

Description**TECHNICAL FIELD**

[0001] The present invention relates to a process and an installation for manufacturing metal containers and to the metal containers obtained with the process.

PRIOR ART

[0002] Metal containers for containing beverages, foods, or cosmetic and pharmaceutical products, such as beverage cans, deodorant aerosol sprays, etc., are well known. Metal containers of this type are manufactured from a metal disc, generally an aluminum disc, which is subjected to a hot extrusion and forming process referred to as impact extrusion.

[0003] The installation for manufacturing metal containers initially comprises a metal disc feeder and an extrusion press in which the metal disc is extruded to form a metal container. The container obtained in the press comprises a cylindrical body with a side wall, a bottom, and an open end opposite the bottom. In a later phase, the installation comprises a necking machine, in which the cylindrical body of the container is formed to obtain a neck with a curled portion at the open end. The process to obtain the curled portion is commonly known as "curling". Furthermore, the installation comprises other machines for performing operations for washing, applying coatings, painting, and screen printing on the container, among others.

[0004] In a further installation, the container is completely finished by placing a valve comprising a gasket supported on the curled portion of the open end to establish an airtight closure of the container. For example, the finished container may be an aerosol which is formed by the cylindrical body and a sprayer comprising the valve that is arranged at the open end closing the cylindrical body of the container.

[0005] Ensuring a good contact between the curled portion of the open end and the valve gasket is critical to guarantee a proper airtight closure of the container. The curled portion is obtained in the necking machine by curving the open end outwardly (curling), such that the curled portion has a rounded shape which does not allow a good contact to be ensured. Therefore, in order to improve the contact with the valve gasket and thus improve the closure of the open end of the container, obtaining a flat surface at the curled portion of the open end is known. For example, EP915029A1 shows a process of manufacturing a metal container in which the flat surface is obtained by machining the upper part of the curled portion.

DISCLOSURE OF THE INVENTION

[0006] The object of the invention is to provide a process, an installation for manufacturing metal containers,

and a metal container obtained with the process, as defined in the claims.

[0007] One aspect of the invention relates to a process for manufacturing metal containers, comprising the following steps:

- supplying a metal disc,
- extruding the metal disc to form a metal container having a cylindrical body with a main axis, the cylindrical body comprises a side wall, a bottom, and an open end opposite the bottom,
- applying a coating on the inside of the cylindrical body of the metal container,
- deforming the open end of the metal container to obtain a neck at the open end,
- curving the neck outwardly to obtain a curled portion at the open end, and
- obtaining a flat surface in the curled portion.

[0008] According to the invention, in order to obtain the flat surface, the process comprises:

- a first sub-step wherein the curled portion is pressed to obtain the flat surface in a normal plane with respect to the main axis of the cylindrical body of the metal container, and
- a second sub-step wherein the curled portion that has been previously pressed is machined to remove the coating from the curled portion, leaving the metal of the metal container exposed.

[0009] Another aspect of the invention relates to an installation for manufacturing metal containers according to the above process, comprising:

- a feeder for supplying metal discs,
- an extrusion press for extruding the metal discs and forming metal containers, with each metal container having a cylindrical body with a main axis, the cylindrical body comprises a side wall, a bottom, and an open end opposite the bottom,
- an internal varnishing machine for applying a coating on the inside of the cylindrical body of the metal containers, and
- a necking machine comprising a clamping table with clamping stations for clamping the metal containers by the bottom, and a tool table with tool stations to form the open end of the metal containers, with the clamping table facing the tool table, and the clamping stations and the tool stations are movable with respect to the others to form the metal containers. One of the tool stations has a first tooling for pressing the curled portion and obtaining a flat surface in a normal plane with respect to the main axis of the cylindrical body of the metal containers, and another one of the tool stations has a second tooling for machining the curled portion and removing the coating, leaving the metal of the metal containers exposed.

[0010] Another aspect of the invention relates to the metal container obtained with the process described above.

[0011] In this way, in the first sub-step, the applied pressure changes the geometry of the curled portion from round to flat, which increases the surface available for supporting the valve gasket that is to be later arranged in order to close the open end of the metal container; however, the flat surface obtained is coated with the coating and is, therefore, slippery, which does not ensure a good contact with the valve gasket. In the second step, the machining removes the coating and leaves the metal exposed, so the flat surface is rougher and allows a better fixing of the valve gasket.

[0012] In document EP915029A1, the flat surface is obtained in a single step, by machining the rounded upper part of the curled portion, leaving the metal exposed. The side wall of the metal container is very thin (between 0.5-0.7 mm thick), and single-step machining weakens the curled portion, since it removes the coating and part of the metal, creating a central point in the curled portion that is not very thick and can cause later breaking or leaking. This means that the machining must be very precise in order to avoid weakening the curled portion. With the process of the invention, in the first sub-step, material is not removed and the geometry of the curled portion goes from round to flat but maintains the same thickness, which means that the subsequent machining in which the coating is removed is simpler and safer because a flat surface is machined directly, therefore minimizing the risk of weakening the curled portion.

[0013] These and other advantages and features of the invention will become apparent in view of the figures and detailed description of the invention.

DESCRIPTION OF THE DRAWINGS

[0014]

Figure 1 shows a block diagram of an example of an installation for manufacturing metal containers.

