(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 674 232 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
01.07.2020 Bulletin 2020/27

(21) Application number: **18849142.7**

(22) Date of filing: **03.08.2018**

(51) Int Cl.:
B65D 81/38 *(2006.01)* ***B65D 77/04*** *(2006.01)*

(86) International application number:
PCT/JP2018/029238

(87) International publication number:
WO 2019/039236 (28.02.2019 Gazette 2019/09)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **24.08.2017 JP 2017161065**

(71) Applicant: **Shinfuji Burner Co., Ltd.**
Toyokawa-shi, Aichi 441-0314 (JP)

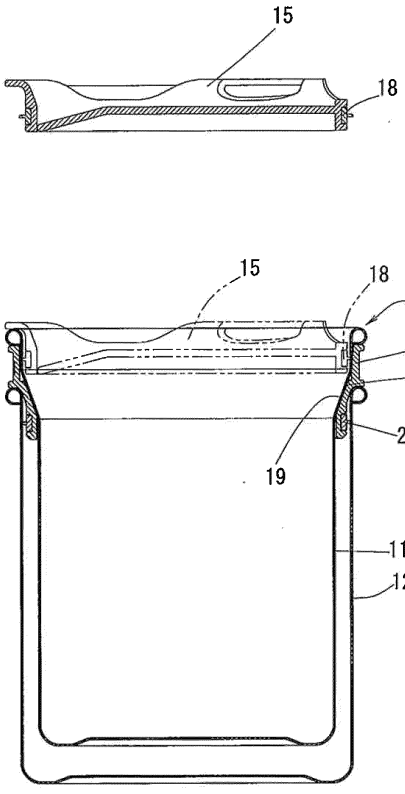
(72) Inventor: **HIOKI, Eiichi**
Toyokawa-shi
Aichi 441-0314 (JP)

(74) Representative: **Kuhnen & Wacker**
Patent- und Rechtsanwaltsbüro PartG mbB
Prinz-Ludwig-Straße 40A
85354 Freising (DE)

(54) **THERMALLY INSULATED CONTAINER**

(57) A thermally insulated container is provided which includes a tubular inner container part (11) having a closed bottom and an open top end; a tubular outer container part (12) having a closed bottom and an open top end, for receiving therein the tubular inner container part (11); and a connection member (13). With the inner container part (11) received in the outer container part (12), the connection member (13) is disposed between an upper end portion of the inner container part (11) and an upper end portion of the outer container part (12) to define a sealed space having a predetermined size between the outer peripheral surface of the inner container part (11) and the inner peripheral surface of the outer container part (12).

FIG. 2



EP 3 674 232 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a thermally insulated container having a multiple wall structure.

BACKGROUND ART

[0002] The following thermally insulated containers are being practically used, e.g., as mugs: thermally insulated containers having a multiple wall structure including inner and outer container parts defining therebetween a sealed space having a predetermined size so as to keep its contents at an elevated or reduced temperature. A method for manufacturing such a thermally insulated container is disclosed e.g., in the below-identified Patent Document 1. In this method, while keeping a predetermined gap between an externally mounted molded member (corresponding to the outer container part) and an internally mounted molded member (corresponding to the inner container part), the diameter of an open end portion of the externally mounted molded member is reduced until the open end portion of the outer molded portion is brought into close contact (pressure contact) with an open end portion of the internally mounted molded member, thereby forming a joint portion at which the molded members are joined together. Air may be left in the gap between the inner and outer molded members, or this gap may be in a vacuum state. (See, e.g., paragraphs 0019 to 0020 and Fig. 3 of Patent Document 1.)

[0003] The inner and outer container parts can be fixedly joined together by closely pressing them against each other as disclosed in Patent Document 1, or can be integrally joined together by metal welding if the container parts are made of metal, or by plastic welding if the container parts are made of resin.

PRIOR ART DOCUMENT(S)

PATENT DOCUMENT(S)

[0004] Patent document 1: Japanese Unexamined Patent Application Publication No. 2008-221317

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0005] In order to fixedly/integrally join the inner and outer container parts by pressing them against each other as disclosed in Patent Document 1, or by metal welding, plastic welding, etc., an elaborate device and/or a skilled metal welder is needed, which increases the manufacturing cost or makes mass-production difficult. Also, if the inner and outer container parts are integrally joined together by metal welding, since the same metal is preferably used for the inner and outer container parts, variations of metals selectable for the inner and outer container parts are limited.

[0006] A thermally insulated container having such a multiple wall structure can be heated directly if it has a vacuum interior structure, but cannot be heated directly if air is present in the container, because such direct heating will expand the air. However, a user may not be able to determine whether or not the thermally insulated container has a vacuum interior structure, and, in this case, the user may have trouble when heating the container.

[0007] It is an object of the present invention to provide a thermally insulated container having a multiple wall structure which can be constructed in a simple manner, and which is capable of keeping its contents at an elevated or reduced temperature.

MEANS FOR SOLVING THE PROBLEMS

[0008] In order to achieve the above object, the present invention provides a thermally insulated container comprising: a tubular inner container part having a closed bottom and an open top end; a tubular outer container part having a closed bottom and an open top end, wherein the tubular inner container part is received in the tubular outer container part; and a connection member, wherein, with the tubular inner container part received in the tubular outer container part, the connection member is disposed between an upper end portion of the tubular inner container part and an upper end portion of the tubular outer container part so as to define a sealed space having a predetermined size between an outer peripheral surface of the tubular inner container part and an inner peripheral surface of the tubular outer container part.

[0009] By connecting the inner and outer container parts together through the connection member, it is possible to omit welding or a similar time-consuming step, and thus to reduce the manufacturing cost of a thermally insulated container having a multiple wall structure and capable of keeping its contents at an elevated or reduced temperature. Also, by removing the inner container part from the outer container part, it is possible to conveniently heat only the inner container part. It is also possible to separately use the inner container part and the outer container part as independent containers, instead of using the entire container as a double-walled thermally insulated container. For example, two users can separately use the inner container part and the outer container part, or a single user can put a food into the inner container part, and a beverage into the outer container part.

[0010] In the thermally insulated container, it is preferable that the tubular inner container part has an outer periphery including a tapered surface of which an outer diameter decreases toward a bottom end of the tubular inner container part, and that the connection member has an inner periphery including a tapered surface of which an inner diameter decreases in an axial direction of the connection member such that the tapered surface of the connection member is disposed along the tapered

surface of the tubular inner container part.

