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(54) **Title:** RESERVOIR LID, FILTER INSERTION MEMBER, RESERVOIR, AND METHOD OF MANUFACTURING RESERVOIR LID

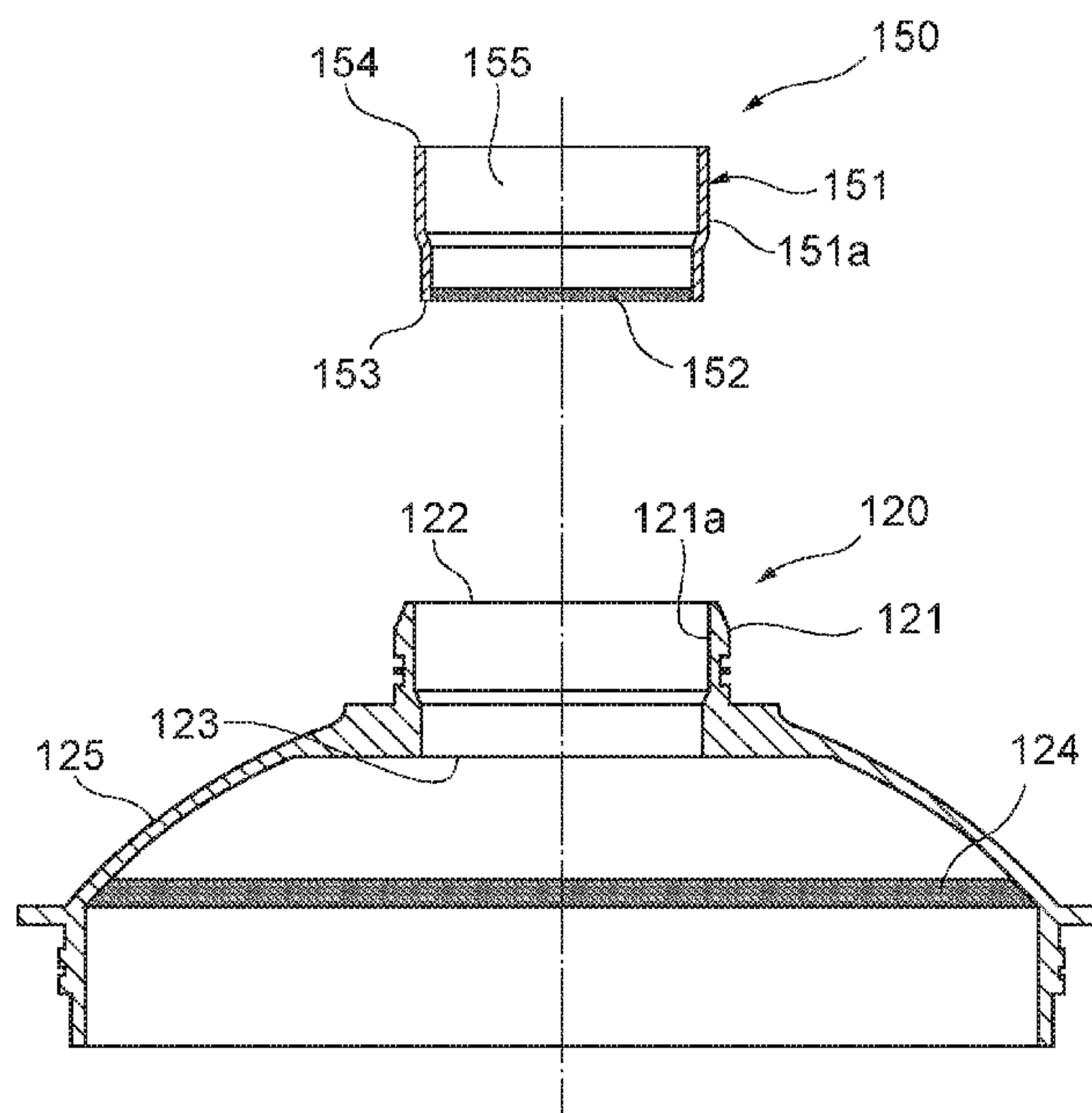


FIG. 4

(57) **Abstract:** A reservoir lid according to one embodiment includes a liquid outlet including an inner surface sandwiched between a first opening and a second opening, a side portion connected to the liquid outlet, a first filter, and at least one second filter disposed at the liquid outlet. The second filter is provided to be located closer to the first opening than the first filter.



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Fig. 2 is an exploded perspective view illustrating an example of the reservoir according to the embodiment.

Fig. 3 is a perspective view illustrating a second filter according to the embodiment.

Fig. 4 is a cross-sectional view illustrating a lid and a filter insertion member taken along a line IV-IV in Fig. 2.

Fig. 5 is a cross-sectional view illustrating the state where the filter insertion member is attached to the lid.

Detailed Description

An embodiment of the present disclosure will be described below in detail with reference to the attached drawings. Note that, in the description of the drawings, identical or equivalent elements are denoted with the same reference signs, and duplicate descriptions thereof are omitted.

In the present disclosure, a reservoir refers to an article for containing a liquid. In one example, the reservoir contains a liquid to be sprayed by a spray and is attached to the spray to supply the liquid to the spray.

The liquid refers to any form of flowable material. In one example, the liquid may be applied to the surface of the tangible body using the spray. For example, the liquid may be applied in a form of atomized or not atomized depending on at least one of the properties of the material and the intended use. Examples of the liquid include paint materials such as paint, primer, surfacer, base coats, lacquer, and varnish, and other materials such as adhesives, sealer, filler, putty, powder coatings, blasting powders, abrasive slurry, mold release agents, and casting finishing agents. The paint may be an aqueous paint or an oil-based paint. The liquid is not limited these and may be optionally selected.

The spray refers to a device for spraying the liquid. The type of the spray is not specifically limited and the reservoir may be used for any type of spray. In the present disclosure, a spray gun is illustrated as an example of the spray. In the typical spray gun, the liquid in the reservoir is supplied to a spray nozzle. When exiting from the spray nozzle, the liquid is atomized by compressed air supplied to the nozzle to form spray. The liquid may be supplied by gravity, supplied by suction, or pumped from a compressed air line for the spray gun or the spray gun itself by an air bleeding line to the reservoir. The application of the spray guns is not specifically limited. In one example, the spray gun is used for respraying onto repaired vehicles or vehicle's scratches.