Figure 2 shows a schematic example of the transformation of a metal disc into a metal container using an extruder of an extrusion press.

Figures 3a to 3e show the steps of transforming a metal disc into a metal container with a curled portion at the open end of the metal container.

Figure 4a shows the curled portion of the open end of the metal container before obtaining the flat surface.

Figure 4b shows the curled portion of the open end of the metal container after pressing the curled portion.

Figure 4c shows the curled portion of the open end of the metal container after machining the curled portion that has been previously pressed.

Figure 5 shows an example of a necking machine.

Figure 6 shows the tool table of the necking machine.

DETAILED DISCLOSURE OF THE INVENTION

[0015] The manufacture of metal containers, for example, containers made of aluminum such as cans or aerosols, for containing a product, such as beverages, foods, or cosmetic and pharmaceutical products, requires a process in which different machines which are arranged in an installation for manufacturing metal containers are used. Depending on the operations to be performed for manufacturing the container, different types of machines can be used, and the machines can be arranged in the installation in different ways.

[0016] The containers are processed in the installation continuously and at a high speed, for example, processing in the order of two hundred containers per minute. The machines are automatically linked by means of transfer units, such as linear conveyor belts, rotary carousels, or similar elements, which transfer the containers from one machine to another.

[0017] Figure 1 shows a block diagram of a non-limiting example of an installation for manufacturing metal containers 10. The installation comprises a feeder 101, an extrusion press 102, a trimming machine 103, a washing machine 104, a drying machine 105, an internal varnishing machine 106, a polymerization furnace 107, a print set comprising a glazing machine 108, a lithographic printing machine 109, and an overprint varnishing machine 110, a necking machine 200, an inspection machine 111, and a packaging machine 112.

[0018] The discs 1 are lubricated and supplied from the feeder 101 to the extrusion press 102 where the discs 1 are extruded to form metal containers 10. Preferably the discs 1 are aluminum discs.

[0019] Each metal container 10 obtained in the extrusion press 102 has a cylindrical body 11 with a main axis X. The container 10 is made in a single piece. The cylindrical body 11 comprises a side wall 12, a bottom 13, and an open end 14 opposite the bottom 13.

[0020] Figure 2 shows a schematic example of the transformation of a metal disc 1 into a metal container 10 by means of an extruder 1020 of the extrusion press 102 which forces the material of the metal disc 1 to deform and be transformed into the cylindrical body 11. The extrusion process is well known and not described in further detail.

[0021] The open end 14 of the containers 10 is trimmed in the trimming machine 103 to remove impurities, and the containers 10 are brushed. The containers 10 are then washed in the washing machine 104 to remove impurities that may remain in the metal, for example, with

alkaline water, and the containers 10 are then dried in the drying machine 105.

[0022] After drying, a coating 15 is applied on the inside of the cylindrical body 11 of the containers 10 in the internal varnishing machine 106 to create a protective barrier between the metal of the container 10 and the product to be contained in the container 10. The coating 15 can be a lacquer that complies with Regulation (EC) 1935/2004 and Regulation (EC) 2023/2006 on "Materials and articles intended to come into contact with food". Once the coating 15 has been applied, the container 10 is heated in the polymerization furnace 107 to harden the coating, for example, the containers are heated at a temperature of about 250°C depending on the type of lacquer used.

[0023] An outer coating of the container 10 is applied in the glazing machine 108 of the print set to prepare it for printing on same in the lithographic printing machine 109, and the container 10 is then externally coated in the overprint varnishing machine 110 to protect the print.

[0024] The open end 14 of the container 10 is then deformed in the necking machine 200 to create a neck 16 with a curled portion 17. The neck 16 is configured to receive a closure element for closing the container 10, such as the valve of an aerosol sprayer. Lastly, the container 10 is inspected in the inspection machine 111 to detect cracks in any area of the finished container 10, and lastly, the containers 10 are grouped together in the packaging machine 112 by batches to be sent to an external factory where the containers 10 are filled with the final product (beverages, foods, or cosmetic and pharmaceutical products), and the open end 14 of the containers 10 is closed with the closure element.

[0025] The necking machine 200 comprises a clamping table 210 with clamping stations 220 for clamping the containers 10 by the bottom 13, and a tool table 230 with tool stations 240 to form the upper end 14 of the containers 10. The clamping table 210 is facing the tool table 230, and the clamping stations 220 and tool stations 240 are movable with respect to the others to form the containers 10. See Figures 5 and 6.

[0026] The clamping table 210 is rotary and oriented vertically. The clamping table 210 has a rotational movement around a horizontal axis, in an indexed manner in defined positions.

[0027] The clamping table 210 comprises the plurality of clamping stations 220 arranged on the periphery thereof. The containers 10 reach the clamping table 210 in a sequential manner, with the containers 10 being fed to said clamping table 210, and with each container 10 being arranged in one of the clamping stations 220.

[0028] The tool table 230 has a translational movement A towards the clamping table 210 from a set back position to a forward position, and a translational movement B from the forward position to the set back position. After each indexed rotational movement of the clamping table 210, the tool table 230 advances with the translational movement A and moves backwards with the translational

movement B, before the following rotational movement of the clamping table 210. The tool table 230 comprises the plurality of tool stations 240 arranged on the periphery thereof. Each tool station 240 is located in a position facing one of the clamping stations 220 during formation of the container 10, said formation occurring during the translational movement of the tool table 230. An operation for forming the open end 14 of the container 10 occurs in each tool station 240. The tool stations 240 are configured depending on the shape of the container 10 to be obtained. For example, the tool table 230 can have forty tool stations 240. The containers 10 are formed by means of stamping strokes between the stations 220 and 240 of the forming machine 200.