[0011] By forming such tapered surfaces on both of the inner container part and the connection members, when the inner container part is inserted through the connection member with the connection member fitted to the upper end portion of the outer container part, the inner container part is smoothly guided by the connection member so as to become coaxial with the outer container part. As a result, a circumferential gap having a uniform size is defined between the inner peripheral surface of the outer container part and the outer peripheral surface of the inner container part, thereby providing an improved ability to keep the contents at an elevated or reduced temperature. Also, when the inner container part is inserted, the tapered surfaces of the inner container part and the connection member come into surface contact with each other, thereby preventing the inner container part from being further inserted. As a result, a gap having a predetermined size is defined between the bottom surfaces of the inner container part and the outer container part. Since the bottom surfaces of the inner and outer container parts are kept out of contact with each other, the contents of the container can be reliably kept at an elevated or reduced temperature.

[0012] In the thermally insulated container having such a tapered surface on its inner container part, the connection member preferably includes: a plurality of radially inwardly rising protrusions on a radially inner surface of an upper end portion of the connection member; and a plurality of radially inwardly rising protrusions on a radially inner surface of a lower end portion of the connection member.

[0013] By forming such protrusions, at the initial stage of the insertion of the inner container part into the outer container part, it is possible to reduce the friction between the connection member and the lower end portion (small diameter portion) of the inner container part due to their contact with each other, and thus to smoothly insert the inner container part into the outer container part. Also, upon completion of the insertion, the upper end portion (large diameter portion) of the inner container part strongly abuts against the protrusions on the upper end portion of the connection member, so that the inner container part is reliably retained by the connection member (and thus by the outer container part). The positions and the number of the protrusions on each of the upper and lower end portions of the connection member are not particularly limited, but preferably, such protrusions are disposed at regular intervals in the circumferential direction. For example, such protrusions may be composed of three protrusions disposed at 120-degree intervals, or four protrusions disposed at 90-degree intervals.

[0014] In the thermally insulated container, the connection member is preferably an injection-molded member.

[0015] The injection-molded connection member has a predetermined rigidity, and thus is less likely to deform when the inner container part is inserted into the connection member. This prevents the inner container part from being inserted into the outer container part while being tilted relative to the outer container part, which in turn prevents the gap between the inner and outer container parts from partially becoming narrow, or prevents the inner and outer container parts from partially coming into contact with each other, thereby maintaining heat-insulating properties of the container.

[0016] In the thermally insulated container, a material forming the tubular inner container part may be different in kind from a material forming the tubular outer container part.

[0017] In other words, according to the intended use, it is possible to select an optimal combination of materials for the inner and outer container parts. For example, the inner container part, for which heat resistance is required, may be made of stainless steel, whereas the outer container part may be made of a resin material, or titanium, aluminum or an alloy thereof so as to be light in weight.

[0018] In the thermally insulated container, one of a cooling medium and a heating medium may be placed in the sealed space.

[0019] By placing a heating or cooling medium in the sealed space, not only is it possible to simply maintain the temperature of the contents of the container such as a beverage, but the contents can also be positively heated or cooled. For example, it is possible to make ice cream, or cook food, in the inner container part. The hearing or cooling medium may be, e.g., refrigerant, ice water or hot water.

EFFECTS OF THE INVENTION

[0020] Since the multiple wall structure of the thermally insulated container according to the present invention is constructed by the inner container part, the outer container part, and the connection member disposed between the inner and outer container parts, this thermally insulated container can be manufactured at a low cost, and still shows sufficient ability to keep its contents at an elevated or reduced temperature, compared to a thermally insulated container of which the inner and outer container parts are integrally joined together by e.g., welding.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

Fig. 1A is a plan view of a thermally insulated container (mug) according to a first embodiment of the present invention.

Fig. 1B is a side view of the thermally insulated container (mug) according to the first embodiment.

Fig. 2 is a sectional view taken along line II-II of Fig. 1B.

Fig. 3 is an enlarged sectional view of a portion of Fig. 2.

Fig. 4 is a perspective view of the thermally insulated container of Figs. 1A and 1B.

Fig. 5 is an exploded side view of the thermally insulated container of Figs. 1A and 1B.

Fig. 6 is a perspective view of the thermally insulated container of Figs. 1A and 1B.

Fig. 7 is a sectional view of a thermally insulated container according to a second embodiment of the present invention.

Fig. 8 is a sectional view of a thermally insulated container according to a third embodiment of the present invention.

Fig. 9 is a sectional view of a thermally insulated container according to a fourth embodiment of the present invention.

Fig. 10 is a sectional view of a thermally insulated container according to a fifth embodiment of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0022] Figs. 1A to 6 illustrate a thermally insulated container 10 according to the first embodiment of the present invention. The thermally insulated container 10 is a mug (the mug is also hereinafter denoted by numeral "10") having a double wall structure, and mainly used outdoors or at home. The mug 10 includes, as its main elements, an inner container part 11, an outer container part 12, and a connection member 13.

[0023] The inner container part 11 is a tubular member having a closed bottom and an open top end, for holding beverages and other items. The inner container part 11 has an outer periphery including, at its portion close to the top end, a tapered surface 14 of which the outer diameter decreases toward the bottom end of the inner container part 11. In the embodiment, the inner container part 11 is made of stainless steel, but it may be made of a resin material if high strength or heat resistance is not required.

[0024] The mug 10 may include a lid 15 disposed at the top end opening of the inner container part 11. The lid 15 is formed with a drinking opening 16 and an air hole 17 so that, when a beverage flows out of the inner container part 11 through the drinking opening 16, air simultaneously flows into the inner container part 11 through the air hole 17, thereby enabling the beverage to flow out smoothly. A seal member 18 is disposed at the outer peripheral edge of the lid 15 so as to reliably keep the lid 15 fitted in the inner container part 11.

[0025] The thermally insulated container 10 of the embodiment is exemplified as a mug 10 of which the lid 15 has a drinking opening 16 and an air hole 17 so that a user can drink the beverage in the inner container part 11 with the lid 15 attached. However, the drinking opening 16 and the air hole 17 may be omitted to provide heat insulating and sealing properties to the lid 15. The thermally insulated container 10 including such a lid 15 can be used not only as a mug 10, but as e.g., a pot or a jar.

[0026] The outer container part 12 is a tubular member having a closed bottom and an open top end, in which the inner container part 11 is received. The outer container part 12 has a uniform outer diameter from its top end to its bottom end. In the embodiment, the outer container part 12 is made of the same material as the inner container part 11, i.e., stainless steel, but it may be made of a resin material so that heat is not transferred from the mug 10 to a user's hand gripping the mug 10. Also, if lightness in weight is important, the outer container part 12 may be made of titanium, aluminum, or an alloy thereof.

[0027] The inner diameter of the outer container part 12 at its open end is equal to the inner diameter of the inner container part 11 at its open end (see Fig. 3). Therefore, instead of putting the lid 15 on the inner container part 11, the lid 15 can be put on the top end opening of the outer container part 12, too.