Fig. 1 is a perspective view illustrating an example of a spray gun system 1 including a reservoir 10 according to the embodiment. The spray gun system 1 further includes a spray gun 20.

The spray gun 20 includes a body 30, a handle 31, a spray nozzle 32 provided at a front end of the body 30, a trigger 33 provided on a side portion of the body 30, and an inlet port 34.

The inlet port 34 connects an inner spray conduit (not illustrated) of the spray gun 20 to the reservoir 10, thereby allowing the liquid in the reservoir 10 to flow into the inner spray conduit. For example, the reservoir 10 contains a liquid to be sprayed (e.g. paint) and is connected to the inlet port 34. The specific structure for connecting the reservoir 10 to the inlet port 34 is not specifically limited, and may be optimally designed. For example, the reservoir 10 may be attached to the inlet port 34 by engaging a first connector format provided in the vicinity of a liquid outlet 121 with a second connector format provided on the inlet port 34 of the reservoir 10, which will be described below.

In use, the spray gun 20 is connected to a compressed air source (not illustrated) by interposing a connector 35 provided at a lower end of the handle 31. As the user pulls the trigger 33, compressed air is delivered through the spray gun 20, and paint is delivered from the reservoir 10 to the spray nozzle 32 through the spray gun 20 by gravity. As a result, when exiting from the spray nozzle 32, the liquid (e.g. paint) is atomized by compressed air exiting from the spray nozzle 32 to form a spray.

Fig. 2 is an exploded perspective view illustrating an example of the reservoir 10. The reservoir 10 includes a liner 110 for containing the liquid to be sprayed and a lid 120 attached to an opening 111 of the liner 110. The liner 110 is an example of the body of the reservoir. The lid 120 is coupled to the liner 110 to obtain a lid/liner assembly. In one example, the reservoir 10 further includes an outer container 130 containing the liner 110, and an annular collar 140 for securing the liner 110 with the lid 120 attached thereto to the outer container 130. The lid/liner assembly is secured within the outer container 130 by containing the lid/liner assembly in the outer container 130 such that the lid 120 is located near an opening 131 of the outer container 130, and attaching the collar 140 to the outer container 130 such that the collar 140 covers the periphery of the lid 120.

The lid 120 includes a liquid outlet 121 for allowing the liquid in the liner 110 to flow into the inner spray conduit of the spray gun 20. In use, with the discharge of the liquid from the liner 110, air enters from an aperture 132 formed in the side surface of the outer container 130, collapsing the liner 110. When the liquid in the liner 110 runs out, the user can remove the reservoir 10 from the spray gun 20, remove the collar 140, and remove the lid/liner assembly from the outer container 130. The outer container 130 and collar 140 remain clean, and the user can contain new liner 110 and lid 120 (i.e., a new lid/liner assembly) in the outer container 130 and reattach the collar 140 to the outer container 130 to obtain a reservoir capable of supplying the liquid. That is, the liner 110 and the lid 120 are single-use consumables, whereas the outer container 130 and the collar 140 can be considered reusable. The liquid in the liner 110 can be

prevented from adhering to the outer container 130 and the collar 140, to reduce loads for cleaning the reservoir 10.

The lid 120 of the reservoir 10 includes a filter for removing any foreign matter contained in the liquid. The filter of the lid 120 will be described in detail with reference to Figs. 3 to 5. Fig. 3 is a perspective view of a filter insertion member 150 according to the embodiment. Fig. 4 is a cross-sectional view of the lid 120 and the filter insertion member 150 taken along a line IV-IV in Fig. 2. Fig. 5 is a cross-sectional view illustrating the state where the filter insertion member 150 is attached to the lid 120.

The lid 120 further includes two filters, a first filter 124 and a filter insertion member 150 (more specifically, a second filter 152). Both the first filter 124 and the filter insertion member 150 are provided to remove foreign matters contained in the liquid discharged from the liner 110.

As illustrated in Fig. 4, the lid 120 includes a tubular liquid outlet 121 and a side portion 125 connected to the liquid outlet 121. The side portion 125 has a larger inner diameter than that of the liquid outlet 121. The first filter 124 is attached to the inner side of the side portion 125 so as to close the flow path of the liquid. The first filter 124 may be detachably attached to the side portion 125. The liquid outlet 121 includes a first opening 122 through which the liquid flows, a second opening 123 located opposite to the first opening 122, and an inner surface 121a sandwiched between the first opening 122 and the second opening 123.

As illustrated in Fig. 3, the filter insertion member 150 includes a tubular frame 151, at least one second filter 152 attached to the frame 151, and a flow path 155 formed by the frame 151. The filter insertion member 150 (more specifically, the frame 151) includes an outer surface 151a shaped to correspond to at least a part of the inner surface 121a of the liquid outlet 121. The second filter 152 is a portion that actually performs the function of the filter in the filter insertion member 150. Examples of a method of attaching the second filter 152 to the frame 151 includes, but is not limited to, ultrasonic welding. The frame 151 includes a first opening end 153 and a second opening end 154 located opposite to the first opening end 153. At least one second filter 152 is attached to the frame 151. In the example of Fig. 3, the second filter 152 is attached to the first opening end 153.

As illustrated in Figs. 4 and 5, the shape of the outer surface 151a of the frame 151 corresponds to at least a part of the shape of the inner surface 121a of the liquid outlet 121. More specifically, the shape of the outer surface 151a matches the shape of at least a part of the inner surface 121a. Thus, the filter insertion member 150 can be securely fitted into the liquid outlet 121. The filter insertion member 150 is attached to be located in the liquid outlet 121, wherein at least one second filter 152 is disposed at the liquid outlet 121. In one example, the filter insertion member 150 is detachably attached to the liquid outlet 121. When the lid 120 is attached to the

liner 110, the user can attach/detach the filter insertion member 150 to/from the liquid outlet 121 without removing the lid 120 from the liner 110. In one example, the filter insertion member 150 attached to the liquid outlet 121 does not protrude from its liquid outlet 121. That is, when the lid 120 is viewed from the side, the filter insertion member 150 is hidden by the liquid outlet 121.