[0029] Figures 3a to 3e show the steps of transforming a metal disc 1 into a metal container 10 with a curled portion 17 on the neck 16 of the open end 14 of the metal container 10. Figure 3a shows the metal disc 1 which is supplied to the extrusion press 102. Figure 3b shows the metal container 10 after exiting the extrusion press 102. Figure 3b shows the open end 14 that has been trimmed in the trimming machine 103. Figure 3c shows the container 10 after exiting the internal varnishing machine 106 with the coating 15 applied on the inside of the cylindrical body 11 of the container 10. Figure 3d shows the container 10 with the neck 16 formed at the open end 14. Figure 3e shows the container 10 with the curled portion 17 formed after curving the neck 16 outwardly. The neck 16 and the curled portion 17 are made in the necking machine 200.

[0030] Figure 4a shows an enlarged detail of Figure 3e denoted with reference IV, where the rounded shape of the curled portion 17 can be observed. According to the invention the process comprises obtaining a flat surface 18 in the curled portion 17 of the open end 14 of the metal container 10. To obtain the flat surface 18 the process comprises a first sub-step wherein the curled portion 17 is pressed to obtain the flat surface 18 in a normal plane N with respect to the main axis X of the cylindrical body 11 of the metal container 10 (see Figure 4b), and a second sub-step wherein the curled portion 17 that has been previously pressed is machined to remove the coating 15 from the curled portion 17, leaving the metal of the metal container 10 exposed. (See Figure 4c). A flat surface 18 without the coating 15 is thereby obtained, which allows the metal of the container 10 to be seen, thereby allowing the valve gasket that is to be later arranged to be suitably supported and to establish a proper airtight closure with the open end 14 of the container 10, since the metal of the container 10 is rougher than the coating 15. In addition, obtaining the surface in two sub-steps minimizes the risks of reducing the thickness of the curled portion 17.

[0031] As observed in Figure 4b, when the curled portion 17 is pressed, the flat surface 18 is obtained in the upper part of the curled portion 17, maintaining the thickness of the curled portion 17. In other words, in the first sub-step a first flat surface 18 is obtained in the upper

part of the curled portion 17 and a second flat surface 18' is obtained in the lower part of the curled portion 17, which is parallel to the first flat surface 18, wherein the thickness of the curled portion 17 before and after pressing the curled portion 17 is the same. For example, the side wall 12 of the metal container 10 has a thickness of between 0.5-0.7 mm, and therefore the curled portion 17 has a thickness of between 0.5-0.7 mm, and after pressing the curled portion 17, the same thickness of between 0.5-0.7 mm is maintained.

[0032] Preferably, in the second sub-step the curled portion 17 is machined at an angle comprised between 5° and -5° with respect to the normal plane N, even more preferably at an angle of 0° with respect to the normal plane N.

[0033] Preferably, the excess material of the coating 15 removed from the curled portion 17 is aspirated. Although the first sub-step presses the coating 15 of the curled portion 17 and facilitates later machining, traces of coating 15 may remain at the open end 14, such that said material is aspirated, preferably the excess material of the coating 15 is aspirated while machining is being performed.

[0034] After the extrusion of the metal disc 1, a container 10 with a thin side wall 12 is obtained, for example, the side wall 12 of the metal container 10 has a thickness of between 0.5-0.7 mm, such that in the second sub-step, the curled portion 17 is machined with a depth of less than 0.1 mm to minimize the risk of weakening the curled portion. That depth allows the coating 15 to be removed without weakening the curled portion 17.

[0035] Preferably, in the second sub-step the coating 15 of the curled portion 17 that has been pressed is removed and part of the metal is removed from the metal container 10. This allows guaranteeing a complete removal of the coating 15 and allows the metal of the container to be lightly machined to improve the fixing with the valve gasket that is to be later arranged.

[0036] Preferably, the flat surface 18 is formed in the necking machine 200. Some of the tool stations 240 of the forming machine 200 are thereby used to make the flat surface 18.

[0037] One of the tool stations 240 has a first tooling 241 for pressing the curled portion 17 and obtaining the flat surface 18, and another one of the tool stations 240 has a second tooling 242 for machining the curled portion 17 and removing the coating 15, leaving the metal of the metal containers 10 exposed.

[0038] For example, the first tooling 241 may comprise rotating cylindrical wheels that press the curled portion 17 of the container 10 and obtaining the flat surface 18, and the second tooling 242 may comprise front cutting blades for machining the previously pressed curled portion 17 and removing the coating 15.

[0039] The first flat surface 18 of the upper part of the curled portion 17 is obtained by applying pressure on the upper part of the curled portion 17 and the second flat surface 18' of the lower part of the curled portion 17 is

generated at the same time by the pressure exerted on the upper part of the curled portion 17. When aluminum is used as the material of the container 10, it is not necessary to use a lower die to obtain the second flat surface 18' of the lower part of the curled portion 17, and it is sufficient for the first tooling 241 to apply pressure on the upper part of the curled portion 17.