[0028] With the inner container part 11 received in the outer container part 12, the connection member 13 defines a sealed space having a predetermined size between the outer peripheral surface of the inner container part 11 and the inner peripheral surface of the outer container part 12. For this purpose, the connection member 13 is disposed between the upper end portions of the inner and outer container parts 11 and 12. The connection member 13 has, on its inner periphery, a tapered surface 19 of which the inner diameter decreases axially downwardly of the connection member 13. The tapered surface 19 is disposed along the tapered surface 14 of the inner container part 11. The lower end portion of the connection member 13that is located below the tapered surface 19 has a smaller diameter than the upper end portion of the connection member 13 that is located above the tapered surface 19. The connection member 13 is formed by injection molding of a resin material, and is rigid enough not to be deformed to a large degree when the inner container part 11 is inserted into the outer container part 12.

[0029] The connection member 13 includes a plurality of radially inwardly rising protrusions 20 on the radially inner surface of its upper end portion; and a plurality of radially inwardly rising protrusions 21 on the radially inner surface of its lower end portion (see Fig. 6). The protrusions 20 and 21 are ribs extending in the axial direction of the connection member 13. In the embodiment, the protrusions 20, 21 on each of the upper and lower end portions of the connection members 13 are exemplified as three protrusions circumferentially disposed at intervals of 120 degrees, but the positions and the number of the protrusions 20, 21 are not particularly limited, and may be altered as necessary.

[0030] A seal member 22 is disposed at the radially outer surface of the lower end portion of the connection member 13. The seal member 22 is made of silicon resin, and reliably keeps the connection member 13 fitted in the outer container part 12 even if the connection member 13 is a rigid injection-molded member. While, in the em-

bodiment, the connection member 13 and the seal member 22 are separate members, they may be formed integrally with each other using a relatively soft material such as silicon resin.

[0031] The connection member 13 partially covers the upper end portion of the inner container part 11 (see Fig. 2), thus reducing the contact area of a user's lips with the upper end portion of the inner container part 11. This minimizes the sensation of heat felt when the user's lips touch the inner container part 11 with a high-temperature beverage in the mug 10 (i.e., in the inner container part 11.

[0032] It is now described how the mug 10 is assembled. First, as illustrated in Fig. 6, the connection member 13 is fitted into the top end opening of the outer container part 12. Then, the inner container part 11 is inserted through the connection member 13 and into the outer container part 12 so as to be arranged coaxially with the outer container part 12. At the initial stage of the insertion, the protrusions 21 of the connection member 13 on the radially inner surface of its lower end portion come into contact with the lower end portion (small diameter portion) of the inner container part 11. Since the protrusions 21 come into substantially line contact with the lower end portion of the inner container part 11, and are shaped so as to guide the insertion of the lower end portion of the inner container part 11, it is possible to minimize the friction between the inner container part 11 and the connection member 13, and thus to smoothly insert the inner container part 11.

[0033] Also, even if the inner container part 11 and the outer container part 12 are not coaxial with each other at the initial stage of the insertion, the inner container part 11 eventually becomes coaxial with the outer container part 12 due to the tapered surface 14 of the inner container part 11 coming into surface contact with the tapered surface 19 of the connection member 13.

[0034] Also, upon completion of the insertion, the protrusions 20 of the connection member 13 on the radially inner surface of its upper end portion strongly abut against the upper end portion (large diameter portion) of the inner container part 11, so that the inner container part 11 is reliably retained by the connection member 13 (and thus by the outer container part 12). This reliably prevents the separation of the inner container part 11when the mug 10 is tilted.

[0035] As necessary, a heating or cooling medium such as refrigerant, ice water or hot water may be placed in the sealed space between the inner container part 11 and the outer container part 12 so that the contents of the mug 10 can be not only simply kept at an elevated or reduced temperature,, but also positively heated or cooled.

[0036] Fig. 7 illustrates a mug 10 according to the second embodiment of the present invention. The mug 10 of the second embodiment is identical in basic structure to the mug 10 of the first embodiment, but the shapes of the inner container part 11, outer container part 12 and connection member 13 are different.

[0037] Specifically, the mug 10 of the second embodiment has, besides the tapered surface on the inner container part 11, an additional tapered surface on the outer container part 12, and thus the outer shape of the mug 10 is such that its lower end portion is slimmer than its upper end portion. Also, two seal members 22 are disposed on the outer periphery of the connection member 13 so as to be vertically spaced apart from each other, thereby ensuring airtightness between the outer container part 12 and the connection member 13. An externally mounted member 23 is disposed on the outer peripheral surface of an upper end portion of the outer container part 12. The externally mounted member 23 is provided to enable a user to grip the mug 10 more reliably (easily).

[0038] Fig. 8 illustrates a mug 10 according to the third embodiment of the present invention. The mug 10 of the third embodiment is identical in basic structure to the mug 10 of the first embodiment, but the shape of the connection member 13 is different.

[0039] Specifically, the connection member 13 of the mug 10 according to the third embodiment has no seal member 22, and is wedged between the inner and outer container parts 11 and 12 by the force with which the inner container part 11 is fitted into the outer container part 12. In this arrangement, since the shape of the connection member 13 can be simplified, it may be possible to reduce the manufacturing cost. The connection member 13 of this embodiment is preferably made of silicon resin, a material having flexibility. An externally mounted member 23 is disposed on the outer peripheral surface of the upper end portion of the outer container part 12. The externally mounted member enables a user to grip the mug 10 more reliably (easily).

[0040] Fig. 9 illustrates a mug 10 according to the fourth embodiment of the present invention. The mug 10 of the fourth embodiment is identical in basic structure to the mug 10 of the first embodiment, but the shapes of the inner container part 11, outer container part 12 and connection member 13 are different.

[0041] Specifically, the inner container part 11 of the mug 10 according to the fourth embodiment has a tapered surface 14 near its top end, and has an outer diameter that gradually decreases from the tapered surface 14 to the bottom end of the inner container part 11. The outer container part 12 has an outer diameter that gradually decreases from a portion of the outer container part 12 close to its top end to its bottom end. Therefore, the outer shape of the mug 10 is such that its lower end portion is slimmer than its upper end portion. The connection member 13 has no seal member 22, and is wedged between the inner and outer container parts 11 and 12 by the force with which the inner container part 11 is fitted into the outer container part 12. In this arrangement, since the shape of the connection member 13 can be simplified, it may be possible to reduce the manufacturing cost, as in the third embodiment.