5 Thus, when the reservoir 10 with the filter insertion member 150 is connected to the inlet port 34, the filter insertion member 150 does not interfere with the connection. Thus, from one aspect, the filter insertion member 150 can be added to the reservoir 10 to continuously use the spray gun system 1 without changing the original design of the reservoir 10 and spray gun 20.

10 The filter insertion member 150 is provided in the liquid outlet 121 such that the first opening end 153 where the second filter 152 is located is closer to the first filter 124 than the second opening end 154. Since the second opening end 154 is located at the edge of the liquid outlet 121, the user can remove the filter insertion member 150 from the liquid outlet 121 while holding the frame 151 without touching the second filter 152.

15 A first filter 124 is provided between the liquid outlet 121 and a bottom 112 of the liner 110, and more specifically, is attached to inner side of the side portion 125 of the lid 120. The second filter 152 is provided to locate closer to the first opening 122 of the liquid outlet 121 than the first filter 124. Thus, the liquid to be sprayed first passes through the first filter 124 and then through the at least one second filter 152 and subsequently reaches the spray nozzle 32. Like the liner 110 and the lid 120, the filter insertion member 150 is also exposed to liquid and thus,
20 considered to be a consumable.

In the examples of Figs. 3 to 5, the second filter 152 is located at the second opening 123 of the liquid outlet 121. However, the position of the second filter 152 is not limited thereto. For example, the second filter 152 may be located at the first opening 122 of the liquid outlet 121 and thus, may be attached to the second opening end 154. When the filter insertion member 150
25 includes two second filters 152, the two second filters 152 may be attached to the frame 151 such that one second filter 152 is located at the first opening 122 and the other second filter 152 is located at the second opening 123. At least one second filter 152 may be attached at any location between the first opening 122 and the second opening 123.

30 The mesh width of each of the first filter 124 and the second filter 152 may be selected as desired. In one example, the mesh width of the second filter 152 may be the mesh width of the first filter 124 or less. Alternatively, the mesh width of the second filter 152 may be less than the mesh width of the first filter 124. The mesh width of the first filter 124 may be any value between 100 um to 200 um (um is micrometer), for example, 200 um, 190 um, 180 um, 170 um, 160 um, 150 um, 140 um, 130 um, 125 um, 120 um, 110 um, or 100 um. In one example, when the mesh width
35 of the first filter 124 is 200 um, the mesh width of the second filter 152 may be any value between

90 um to 200 um, for example, 200 um, 190 um, 180 um, 170 um, 160 um, 150 um, 140 um, 130 um, 125 um, 120 um, 110 um, 100 um or 90 um. In another example, if the mesh width of the first filter 124 is 125 um, the mesh width of the second filter 152 may be any value between 90 um to 125 um, for example, 125 um, 120 um, 110 um, 100 um or 90 um.

5 The material for forming the first filter 124 and the second filter 152 is not specifically limited as long as it is resistant to the liquid contained in the liner 110. For example, the material may be resin such as plastic, nylon, and polypropylene, or metal.

10 A method of manufacturing the lid 120 of the reservoir 10 including a plurality of filters will be described. In one example, the lid 120 of the reservoir 10 is prepared. The lid 120 includes the liquid outlet 121 including the inner surface 121a sandwiched between the first opening 122 and the second opening 123, the side portion 125 connected to the liquid outlet 121, and the first filter 124.

15 Further, the filter insertion member 150 is prepared. The filter insertion member 150 includes the tubular frame 151 and the flow path 155 formed by the frame 151. The frame 151 includes the outer surface 151a, the first opening end 153, and the second opening end 154 located opposite to the first opening end 153. The shape of the outer surface 151a corresponds to at least a part of the shape of the inner surface 121a of the liquid outlet 121. At least one second filter 152 is attached to the frame 151.

20 Subsequently, the filter insertion member 150 is positioned within the liquid outlet 121 such that at least a part of the inner surface 121a of the liquid outlet 121 is adjacent at least a part of the outer surface 151a of the filter insertion member 150. In this step, the at least one second filter 152 is provided in the liquid outlet 121 such that the at least one second filter 152 is located closer to the first opening 122 than the first filter 124. The series of steps provides the lid 120 including the plurality of filters.

25 As described above, the reservoir lid according to one aspect of the present disclosure includes, a liquid outlet including an inner surface sandwiched between a first opening and a second opening, and configured to cause liquid to flow through, a side portion connected to the liquid outlet, a first filter, and at least one second filter disposed at the liquid outlet. The second filter is provided to be located closer to the first opening than the first filter.

30 The reservoir according to one aspect of the present disclosure includes the reservoir lid described above and the reservoir body coupled to the lid.

35 A method of manufacturing a reservoir lid according to one aspect of the present disclosure is a method of manufacturing a reservoir lid including a plurality of filters, the method including, preparing a reservoir lid including a liquid outlet including an inner surface sandwiched between a first opening and a second opening, a side portion connected to the liquid outlet, and a

first filter, preparing a filter insertion member including a tubular frame including an outer surface, a first opening end, and a second opening end located opposite to the first opening end, and a flow path formed by the tubular frame, a shape of the outer surface corresponding to at least a part of a shape of the inner surface of the liquid outlet, and at least one second filter being attached to the tubular frame, and positioning the filter insertion member in the liquid outlet such that at least a part of the inner surface of the liquid outlet is adjacent to at least a part of the outer surface of the filter insertion member, and providing the at least one second filter in the liquid outlet such that the at least one second filter is located closer to the first opening than the first filter.

In such an aspect, since the reservoir lid includes the two filters, even when any foreign matter in the liquid passes through the first filter, the foreign matter can be captured by the second filter. Therefore, it is possible to more reliably prevent or suppress the discharge of foreign matters in the liquid. This may also lead to improved quality of the liquid to be discharged.

