30°C. By performing such local heating, the adhesion between the base material and the coated resin is increased, and the resin film can be suppressed from being peeled off from the base material during processing of the curl or the flange. As a result, a good finish can be achieved.

[0056] Note that, when the flange 20 as illustrated in FIG. 6 is formed on the opening portion 1A of the metal container 1, the flange 20 serves as a portion for winding and tightening an outer edge portion of a lid body. By winding and tightening the lid body, the metal container 1 becomes a can body for sealing contents. Here, the lid body to be wound and tightened is a metal lid body, and examples thereof include a pull-tab type or stay-on-tab type partial open end (POE) can lid, a full open end (FOE) can lid, and the like, but may be a lid body of another form. Further, instead of the flange 20, the opening portion 1A of another form may be used, and with respect to that opening portion 1A, a lid body of another form such as a screw lid may be detachably attached.

[0057] Further, as described above, when the resin-coated base material is used as the plate-like metal material, a lubricant (coolant) is not necessary at the sidewall portion forming step S5. This makes it possible to realize a manufacturing method in which a cleaning step is not provided between or after a series of steps. As a result, it is possible to carry out manufacturing with high productivity without washing and drying steps, and it is possible to carry out manufacturing advantageous from an environmental point of view by eliminating disposal of the lubricant.

[0058] In addition, the inclination forming surface 202 of the outer tool 200 is not limited to the curved surface as described above, and may have another shape. For example, the inclination forming surface may be a conical surface (not illustrated) inclined to spread outward with respect to the central axis 100P of the inner tool 100. When the inclination forming surface 202 is such a conical surface, the length in the inclination direction of the inclination forming surface 202 (conical surface) of the outer tool 200 used in the fourth to sixth diameter reduction drawing for forming the continuous tapered surface tm is preferably longer than that of the outer tool 200 used in the first to third diameter reduction drawing for forming the tapered surface t. As a result, as described above, the continuous tapered surface tm of sufficient size can be formed with a small number of steps of the diameter reduction drawing.

[0059] As described above, according to the method for manufacturing the metal container 1 according to the embodiment, by forming the sidewall portion 1B by the diameter reduction drawing from the bottom portion 1C side, it is possible to cope with various shapes. According to the method for manufacturing the metal container 1, in the formation of the sidewall portion 1B, the bulging portion 11 bulging in the circumferential direction is formed, and the continuous tapered surface tm where the tapered surfaces t are formed in a continuous manner is formed by performing diameter reduction drawing a plurality of times on the lower side than the bulging portion 11. As such, according to the method for manufacturing the metal container 1, it is possible to manufacture the metal container 1 capable of effectively forming a container having a shape capable of avoiding a blocking phenomenon during transportation of the metal container in the stacked state while forming the sidewall portion 1B having a surface of sufficient size, on which printing can be easily performed.

[0060] Although the embodiments of the present invention have been described in detail with reference to the drawings, specific configurations are not limited to these embodiments, and design changes and the like within a range not departing from the gist of the present invention are also included in the present invention. In addition, the above-described embodiments can be combined with each other by applying techniques to each other as long as there is no particular contradiction or problem in the purpose, configuration, and the like.

Reference Signs List

[0061] 1 Metal container, 1A Opening portion, 1B Sidewall portion, 1C Bottom portion, 10 Curl, 11 Bulging portion, 20 Flange, 100 Inner tool, 100P Central axis, 200 Outer tool, 201 Drawing surface, 202 Inclination forming surface, 300 Pressing tool, t Tapered surface, tm Continuous tapered surface, s Vertical surface, n Necking portion, S0 Plate-like metal material preparation step, S1 Cupping step, S2 Trimming step, S3 Tip diameter reduction drawing step, S4 Opening portion forming step, S5 Sidewall portion forming step, St1 to St6 Moving stroke, Tr1 to Tr6 Tool radius, Cp Bottomed cup, F1 Outer surface contact portion, F2 Inner surface contact portion, r, r1, r2 Radius of curvature, R10 Outer diameter of opening portion 1A, R11 Outer diameter of bulging portion 11