[0040] In this sense, the neck 16 of the container 10 is initially formed progressively in the first tool stations 240 of the necking machine 200, in the antepenultimate tool station 240 the neck 16 is curved outwardly to obtain the curled portion 17, in the penultimate tool station 240, with the first tooling 241, the curled portion 17 is pressed to obtain the flat surface 18, and in the last tool station 240, with the second tooling 242, the coating 15 that covers the previously pressed curled portion 17 is machined. The second tooling 242 may comprise a pipe for aspirating the chips of coating 15 that detach during machining.

Claims

1. Process for manufacturing metal containers, comprising the following steps:

- supplying a metal disc (1),
- extruding the metal disc (1) to form a metal container (10) having a cylindrical body (11) with a main axis (x), the cylindrical body (11) comprises a side wall (12), a bottom (13), and an open end (14) opposite the bottom (13),
- applying a coating (15) on the inside of the cylindrical body (11) of the metal container (10),
- deforming the open end (14) of the metal container (10) to obtain a neck (16) at the open end (14),
- curving the neck (16) outwardly to obtain a curled portion (17) at the open end (14), and
- obtaining a flat surface (18) in the curled portion (17),

characterized in that in order to obtain the flat surface (18), the process comprises:

- a first sub-step wherein the curled portion (17) is pressed to obtain the flat surface (18) in a normal plane (N) with respect to the main axis (X) of the cylindrical body (11) of the metal container (10), and
- a second sub-step wherein the curled portion (17) that has been previously pressed is machined to remove the coating (15) from the curled portion (17), leaving the metal of the metal container (10) exposed.

2. Process according to claim 1, wherein in the second sub-step, the curled portion (17) is machined at an angle comprised between 5° and -5° with respect to

the normal plane (N).

3. Process according to claim 2, wherein the curled portion (17) is machined at an angle of 0° with respect to the normal plane (N). 5
4. Process according to any of the preceding claims, wherein in the first sub-step, a first flat surface (18) is obtained in the upper part of the curled portion (17) and a second flat surface (18') is obtained in the lower part of the curled portion (17), which is parallel to the first flat surface (18), wherein the thickness of the curled portion (17) before and after pressing the curled portion (17) is the same. 10
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5. Process according to any of the preceding claims, wherein the excess material of the coating (15) removed from the curled portion (17) is aspirated. 15
6. Process according to any of the preceding claims, wherein the side wall (12) of the metal container (10) has a thickness of between 0.5-0.7 mm and in the second sub-step, the curled portion (17) is machined with a depth of less than 0.1 mm. 20
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7. Process according to any of the preceding claims, wherein in the second sub-step, the coating (15) is removed from the curled portion (17) that has been pressed and part of the metal is removed from the metal container (10). 25
8. Process according to any of the preceding claims, wherein the flat surface (18) is formed in a necking machine (200) comprising a clamping table (210) with clamping stations (220) for clamping the metal containers (10) by the bottom (13), and a tool table (230) with tool stations (240) to form the open end (14) of the metal containers (10), with the clamping table (210) facing the tool table (230), and the clamping stations (220) and the tool stations (240) are movable with respect to the others to form the metal containers (10). 30
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9. Process according to the preceding claim, wherein the first sub-step is performed with a first tooling (241) of one of the tool stations (240) of the necking machine (200), and the second sub-step is performed with a second tooling (242) of another one of the tool stations (240) of the necking machine (200). 45
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10. Installation for manufacturing metal containers according to the process of any of claims 1 to 9, comprising: 55
 - a feeder (101) for supplying metal discs (1),
 - an extrusion press (102) for extruding the metal discs (1) and forming metal containers (10), with

each metal container (10) having a cylindrical body (11) with a main axis (x), the cylindrical body (11) comprises a side wall (12), a bottom (13), and an open end (14) opposite the bottom (13),

- an internal varnishing machine (106) for applying a coating (15) on the inside of the cylindrical body (11) of the metal containers (10), and
- a necking machine (200) comprising a clamping table (210) with clamping stations (220) for clamping the metal containers (10) by the bottom (13), and a tool table (230) with tool stations (240) to form the open end (14) of the metal containers (10), with the clamping table (210) facing the tool table (230), and the clamping stations (220) and the tool stations (240) are movable with respect to the others to form the metal containers (10),

characterized in that one of the tool stations (240) has a first tooling (241) for pressing the curled portion (17) and obtaining a flat surface (18) in a normal plane (N) with respect to the main axis (x) of the cylindrical body (11) of the metal containers (10), and another one of the tool stations (240) has a second tooling (242) for machining the curled portion (17) and removing the coating (15), leaving the metal of the metal containers (10) exposed.