[0042] Fig. 10 illustrates a mug 10 according to the fifth

embodiment of the present invention. The mug 10 of the fifth embodiment is identical in basic structure to the mug 10 of the first embodiment, but the shapes of the inner container part 11, outer container part 12 and connection member 13 are different.

[0043] Specifically, the inner and outer container parts 11 and 12 of the mug 10 according to the fifth embodiment are identical in shape to each other, and each has an outer diameter that gradually decreases from a portion of the container part close to its top end to its bottom end. The connection member 13 has no seal member 22, and is wedged between the inner and outer container parts 11 and 12 by the force with which the inner container part 11 is fitted into the outer container part 12. In this arrangement, since the inner and outer container parts 11 and 12 can be formed with the same mold, and the shape of the connection member 13 can be simplified, it may be possible to reduce the manufacturing cost.

[0044] The above embodiments are mere examples in every respect. For example, the shapes of the elements of the mug 10, such as the inner container part 11, the outer container part 12 and the connection member 13, may be altered as necessary, provided that the object of the present invention, i.e., to provide a thermally insulated container having a multiple wall structure which can be constructed in an simple manner, and which is capable of keeping its contents at an elevated or reduced temperature, can be achieved.

[0045] For example, while the mug 10 is exemplified as having a double wall structure in each of the above embodiments, the mug 10 may have a triple or more wall structure. Such a mug 10 may show an improved ability to keep its contents at an elevated or reduced temperature.

[0046] While the mug 10 having a double wall structure described in each of the above embodiments is capable of keeping its contents at an elevated or reduced temperature, a portion of the outer container part 12 or the connection member 13 of the mug 10 may have the function of a simplified valve element or air pump capable of discharging air in the space between the two walls of the mug (thereby creating a vacuum or a decompressed state in this space). This further improves the ability of the mug 10 to keep its contents at an elevated or reduced temperature, compared to when there is an air layer at atmospheric pressure in the space between the two walls of the mug 10.

DESCRIPTION OF REFERENCE NUMERALS

[0047]

10: thermally insulated container (mug)
11: inner container part
12: outer container part
13: connection member
14: tapered surface (of the inner container part)
15: lid
16: drinking opening
17: air hole
18: seal member (for the lid)
19: tapered surface (of the connection member)
20: protrusion (on the upper end portion of the connection member)
21: protrusion (on the lower end portion of the connection member)
22: seal member (for the connection member)
23: externally mounted member

Claims

1. A thermally insulated container comprising:

a tubular inner container part (11) having a closed bottom and an open top end;
a tubular outer container part (12) having a closed bottom and an open top end, wherein the tubular inner container part (11) is received in the tubular outer container part (12); and
a connection member (13), wherein, with the tubular inner container part (11) received in the tubular outer container part (12), the connection member (13) is disposed between an upper end portion of the tubular inner container part (11) and an upper end portion of the tubular outer container part (12) so as to define a sealed space having a predetermined size between an outer peripheral surface of the tubular inner container part (11) and an inner peripheral surface of the tubular outer container part (12).

2. The thermally insulated container according to claim 1, wherein the tubular inner container part (11) has an outer periphery including a tapered surface (14) of which an outer diameter decreases toward a bottom end of the tubular inner container part (11), and wherein the connection member (13) has an inner periphery including a tapered surface (19) of which an inner diameter decreases in an axial direction of the connection member (13) such that the tapered surface (19) of the connection member (13) is disposed along the tapered surface (14) of the tubular inner container part (11).

3. The thermally insulated container according to claim 2, wherein the connection member (13) includes:

a plurality of radially inwardly rising protrusions (20) on a radially inner surface of an upper end portion of the connection member (13); and
a plurality of radially inwardly rising protrusions (21) on a radially inner surface of a lower end portion of the connection member (13).

4. The thermally insulated container according to any

one of claims 1 to 3, wherein the connection member (13) is an injection-molded member.

5. The thermally insulated container according to any one of claims 1 to 4, wherein a material forming the tubular inner container part (11) is different in kind from a material forming the tubular outer container part (12).

6. The thermally insulated container according to any one of claims 1 to 5, wherein one of a cooling medium and a heating medium can be placed in the sealed space.