Claims

1. A metal container comprising:

an opening portion;
a sidewall portion; and
a bottom portion,
the metal container having a lower end outer diameter smaller than an upper end inner diameter,
wherein the metal container has a shape of a bottomed cup formed by drawing a plate-like metal material and subjected to trimming,
the sidewall portion having a tapered profile is formed by performing diameter reduction drawing on the bottom portion side with respect to the opening portion of the bottomed cup, and
the sidewall portion is formed with a bulging portion bulging in a circumferential direction and a continuous tapered surface where tapered surfaces are formed in a continuous manner by performing diameter reduction drawing a plurality of times on a lower side with respect to the bulging portion.

2. A method for manufacturing a metal container including an opening portion, a sidewall portion, and a bottom portion and having a lower end outer diameter smaller than an upper end inner diameter, the method comprising:

forming a bottomed cup by drawing a plate-like metal material;
trimming the bottomed cup; and
forming the sidewall portion having a tapered profile by performing diameter reduction drawing on the bottom portion side with respect to the opening portion of the bottomed cup,
wherein in the forming the sidewall portion, a

bulging portion bulging in a circumferential direction is formed, and a continuous tapered surface where tapered surfaces are formed in a continuous manner is formed by performing diameter reduction drawing a plurality of times on a lower side with respect to the bulging portion.

3. The method for manufacturing a metal container according to claim 2,
wherein assuming that a vertical height H from a ground contact portion to an upper end of the metal container is 100%, the continuous tapered surface has a vertical height H1 of at least from 20 to 30% with respect to the vertical height H.

4. The method for manufacturing a metal container according to claim 2, comprising:
forming the opening portion including a curl or a flange.

5. The method for manufacturing a metal container according to claim 2,
wherein a ratio of an upper end inner diameter to a lower end outer diameter of the metal container is from 1.2:1 to 2:1.

6. The method for manufacturing a metal container according to claim 2,
wherein the tapered surface and the continuous tapered surface are formed by diameter reduction drawing using an outer tool including a curved surface, and the curved surface of the outer tool for forming the continuous tapered surface has a larger radius of curvature than a radius of curvature of the curved surface of the outer tool for forming the tapered surface.