In the reservoir lid according to another aspect, the first filter may be attached to the side portion. By providing the first filter at any location other than the liquid outlet, foreign matters can be efficiently captured.

In the reservoir lid according to another aspect, the first filter may be detachably attached to the side portion. In this case, the first filter may be attached to the existing lid later, or the first filter may be replaced.

In the reservoir lid according to another aspect, the second filter may be detachably attached to the liquid outlet. This configuration allows the second filter to be attached/detached to/from the liquid outlet without opening the lid (i.e., keeping the lid attached to the reservoir), more reliably preventing mixing of foreign matters into the liner at attachment/detachment of the second filter.

The reservoir lid according to another aspect may further include a filter insertion member. The filter insertion member may include a tubular frame including a first opening end and a second opening end, an outer surface, and a flow path formed by the tubular frame. The shape of the outer surface may correspond to at least a part of the shape of the inner surface of the liquid outlet, at least one second filter may be attached to the tubular frame of the filter insertion member, and the filter insertion member may be located in the liquid outlet. Since the second filter is securely attached to the liquid outlet by the filter insertion member, filtering can be performed more reliably on the liquid that is about to flow out of the liquid outlet.

In the reservoir lid according to another aspect, the filter insertion member may be detachably attached to the liquid outlet. This configuration allows the filter insertion member to be attached/detached to/from the liquid outlet without opening the lid (i.e., keeping the lid attached to

the reservoir), more reliably preventing mixing of foreign matters into the liner at attachment/detachment of the filter insertion member.

5 In the reservoir lid according to another aspect, at least one second filter may be located at the first opening. This configuration can facilitate attachment of the second filter to the lid because the first opening corresponds to the end of the liquid outlet.

In the reservoir lid according to another aspect, at least one second filter may be located at the second opening. This configuration can facilitate attachment of the second filter to the lid because the second opening corresponds to the end of the liquid outlet. In addition, the user can handle the lid while holding the liquid outlet without touching the second filter.

10 In the reservoir lid according to another aspect, the mesh width of at least one second filter may be the mesh width of the first filter or less. By reducing the mesh width along the flow of the liquid or by aligning filters of the same mesh width, foreign matters in the liquid can be more efficiently captured.

15 In the reservoir lid according to another aspect, the mesh width of at least one second filter may be 125 μm or less. By setting the mesh width in this way, any foreign matter in the liquid can be more reliably captured.

In the reservoir lid according to another aspect, the liquid may be a liquid to be sprayed. In this case, it is possible to more reliably prevent or suppress the spraying of foreign matters in the liquid.

20 The liquid to be sprayed may be a paint. For the paint, foreign matters may be mixed in the paint in a prior step, such as manual mixing colors. To remove such foreign matter from the paint, the paint may be passed through a funnel-shaped filter when the paint is put into the reservoir, but such pre-processing burdens the user. In addition, when paint is passed through the funnel-shaped filter, the paint flows to the reservoir by gravity, taking time to fill the paint. In one aspect of the present disclosure, since the reservoir lid includes two filters, it is possible to prevent or suppress the discharge of foreign matters in the paint (for example, from a spray) without using such high-load and time-consuming method.

25 A filter insertion member according to one aspect of the invention is a filter insertion member for a reservoir lid, and includes, a tubular frame including an outer surface, a first opening end, and a second opening end located opposite to the first opening end, and a filter provided at the second opening end and has a mesh width of 125 μm or less. The filter is detachably attached to a liquid outlet of the reservoir lid.

35 In such an aspect, the filter can be attached to and detached from the liquid outlet without opening the reservoir lid, more reliably preventing the mixing of foreign matters into the container at attachment and detachment of the filter insertion member. Furthermore, by setting the mesh

width to 125 μm or less, it is possible to more reliably capture foreign matters in the paint. By adding such filter to a lid including another filter, it is possible to more reliably prevent or suppress the discharge of foreign matters in the liquid. Also, by providing the filter at the second opening end of the frame, the user can handle the filter insertion member while holding the frame without touching the filter.

Examples

Examples will be specifically described below. However, the present disclosure is not limited to Examples.

The performance of the reservoir corresponding to the above embodiment was verified. A PPS (trade name) Paint Preparation System manufactured by 3M was used as the spray gun system. An aqueous paint manufactured by Axalta was used as the liquid to be sprayed. Because foreign matters may be naturally mixed in the preparation of the paint, a foreign matter was not intentionally mixed into the paint. Examples of the naturally mixed foreign matters include dust in the air, fiber of clothing, dirt adhered to the container, and gel or solid objects that are not dissolved in the paint. Following three types of reservoirs were prepared. Both of Examples 1 and 2 were reservoirs obtained by attaching a component having the same structure as the filter insertion member 150 described above to a liquid outlet of a PPS (trade name) series 2.0 spray cup system including a filter with a mesh width of 125 μm , which was manufactured by the 3M, corresponding to the first filter. The mesh width of the additional filter corresponding to the second filter was 90 μm in Example 1 and 125 μm in Example 2. The PPS (trade name) series 2.0 spray cup system including a filter with a mesh width of 125 μm corresponding to the first filter, which was manufactured by the 3M, was prepared as a comparative example. That is, the comparative example does not have a configuration corresponding to the filter insertion member 150 in the embodiment described above.

In each of Examples 1, 2 and Comparative Example, an aqueous paint was sprayed onto a 200 mm \times 200 mm area of a metal plate using a spray gun system, and then the number of foreign matters adhered to the area was confirmed. For foreign matters, a foreign matter having a diameter of 5 μm to 20 μm was referred to as a small foreign matter, and a foreign matter having a diameter of 50 μm to 200 μm was referred to as a large foreign matter. The confirmed foreign matters were as follows.

Example 1: no foreign matter

Example 2: two small foreign matters

Comparative Example: four small foreign matters and one large foreign matter

The embodiments of the present disclosure have been described in detail. However, the present disclosure is not limited to the above embodiment. The present disclosure may be variously modified within the scope of the subject matter thereof.