11. Metal container obtained according to the process of any of claims 1 to 9. 30

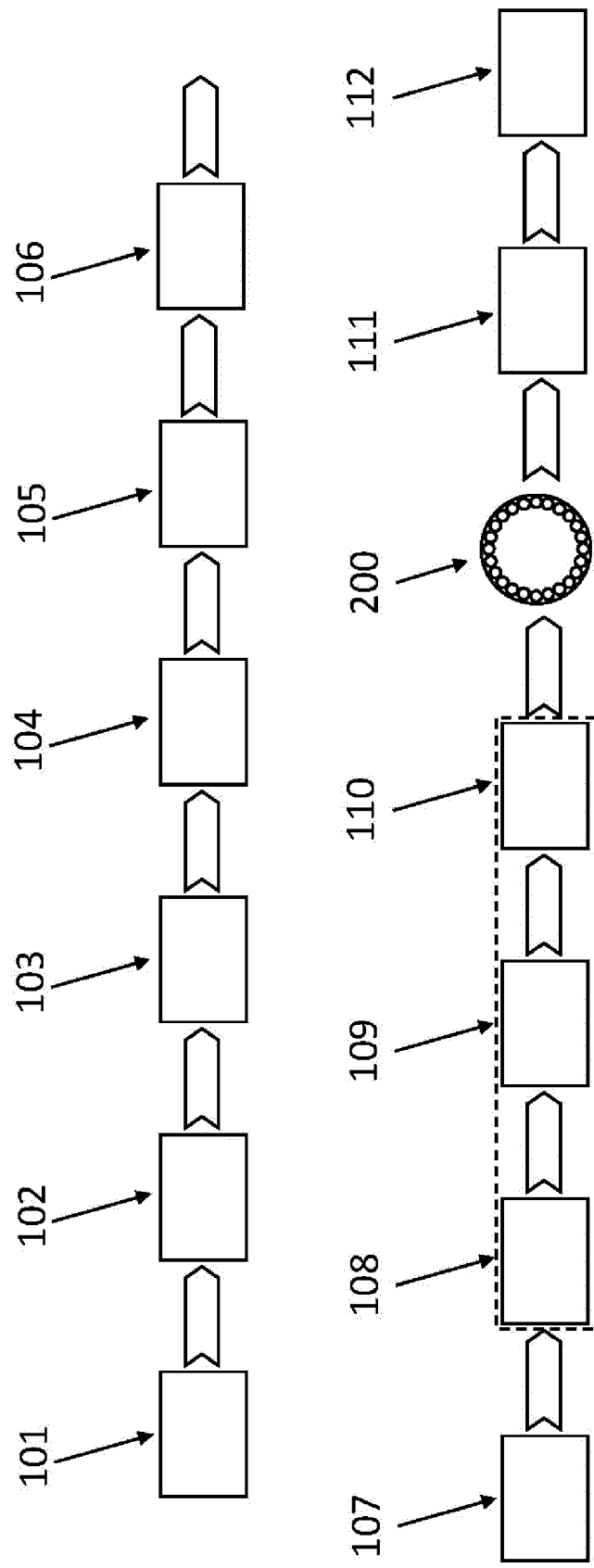


FIG. 1

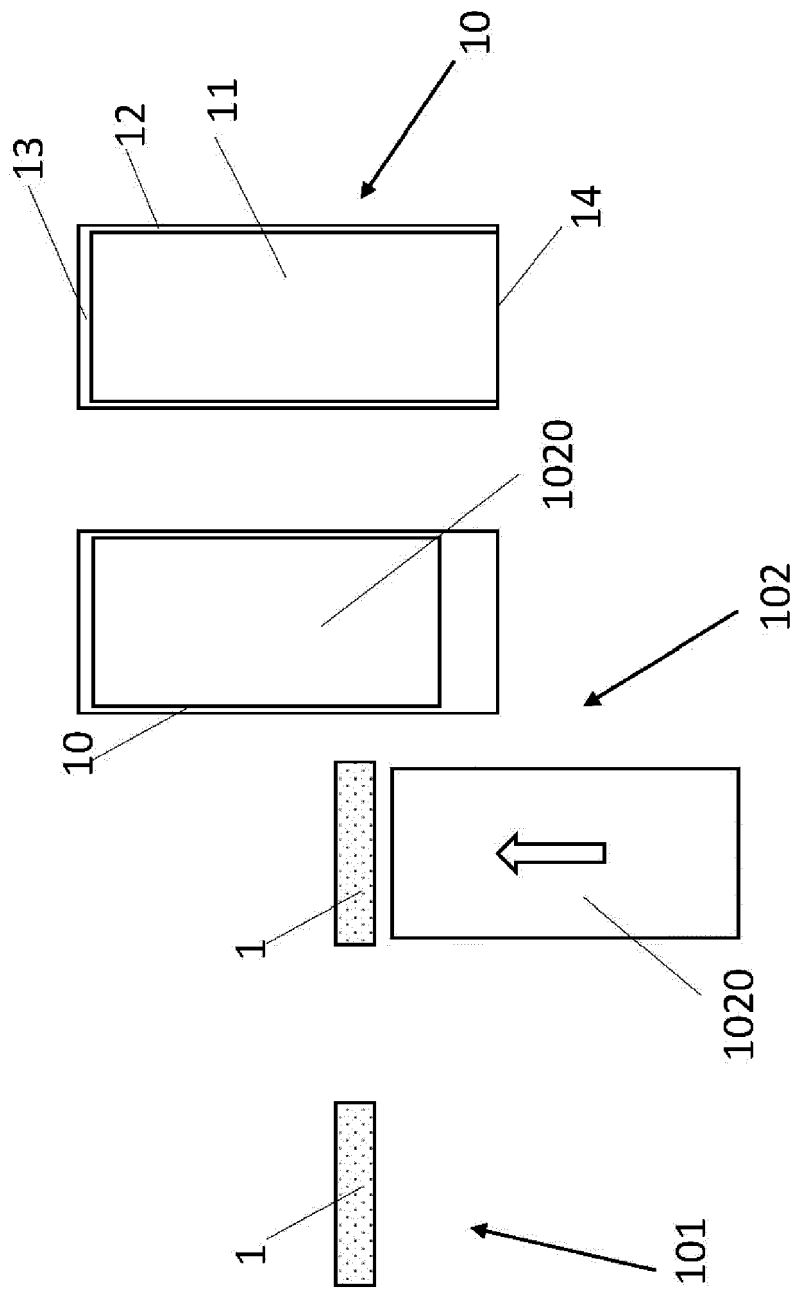