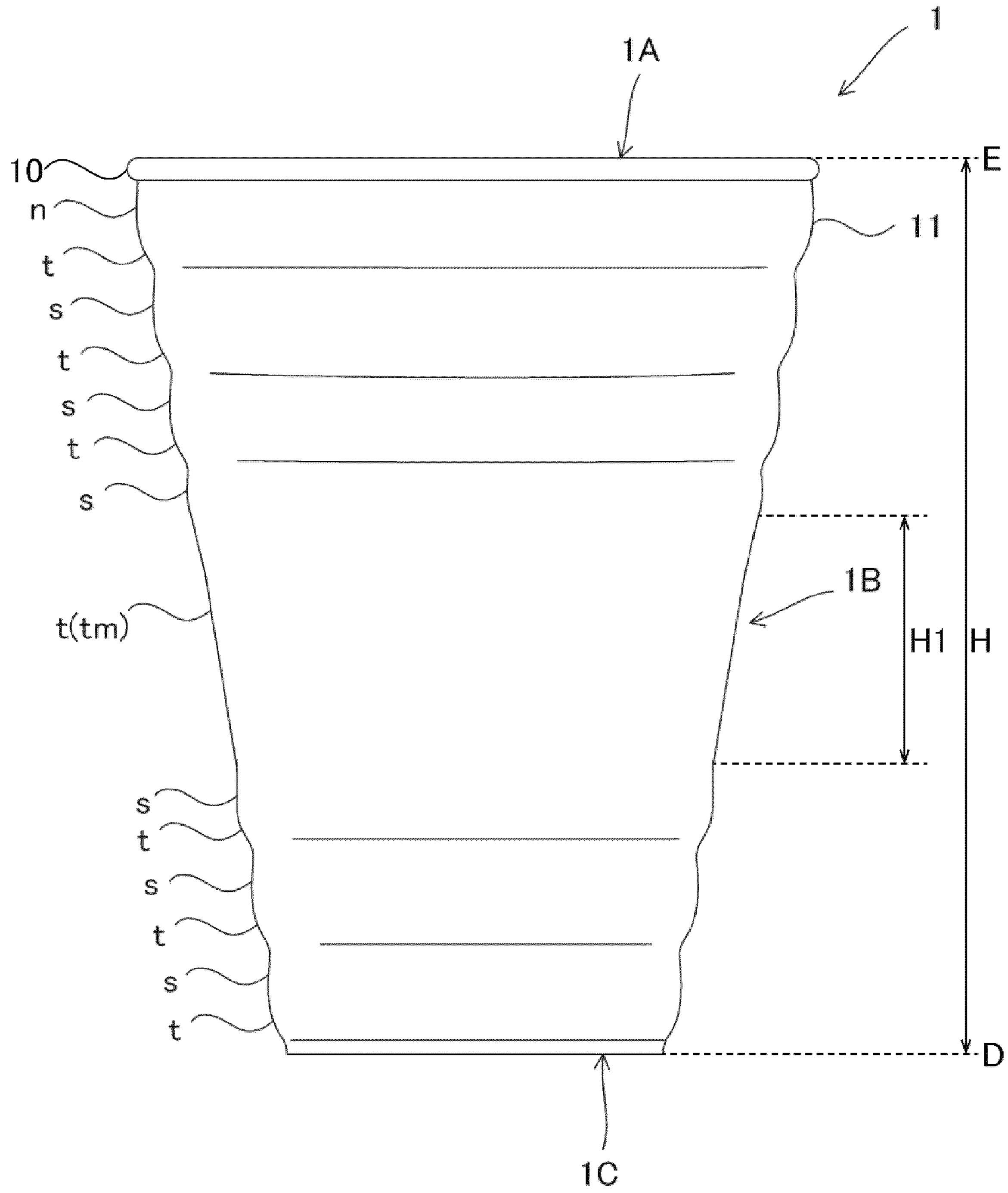