5 In the embodiment described above, the filter insertion member 150 is detachably attached to the liquid outlet 121, but the filter insertion member may be permanently attached to the liquid outlet by welding, gluing, or the like. In the embodiment described above, at least one second filter 152 is detachably attached to the liquid outlet 121, but at least one second filter may be permanently attached to the liquid outlet by ultrasonic welding or the like.

10 Although the liquid is sprayed in the above embodiment, the method of discharging the liquid is not specifically limited, and may be discharged by any method other than spraying. In this regard, any of the reservoir, the reservoir lid, and the filter insertion member may be a part of any device other than the spray.

Reference Signs List

1 ... Spray gun system, 10 ... Reservoir, 20 ... Spray gun, 30 ... Body, 31 ... Handle, 32 ...
 15 Spray nozzle, 33 ... Trigger, 34 ... Inlet port, 35 ... Connector, 110 ... Liner, 111 ... Opening, 112 ...
 Bottom, 120 ... Lid, 121 ... Liquid outlet, 121a ... Inner surface, 122 ... First opening, 123 ...
 Second opening, 124 ... First filter, 125 ... Side portion, 130 ... Outer container, 131 ... Opening,
 132 ... Aperture, 140 ... Collar; 150 Filter insertion member, 151 ... Frame, 151a ... Outer surface,
 152 ... Second filter, 153 ... First opening end, 154 ... Second opening end, 155 ... Flow path

20

What is claimed is:

1. A reservoir lid comprising:
a liquid outlet including an inner surface sandwiched between a first opening and a second
5 opening, and configured to cause liquid to flow through;
a side portion connected to the liquid outlet;
a first filter; and
at least one second filter disposed at the liquid outlet, wherein
the second filter is provided to be located closer to the first opening than the first filter.
10
2. The reservoir lid according to claim 1, wherein the first filter is attached to the side
portion.
3. The reservoir lid according to claim 2, wherein the first filter is detachably attached to the
15 side portion.
4. The reservoir lid according to any one of claims 1 to 3, wherein the second filter is
detachably attached to the liquid outlet.
- 20 5. The reservoir lid according to any one of claims 1 to 4, further comprising a filter insertion
member, wherein
the filter insertion member includes
a tubular frame including a first opening end and a second opening end,
an outer surface, and
25 a flow path formed by the tubular frame,
a shape of the outer surface corresponds to at least a part of a shape of the inner surface of
the liquid outlet,
the at least one second filter is attached to the tubular frame of the filter insertion member,
and
30 the filter insertion member is located in the liquid outlet.
6. The reservoir lid according to claim 5, wherein the filter insertion member is detachably
attached to the liquid outlet.
- 35 7. The reservoir lid according to any one of claims 1 to 6, wherein the at least one second
filter is located at the first opening.

8. The reservoir lid according to any one of claims 1 to 7, wherein the at least one second filter is located at the second opening.
9. The reservoir lid according to any one of claims 1 to 8, wherein a mesh width of the at least one second filter is a mesh width of the first filter or less.
10. The reservoir lid according to any one of claims 1 to 9, wherein a mesh width of the at least one second filter is 125 μm or less.
11. The reservoir lid according to any one of claims 1 to 10, wherein the liquid is a liquid to be sprayed.
12. A filter insertion member for a reservoir lid, the filter insertion member comprising:
a tubular frame including an outer surface, a first opening end, and a second opening end located opposite to the first opening end; and
a filter provided at the second opening end, the filter having a mesh width of 125 μm or less, wherein
the filter is detachably attached to a liquid outlet of the reservoir lid.
13. A reservoir comprising:
the reservoir lid described in any one of claims 1 to 11; and
a reservoir body coupled to the lid.
14. A method of manufacturing a reservoir lid including a plurality of filters, the method comprising:
preparing a reservoir lid including a liquid outlet including an inner surface sandwiched between a first opening and a second opening, a side portion connected to the liquid outlet, and a first filter;
preparing a filter insertion member including a tubular frame including an outer surface, a first opening end, and a second opening end located opposite to the first opening end, and a flow path formed by the tubular frame, a shape of the outer surface corresponding to at least a part of a shape of the inner surface of the liquid outlet, and at least one second filter being attached to the tubular frame; and
positioning the filter insertion member in the liquid outlet such that at least a part of the inner surface of the liquid outlet is adjacent to at least a part of the outer surface of the filter

insertion member, and providing the at least one second filter in the liquid outlet such that the at least one second filter is located closer to the first opening than the first filter.