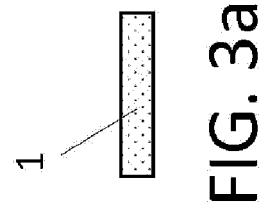
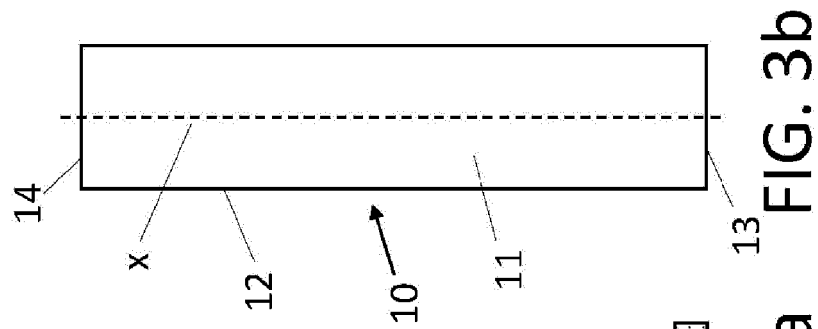
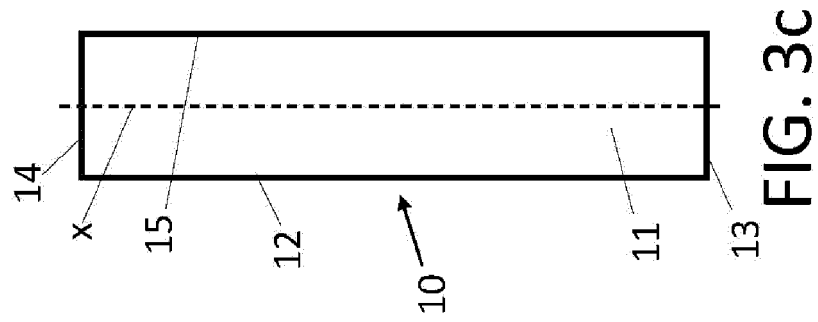
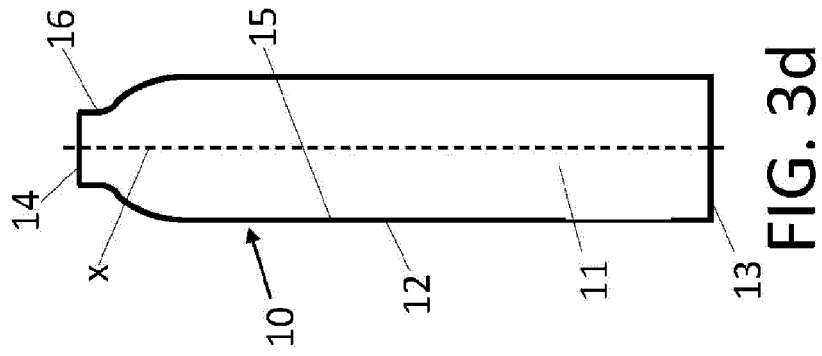
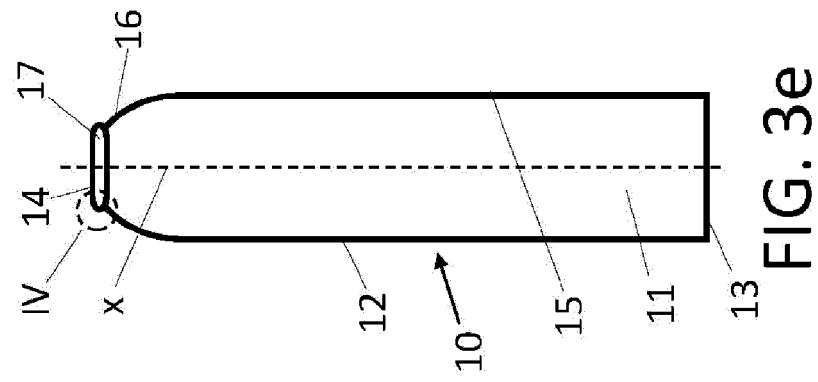