FIG. 1

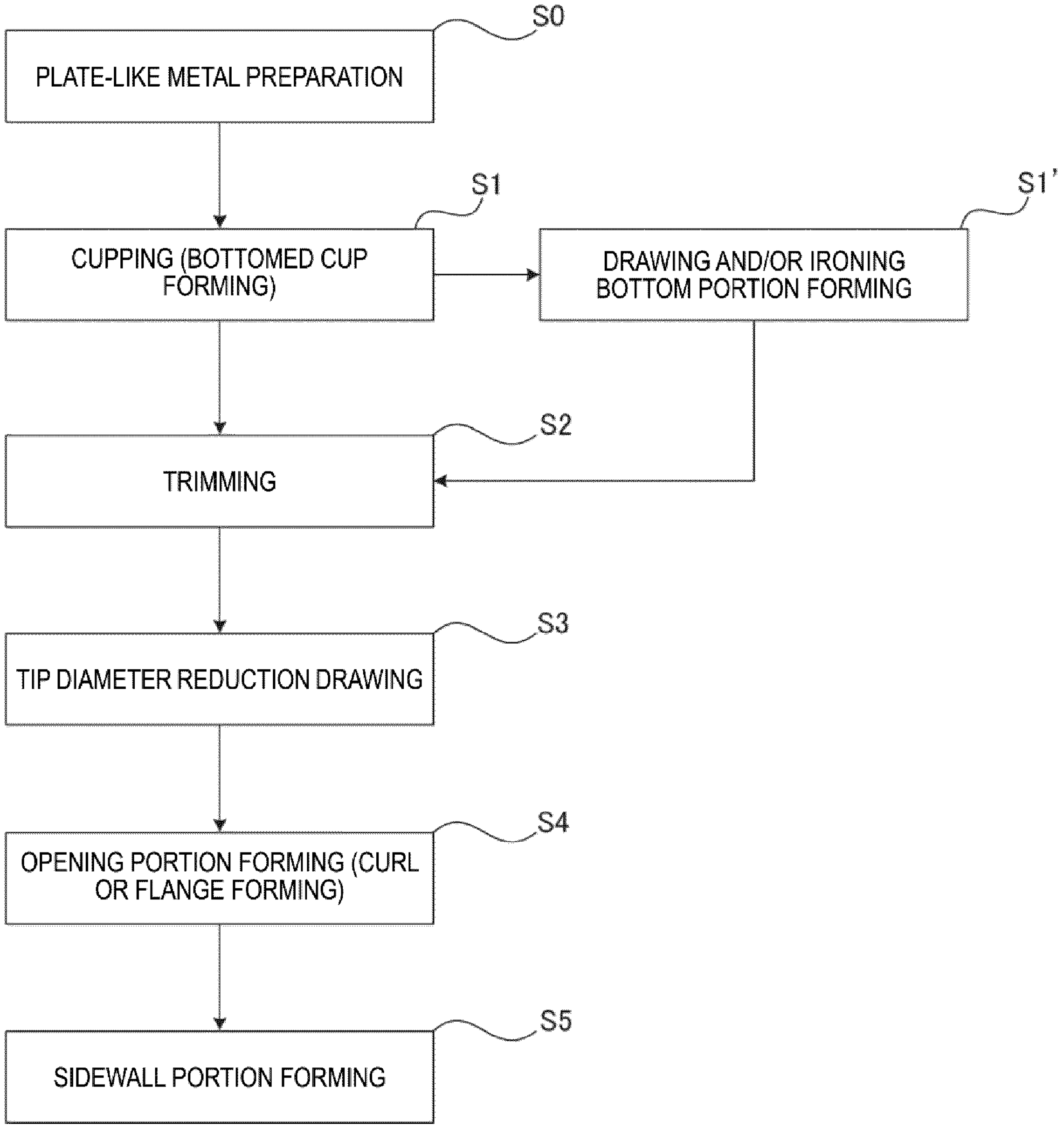