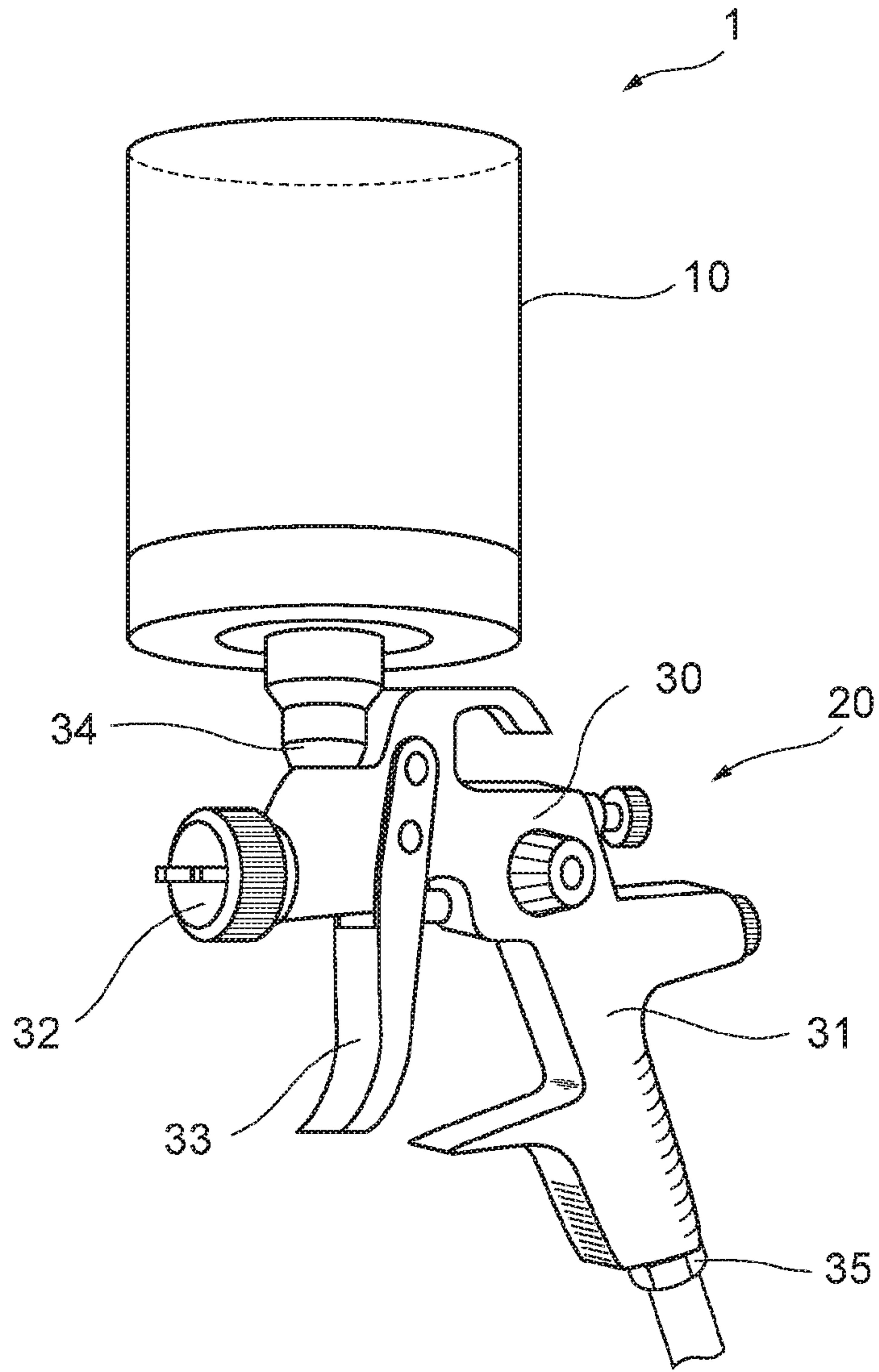


FIG. 1

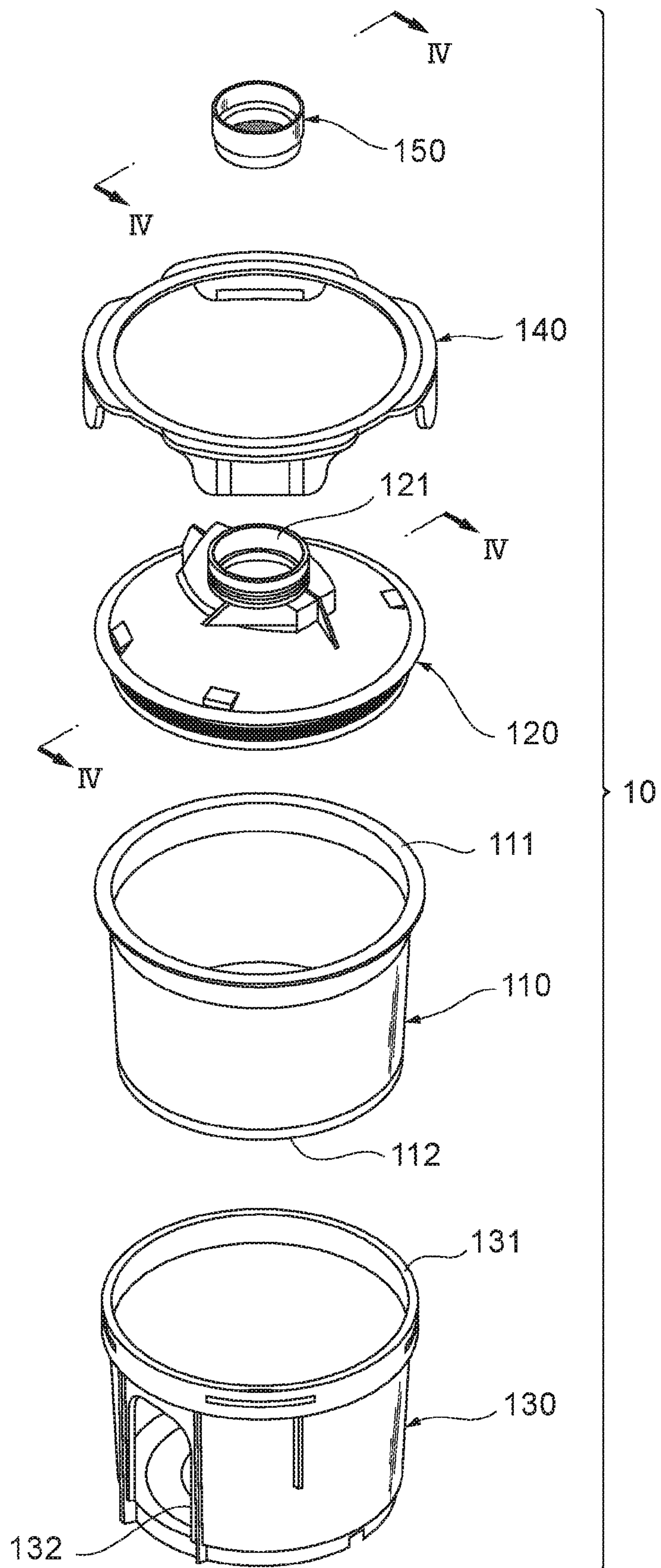


FIG. 2

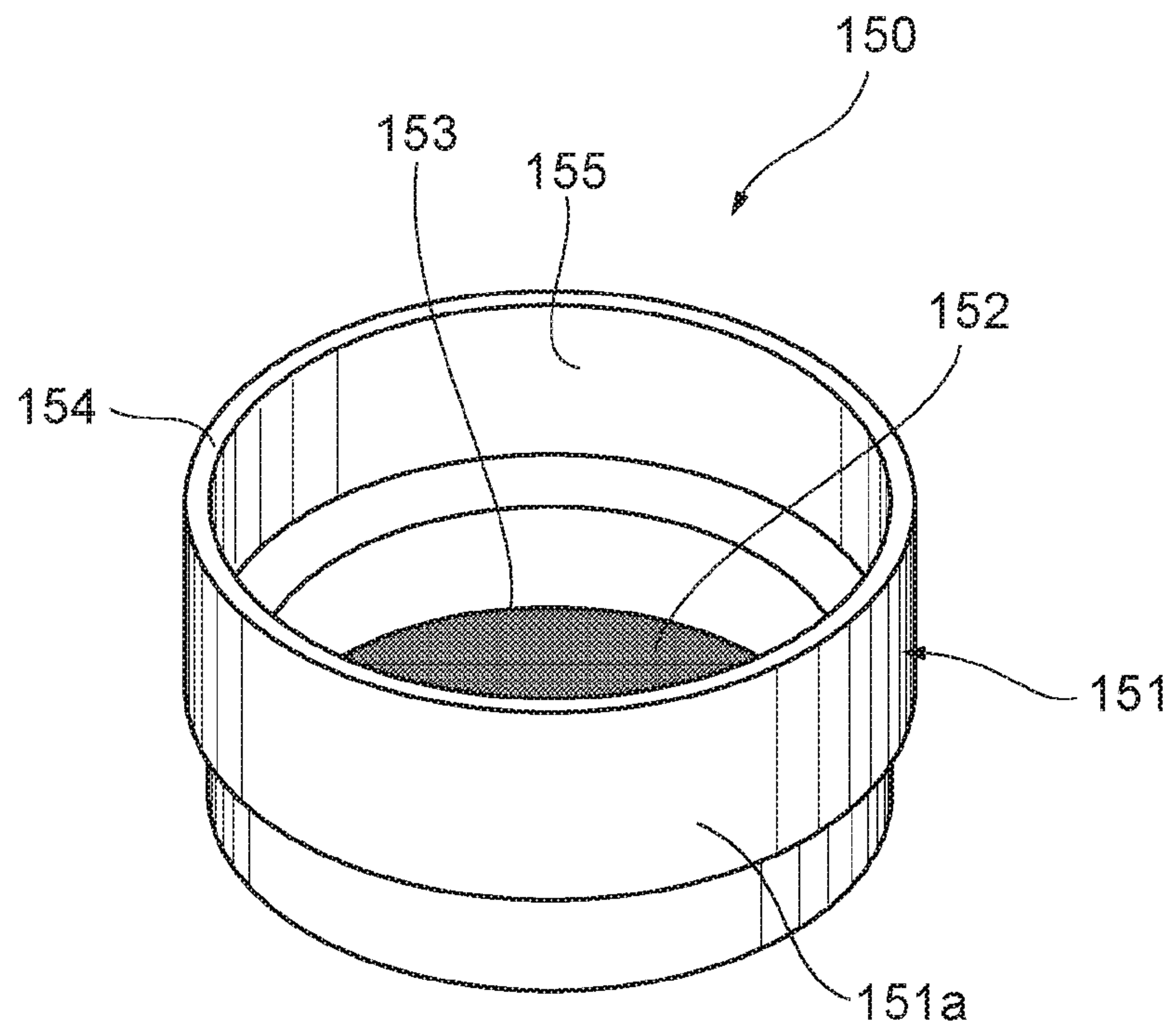


FIG. 3

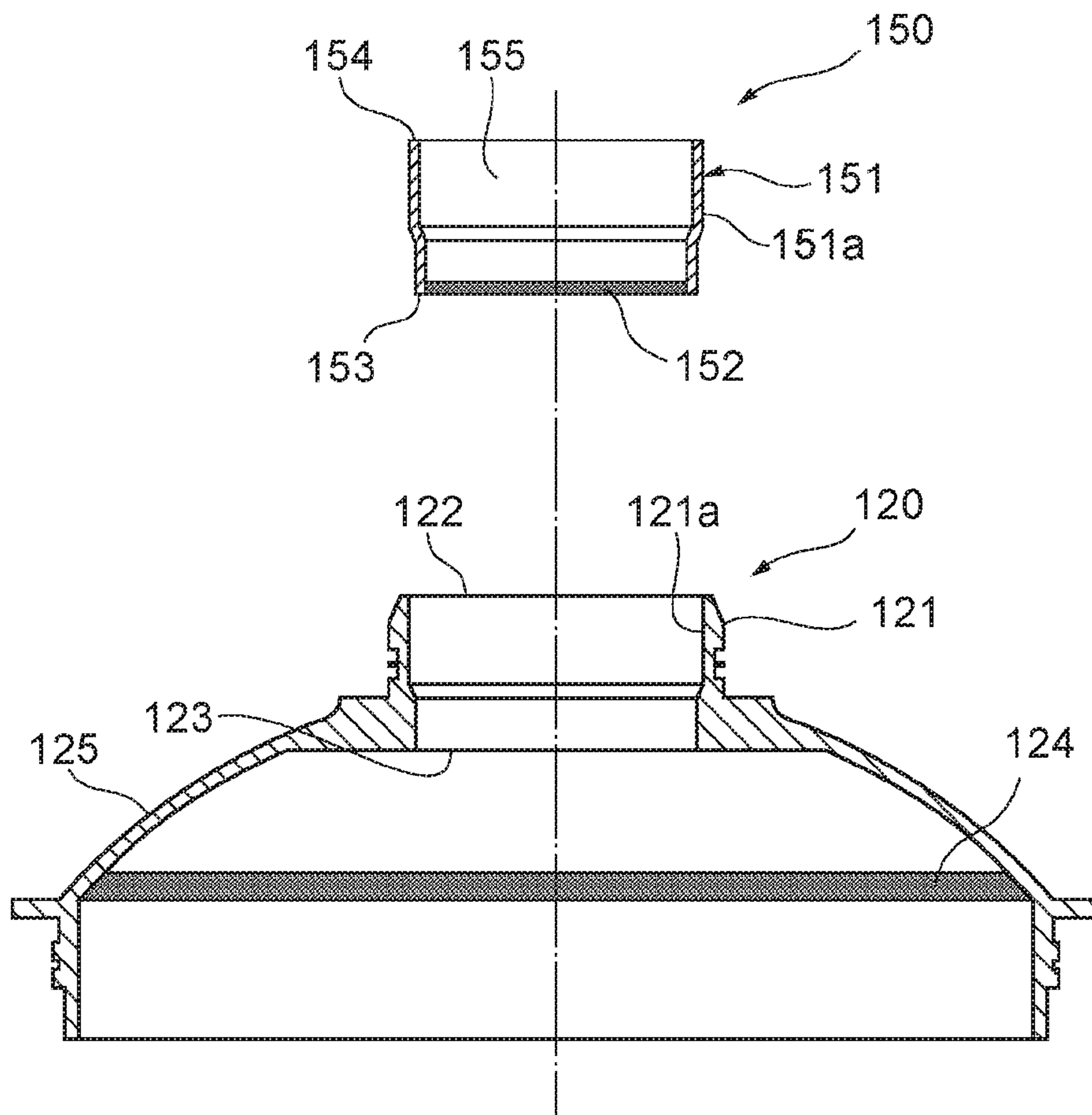


FIG. 4

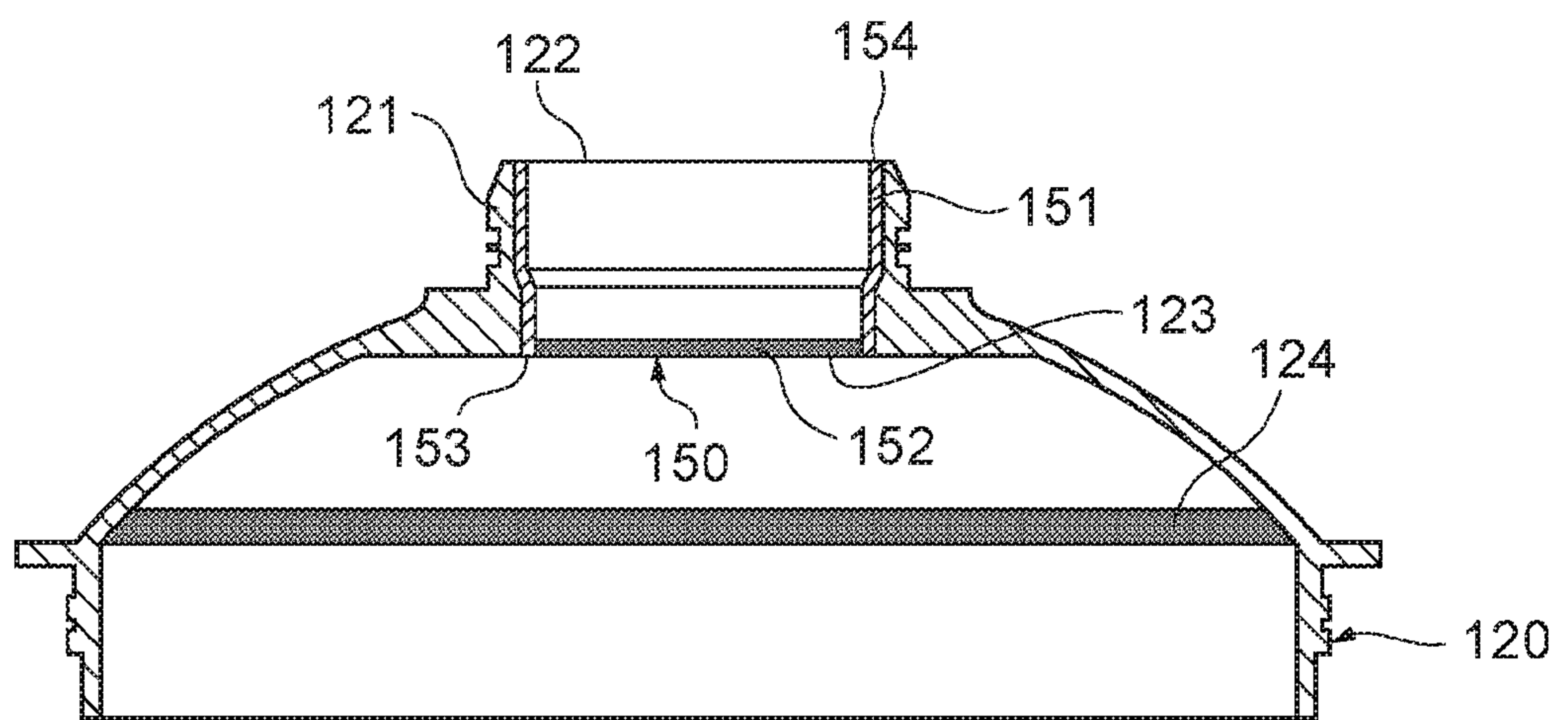


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2020/061278

A. CLASSIFICATION OF SUBJECT MATTER
 INV. B05B7/24 B05B15/40
 ADD.
 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)
 B05B B65D
 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/102550 A1 (JOSEPH STEPHEN C P [US] ET AL) 18 May 2006 (2006-05-18) figures 3,5,6	1-14
A	----- WO 98/32539 A1 (MINNESOTA MINING & MFG [US]; JOSEPH STEPHEN C P [GB] ET AL.) 30 July 1998 (1998-07-30) figures 15-17	1-14
A	----- US 2012/322052 A1 (HALVERSON KURT J [US] ET AL) 20 December 2012 (2012-12-20) figures 3,6	1-14
A	----- US 2010/255484 A1 (HALVERSON KURT J [US] ET AL) 7 October 2010 (2010-10-07) figures 3,5,6	1-14
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Further documents are listed in the continuation of Box C.

See patent family annex.

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