FIG. 1A

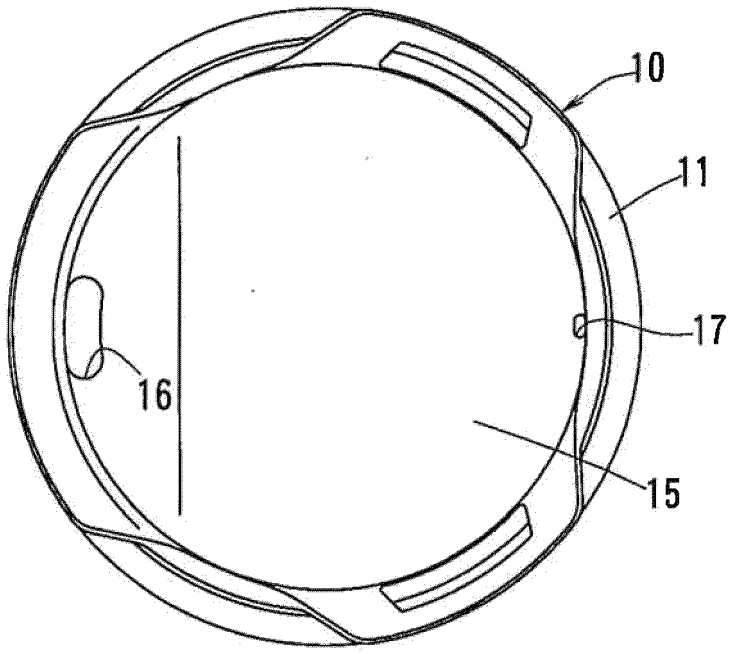


FIG. 1B

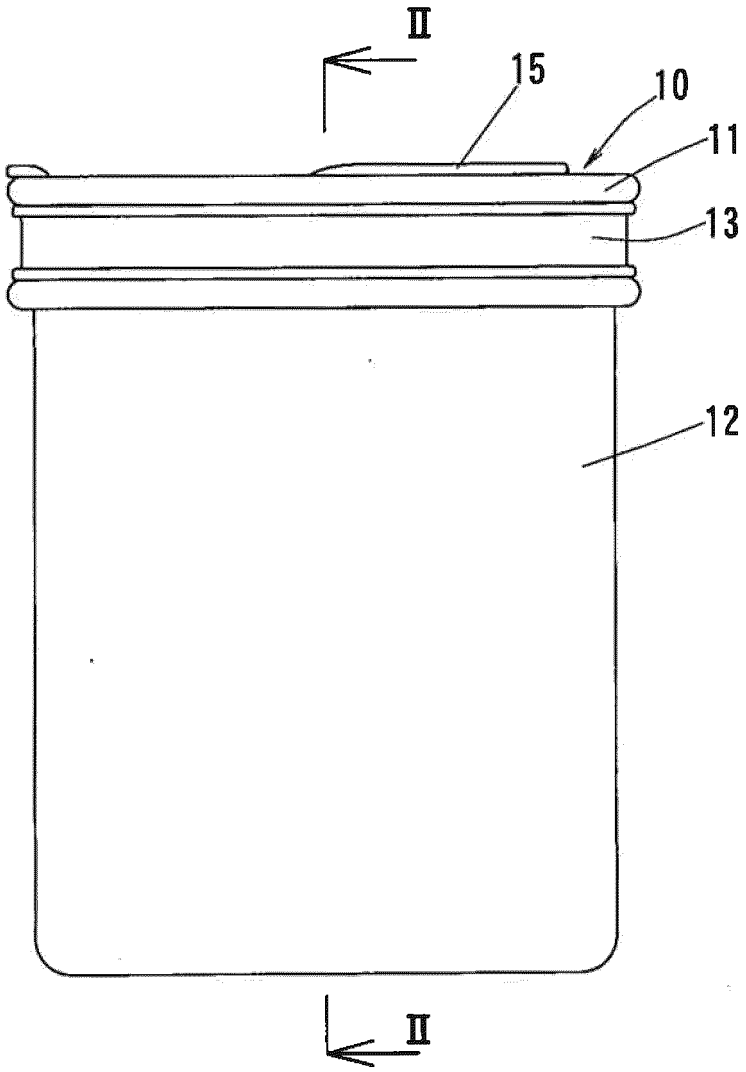


FIG. 2

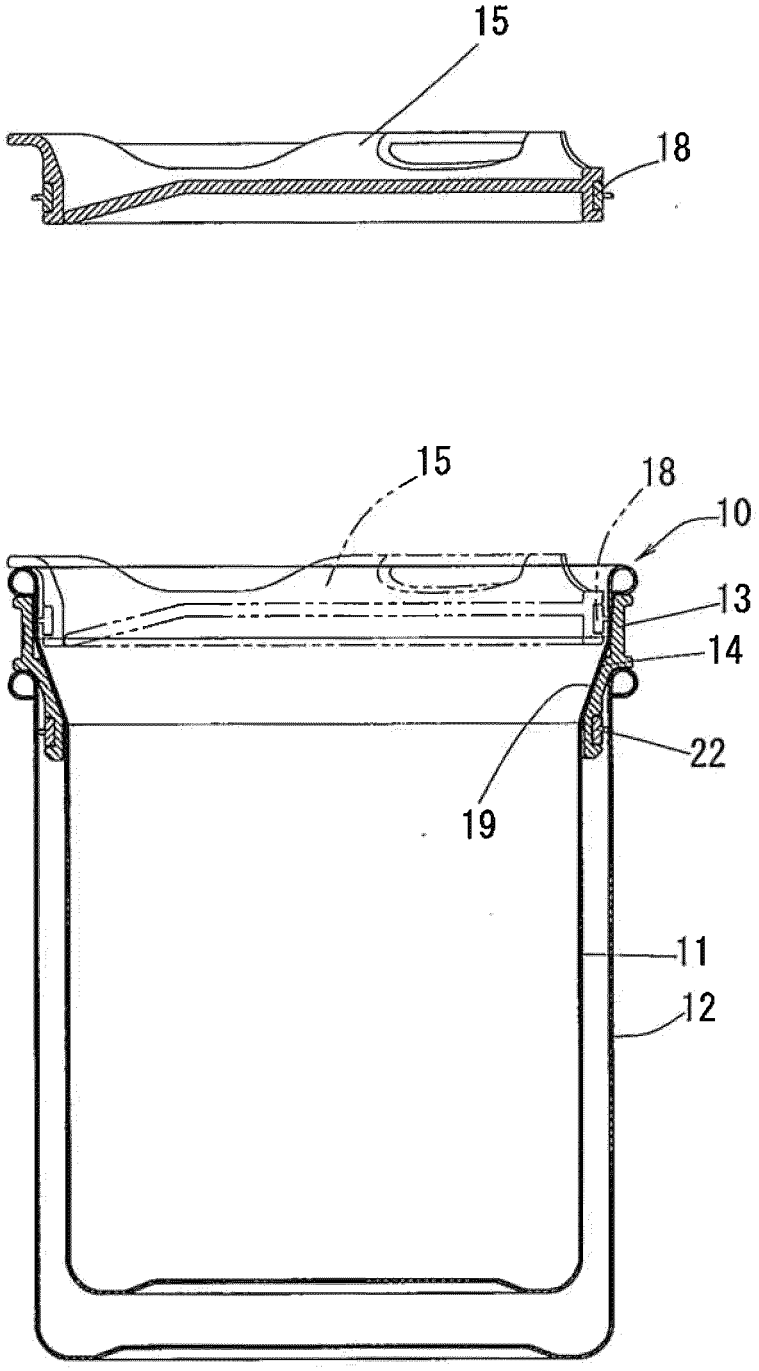


FIG. 3

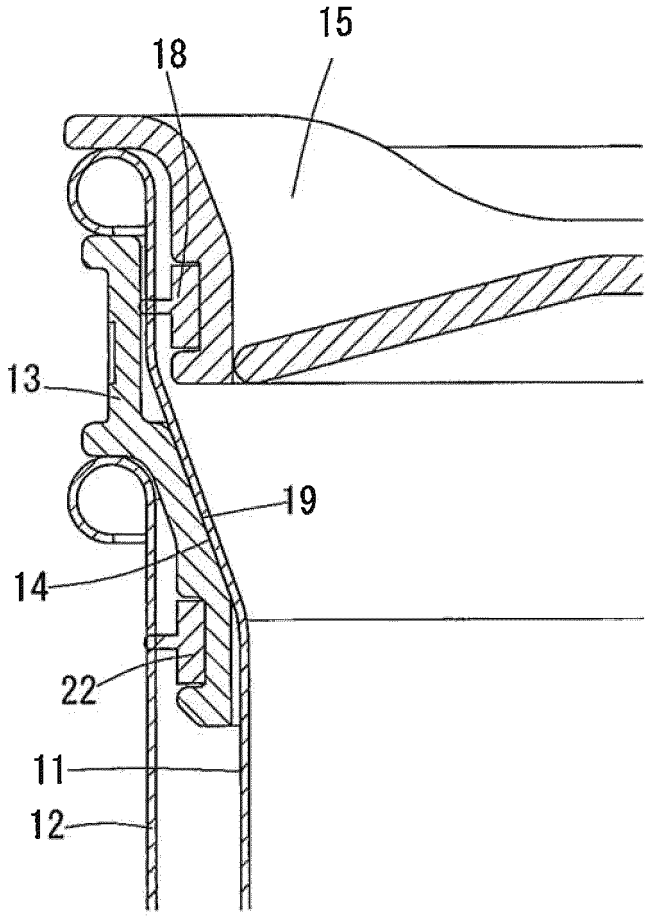


FIG. 4

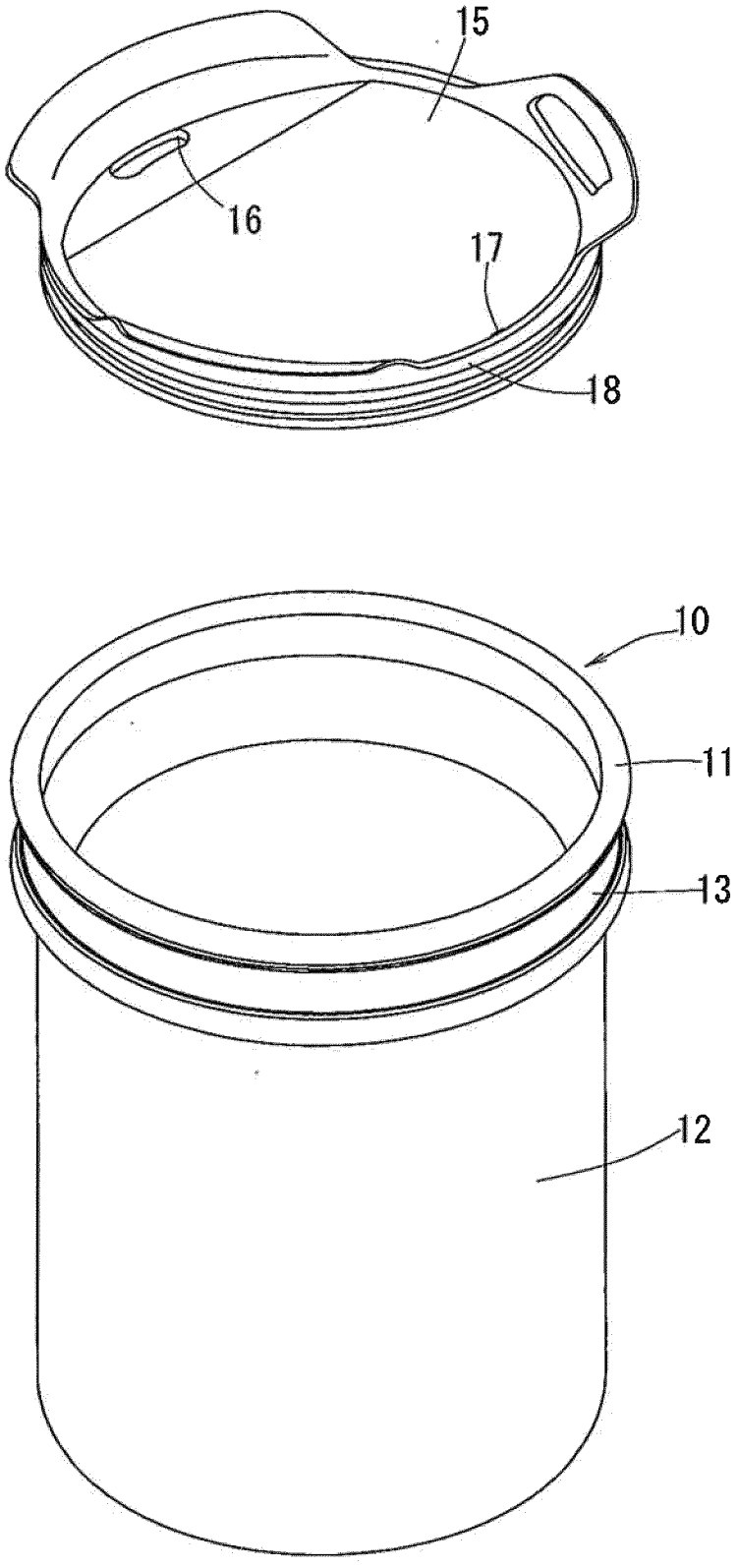


FIG. 5

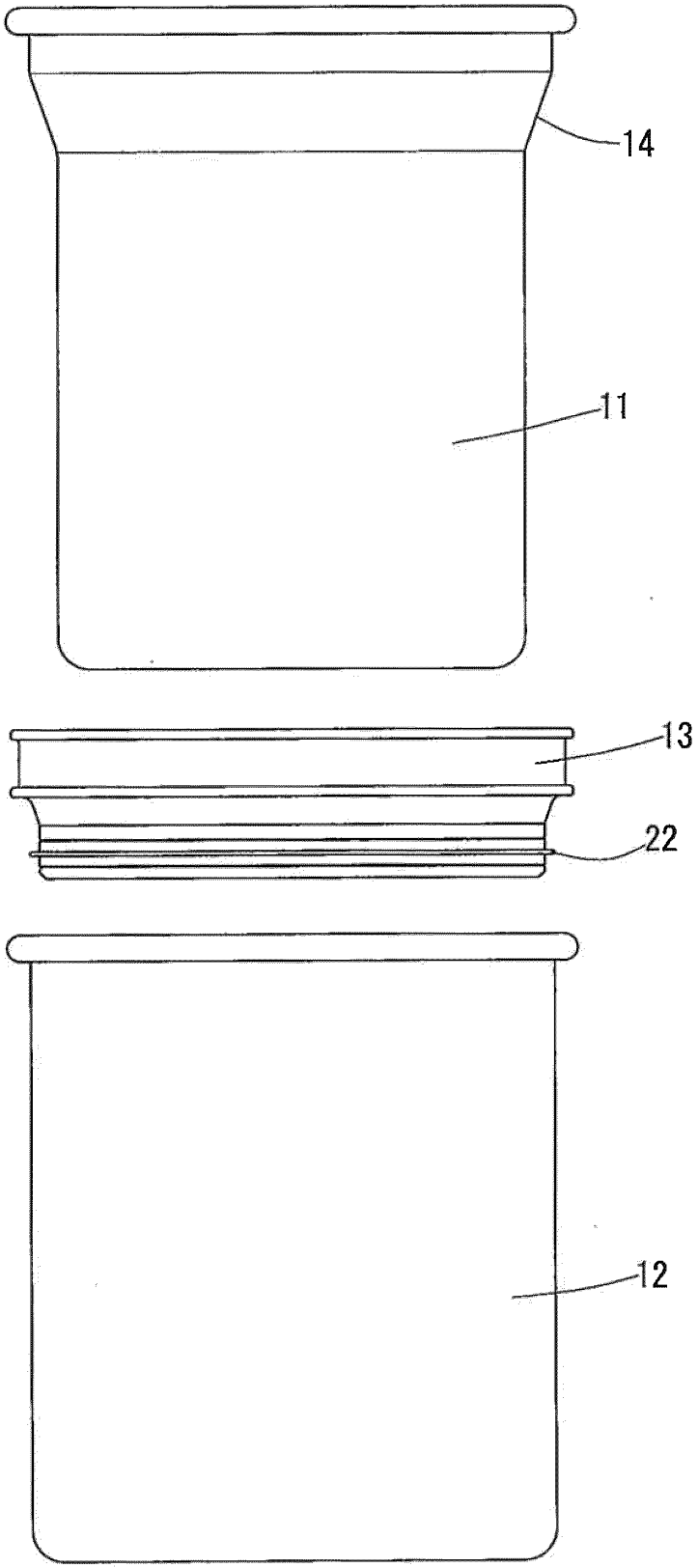


FIG. 6

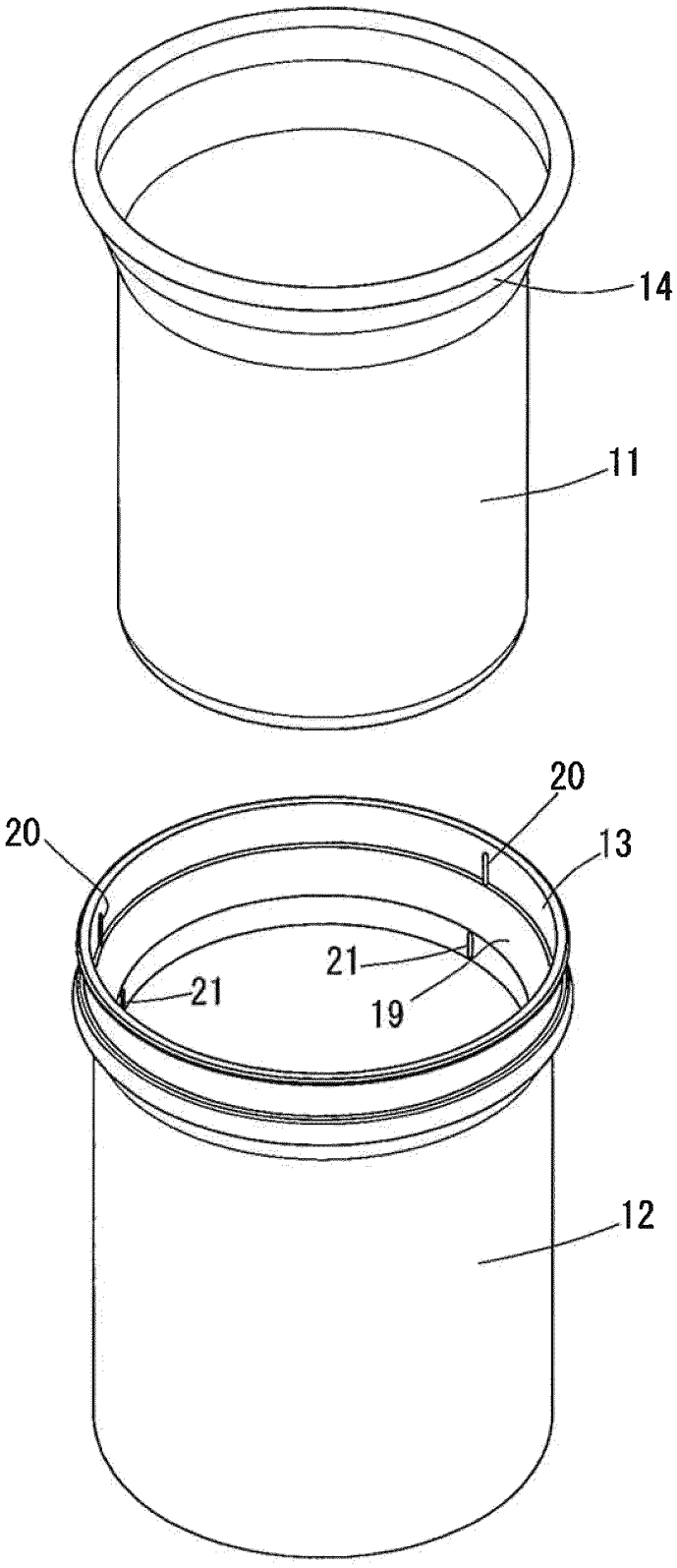


FIG. 7

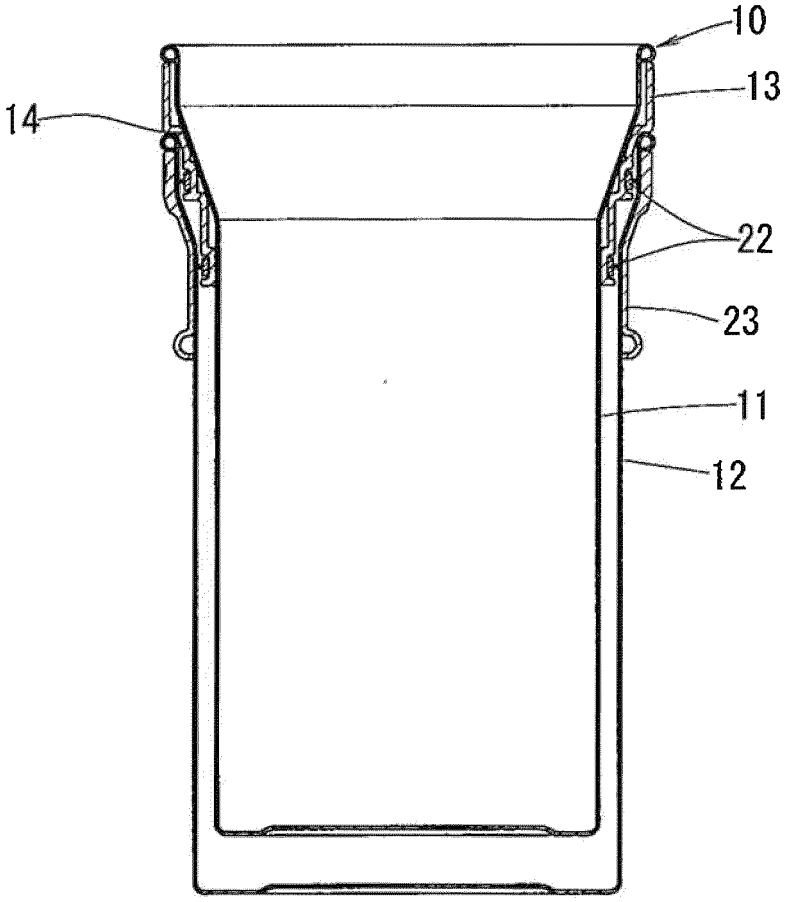


FIG. 8

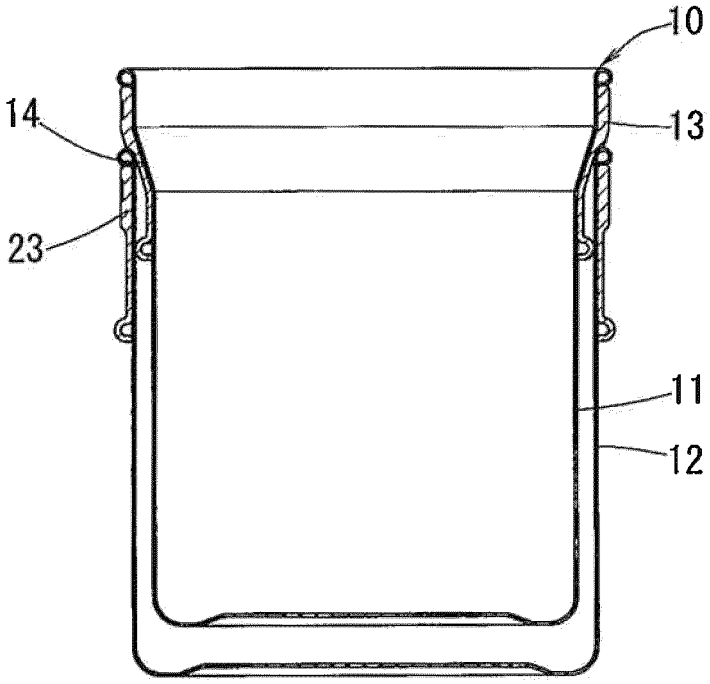


FIG. 9

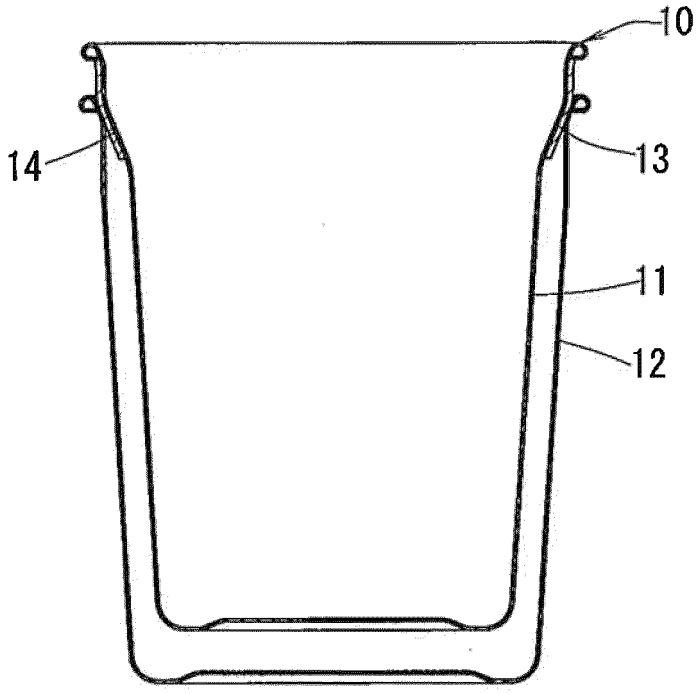
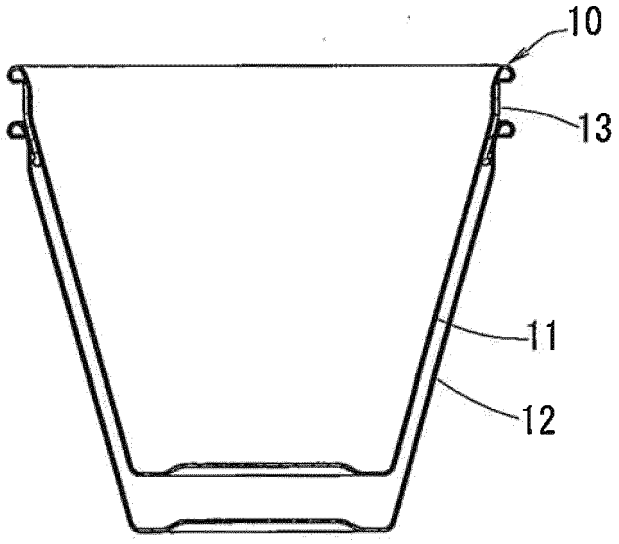


FIG. 10



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/029238