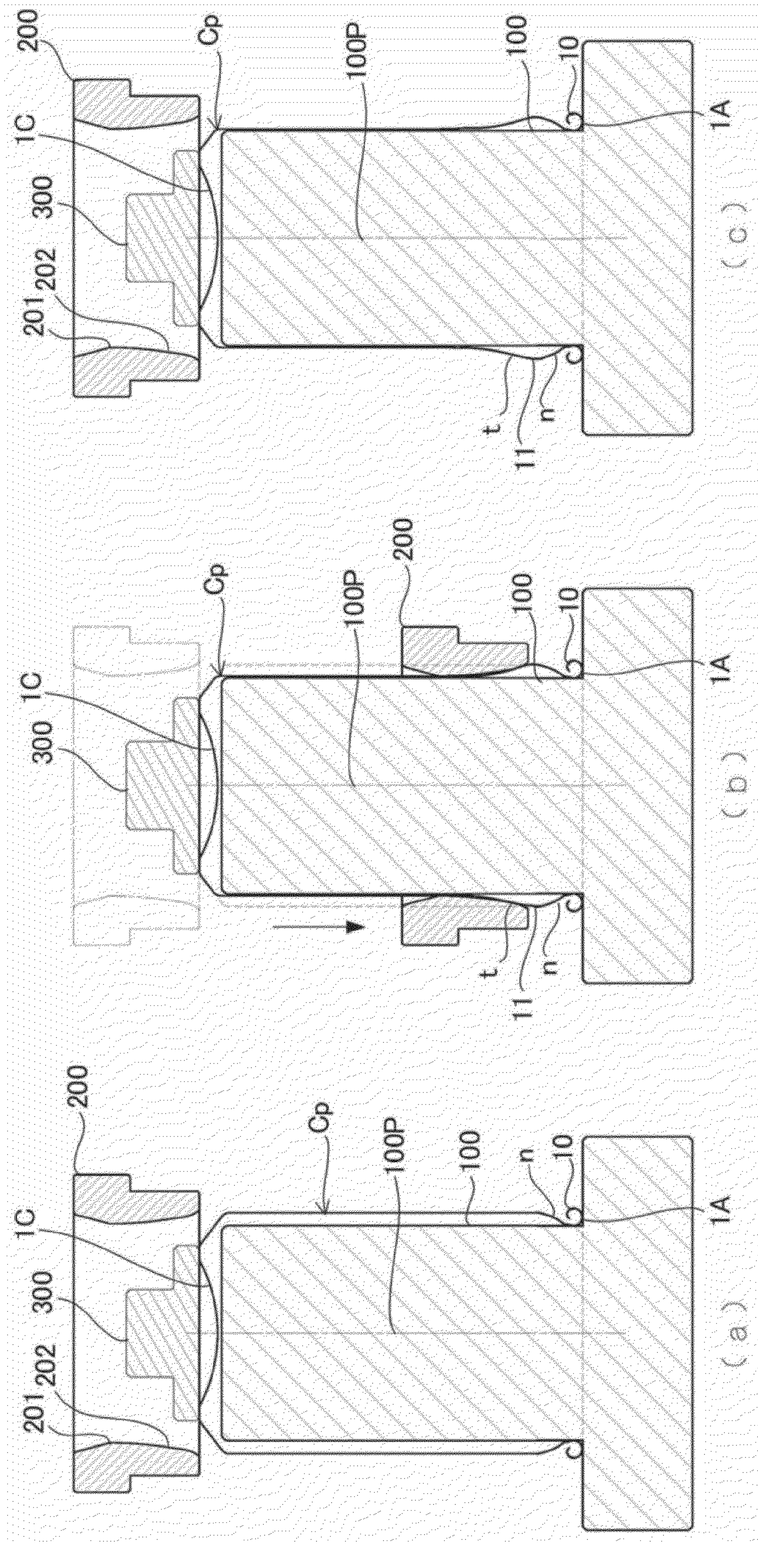