FIG. 2



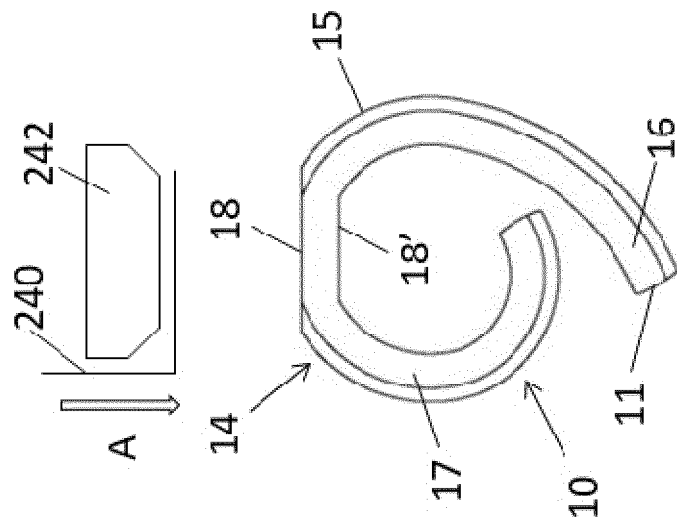


FIG. 4a

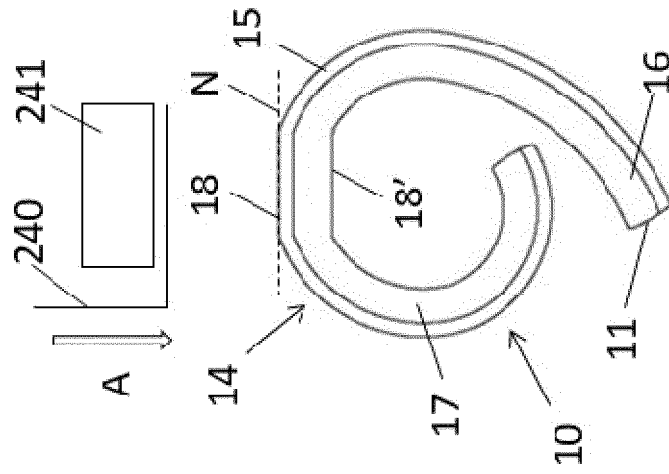


FIG. 4b

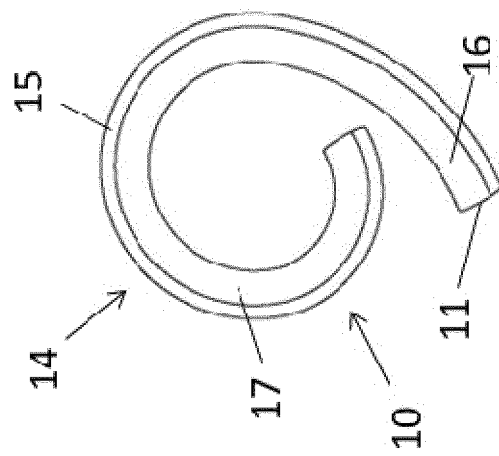


FIG. 4c

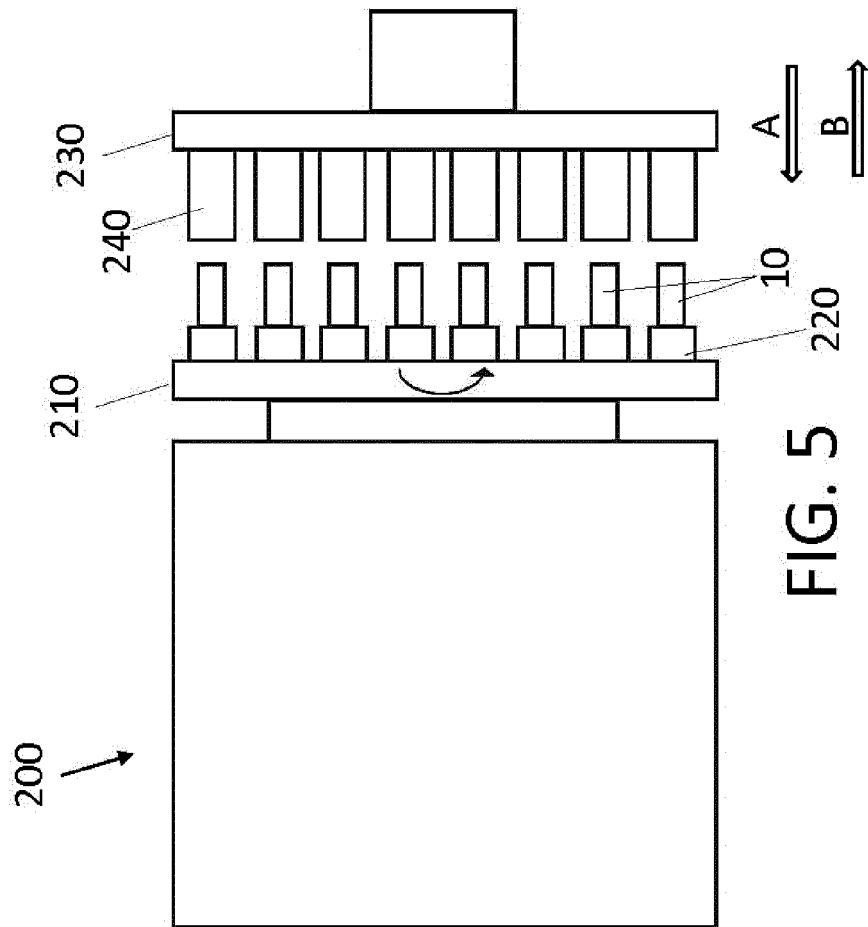


FIG. 5

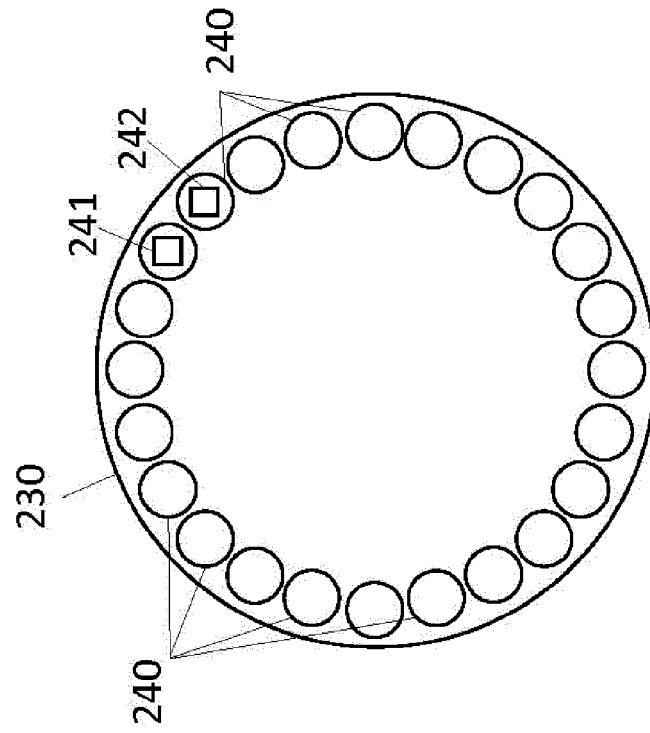


FIG. 6



EUROPEAN SEARCH REPORT

Application Number

EP 23 38 2011

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2014/299566 A1 (TAKATOMI TETSUYA [JP] ET AL) 9 October 2014 (2014-10-09)	11	INV. B21D51/26
A	* figures 1-3 *	1-10	ADD. B21C23/18
X,D	EP 0 915 029 A1 (PROCTER & GAMBLE [US]) 12 May 1999 (1999-05-12)	11	
A	* claim 1; figures 1-3 *	1-10	
X	DE 29 32 826 A1 (LECHNER GMBH) 26 March 1981 (1981-03-26)	11	
A	* pages 6, 7; figures 1-5 *	1-10	
X	CN 102 616 421 A (UNIVERSAL CAN CORP) 1 August 2012 (2012-08-01)	11	
A	* figures 4a, 4b *	1-10	
X	JP 2003 011979 A (TAKEUCHI PRESS) 15 January 2003 (2003-01-15)	11	
A	* figure 8 *	1-10	
A	US 2020/199715 A1 (SILES JOHN L [US] ET AL) 25 June 2020 (2020-06-25)	1-11	TECHNICAL FIELDS SEARCHED (IPC) B21D B21L B21C
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 June 2023	Examiner Vassoille, Philippe
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 23 38 2011

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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Patent document cited in search report		Publication date		Patent family member(s)		Publication date
US 2014299566	A1	09-10-2014	EP	2781278 A1		24-09-2014
			JP	5937337 B2		22-06-2016
			JP	2013107093 A		06-06-2013
			US	2014299566 A1		09-10-2014
			WO	2013073647 A1		23-05-2013