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. B65D81/38(2006.01)i, B65D77/04(2006.01)i

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. B65D81/38, B65D77/04

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	1971-2018
Registered utility model specifications of Japan	1996-2018
Published registered utility model applications of Japan	1994-2018

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 3203301 U (YUTAKA SANGYOU) 24 March 2016, paragraphs [0011]-[0033], fig. 1-3 (Family: none)	1-2, 6 3-5
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 162550/1976 (Laid-open No. 080748/1978) (ARONKASEI CO., LTD.) 05 July 1978, specification, page 5, line 5 to page 9, line 3, fig. 1-2 (Family: none)	3-6
Y	JP 2006-069612 A (HONDA MOTOR CO., LTD.) 16 March 2006, paragraph [0022], fig. 1, 4 (Family: none)	3-6

☒ 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
"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
"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
03 September 2018 (03.09.2018)	11 September 2018 (11.09.2018)

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

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/029238

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2009-073473 A (JTEKT CORP.) 09 April 2009, paragraphs [0010]-[0011], [0023], fig. 3-5 (Family: none)	3-6
Y	JP 2015-155317 A (SEVEN . SEVEN CO., LTD.) 27 August 2015, paragraphs [0031]-[0039], fig. 2 & US 2015/0232232 A1 paragraphs [0042]-[0050], fig. 2	4-6
A	US 2013/0221013 A1 (KOLOWICH, J. Bruce) 29 August 2013, fig. 16-17 & US 2011/0204065 A1 & US 2007/0144703 A1 & US 2006/0032605 A1 & US 2004/0083755 A1 & US 6634417 B1 & US 2016/0332799 A1 & WO 1998/045208 A1	1-6
A	JP 3138983 U (IWABUCHI, Takashi) 31 January 2008, paragraphs [0014]-[0020], fig. 1-5 (Family: none)	1-6

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2008221317 A **[0004]**