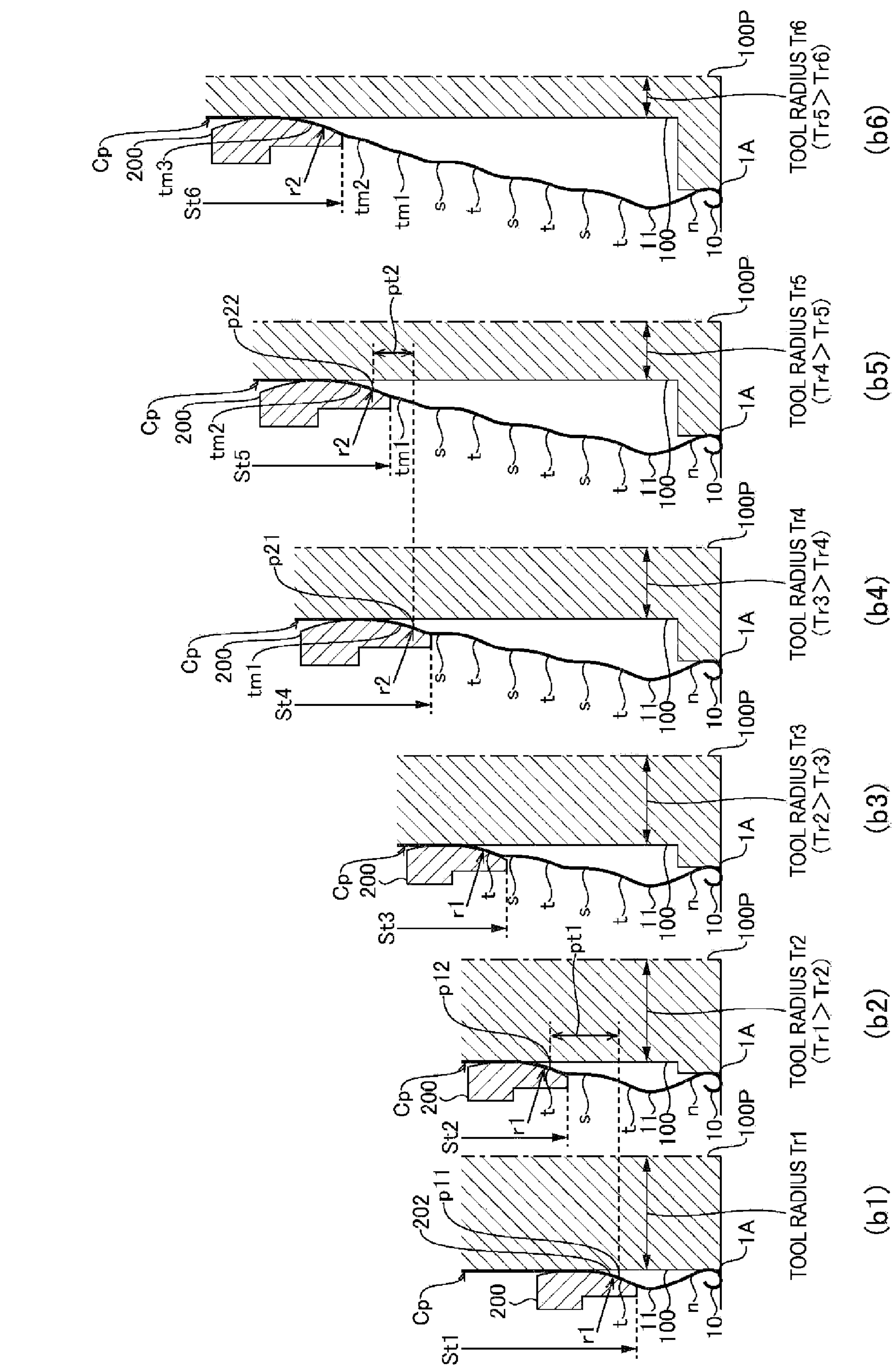