EP 0915029	A1	12-05-1999	CA	2307671 A1		14-05-1999
			CN	1278228 A		27-12-2000
			EP	0915029 A1		12-05-1999
			JP	2001521867 A		13-11-2001
			WO	9923015 A2		14-05-1999

DE 2932826	A1	26-03-1981	NONE			

CN 102616421	A	01-08-2012	NONE			

JP 2003011979	A	15-01-2003	NONE			

US 2020199715	A1	25-06-2020	AR	087892 A1		23-04-2014
			AR	111848 A2		28-08-2019
			AU	2012308416 A1		01-05-2014
			AU	2016204457 A1		28-07-2016
			AU	2018241184 A1		01-11-2018
			AU	2020230322 A1		01-10-2020
			BR	112014006382 A2		04-04-2017
			BR	122018017039 B1		21-01-2020
			CA	2848846 A1		21-03-2013
			CA	2979863 A1		21-03-2013
			CA	3040764 A1		21-03-2013
			CN	104011237 A		27-08-2014
			CN	110218869 A		10-09-2019
			EP	2756108 A1		23-07-2014
			EP	3141624 A1		15-03-2017
			EP	3144403 A1		22-03-2017
			HU	E053500 T2		28-06-2021
			HU	E055985 T2		28-01-2022
			KR	20140084040 A		04-07-2014
			KR	20160098526 A		18-08-2016
			KR	20160120799 A		18-10-2016
			MX	341354 B		17-08-2016
			RU	2014115212 A		27-10-2015
			SI	3141624 T1		30-11-2021
			SI	3144403 T1		30-04-2021
			UA	114608 C2		10-07-2017
			US	2013068352 A1		21-03-2013
			US	2016230256 A1		11-08-2016

EPO FORM P0459

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EP 23 38 2011

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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20-06-2023

10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
			US 2020199715 A1	25-06-2020
			WO 2013040339 A1	21-03-2013
15	-----			
20				
25				
30				
35				
40				
45				
50				
55				

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 915029 A1 [0005] [0012]