S0
PLATE-LIKE METAL PREPARATION
S1
CUPPING (BOTTOMED CUP FORMING)
S1'
DRAWING AND/OR IRONING BOTTOM PORTION FORMING
S2
TRIMMING
S3
TIP DIAMETER REDUCTION DRAWING
S4
OPENING PORTION FORMING (CURL OR FLANGE FORMING)
S5
SIDEWALL PORTION FORMING

FIG. 2



IMPLEMENTED IN ORDER OF (a) → (b) → (c)

FIG. 3



(b1)
TOOL RADIUS Tr1
(b2)
TOOL RADIUS Tr2
(Tr1 > Tr2)
(b3)
TOOL RADIUS Tr3
(Tr2 > Tr3)
(b4)
TOOL RADIUS Tr4
(Tr3 > Tr4)
(b5)
TOOL RADIUS Tr5
(Tr4 > Tr5)
(b6)
TOOL RADIUS Tr6
(Tr5 > Tr6)
Cp
200
202
p11
p12
p21
p22
pt1
pt2
r1
r2
St1
St2
St3
St4
St5
St6
tm1
tm2
tm3
t
s
n
11
10
100
100P
1A

FIG. 4

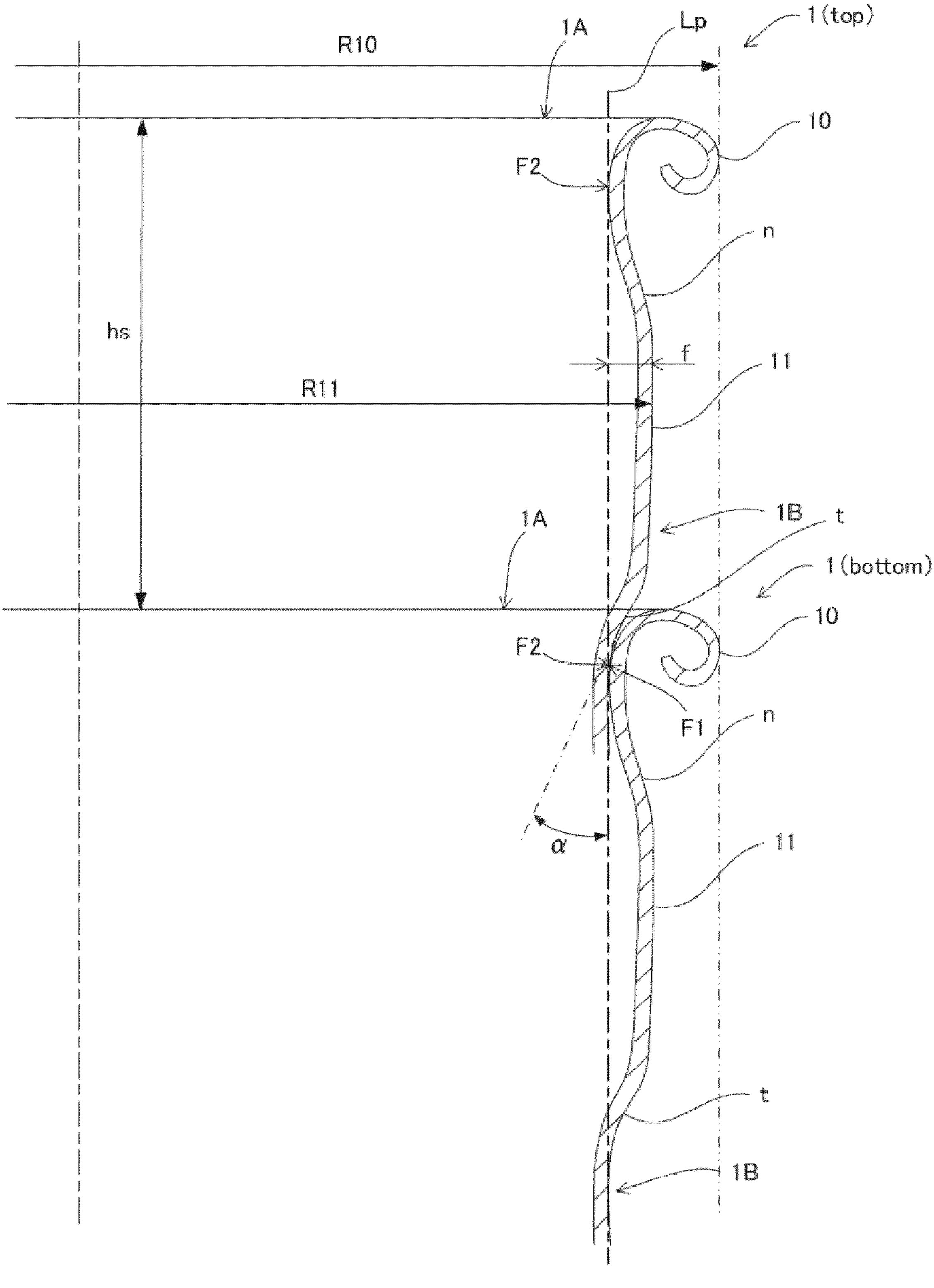


FIG. 5

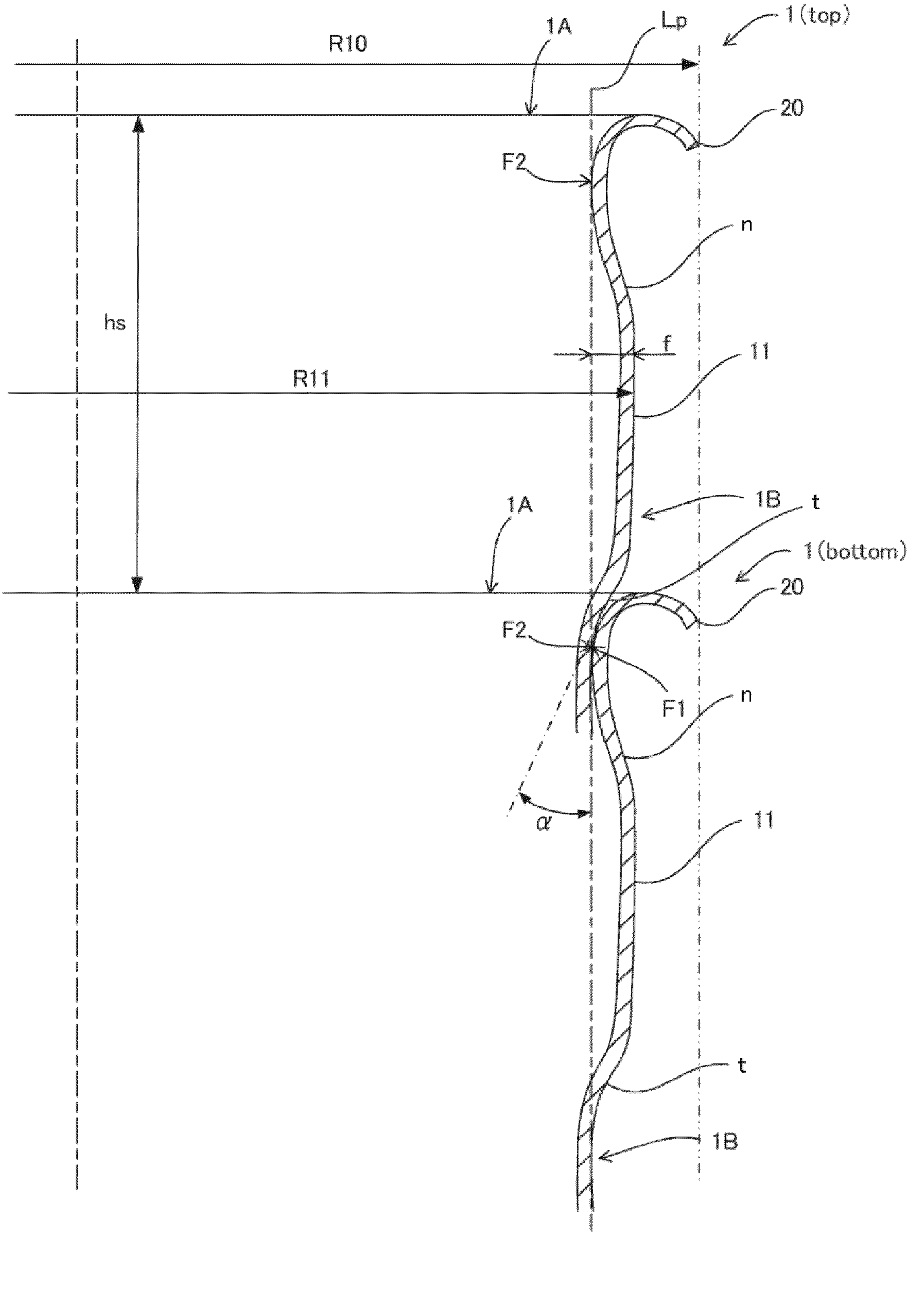


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2023/036854

A. CLASSIFICATION OF SUBJECT MATTER

B21D 22/28(2006.01)i; ***B21D 22/30***(2006.01)i; ***B21D 51/26***(2006.01)i; ***B65D 1/26***(2006.01)i; ***B65D 21/02***(2006.01)i; ***B65D 21/032***(2006.01)i
FI: B65D21/032; B65D1/26 110; B65D21/02 410; B21D22/28 A; B21D51/26 K; B21D51/26 L; B21D51/26 M; B21D22/30 B

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)

B21D22/28; B21D22/30; B21D51/26; B65D1/26; B65D21/02; B65D21/032

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2023
Registered utility model specifications of Japan 1996-2023
Published registered utility model applications of Japan 1994-2023

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.
X Y	JP 2022-52374 A (TOYO SEIKAN KAISHA, LTD.) 04 April 2022 (2022-04-04) paragraphs [0014]-[0021], fig. 1-2	1-5 1-6
Y	JP 2022-510285 A (BALL CORP.) 26 January 2022 (2022-01-26) paragraphs [0022], [0047], fig. 10	1-6
Y	JP 2002-292434 A (DAIWA CAN CO., LTD.) 08 October 2002 (2002-10-08) paragraphs [0071]-[0096], fig. 9-10	6

☐ 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
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"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
"T" 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	Date of mailing of the international search report
01 November 2023	**14 November 2023**

Name and mailing address of the ISA/JP	Authorized officer
Japan Patent Office (ISA/JP) **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2023/036854

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JP 2022-510285 A	26 January 2022	US 2019/0112100 A1 paragraphs [0021], [0067], fig. 10	
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		MX 2021006558 A	
JP 2002-292434 A	08 October 2002	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

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