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(54) **Title:** METHOD FOR PRODUCING A CAN LID FROM A COMPOSITE MATERIAL

(54) **Bezeichnung:** VERFAHREN ZUM HERSTELLEN EINES DOSENDECKELS AUS EINEM VERBUNDMATERIAL

(57) **Abstract:** The invention relates to a method for producing a can lid from a composite material, comprising at least one sheet metal part, in particular an aluminum or tin plate part, and at least one plastic part, in particular made of polypropylene or polyethylene terephthalate, wherein the plastic part and the sheet metal part are joined together by pressing together and induction heating in order to establish a stable connection with as little effort as possible and a short production time.

(57) **Zusammenfassung:** Verfahren zum Herstellen eines Dosendeckels aus einem Verbundmaterial umfassend mindestens ein Metallblechteil, insbesondere Aluminium- oder Weißblechteil, und mindestens ein Kunststoffteil, insbesondere aus Polypropylen oder Polyethylenterephthalat, wobei zur Bewirkung einer stabilen Verbindung mit möglichst geringem Aufwand und geringer Herstellungszeit das Kunststoffteil und das Metallblechteil durch Aneinanderpressen und induktives Erwärmen zusammengefügt werden.

METHOD OF MANUFACTURING A CAN LID COMPOSED OF A COMPOSITE MATERIAL

The present invention relates to a method of manufacturing a can lid composed of a composite material and comprising at least one sheet metal part, in particular an aluminum part or a tin plate part, and at least one plastic part, in particular composed of polypropylene or polyethylene terephthalate.

Can lids for beverage cans typically have an opening section that is separated from the remaining can lid by a weakening line and that can be moved out of the end plane via a pull member fastened thereto to open the can. The opening section can in this respect be moved into the can or can be moved upward. Reclosable can lids are also known in which a sealing frame of plastic material that is connected to the fixed end surface and that surrounds the opening region is connected to the metal end region surrounding the opening region. A closure unit that is connected to the metal opening section of the can lid that can be pivoted open cooperates with the sealing frame. The sealing frame and the closure unit preferably consist of plastic and the can lid consists of aluminum or tin plate. Similar can lids are used for foodstuff cans. It has also become known that a microgap is provided between the opening section and the fixed can region instead of the weakening line. In this case, the can lid is coated inwardly by a plastic film to cover the microgap in a sealing manner. The plastic film is also pulled open on the opening of the can lid, for which purpose the plastic film can likewise be provided with a weakening line.

It is the underlying object of the invention to provide a method of manufacturing such a can lid that is as simple and as inexpensive as possible.

This object is satisfied in that the plastic part and the sheet metal part are joined together by being pressed together and by inductive heating.

The plastic part is partly melted by the inductive heating and is thereby connected to the sheet metal part with material continuity. Inductive heating has the advantage here that only the sheet metal part is directly heated since eddy currents can be generated only in the sheet melt part due to the induction. In contrast, the plastic part is indirectly heated by the metal part, whereby the side of the plastic part contacting the sheet metal part is in particular partly melted.

The sheet metal part and/or the plastic part is/are preferably coated with a bonding agent prior to the joining. The stability of the join connection can thereby be increased.

The bonding agent preferably includes the same plastic as the plastic part to be connected to the sheet metal part. A particularly good adhesion hereby results and thus a particularly firm join connection.

A completely formed can lid element of sheet metal is particularly preferably joined together with a plastic film having an adapted shape, in particular a thermally shaped plastic film. A particularly firm join connection is also hereby achieved. In addition, the join connection can be established with relatively little energy effort since a matching deformation of the plastic part during the joining is not required.

To manufacture a reclosable can lid, the can lid element is joined in accordance with a further embodiment of the invention together with a plastic film on its one side and to a closure element on its other side that covers the opening region of the can lid and that comprises a sealing frame and a closure unit that can be pivoted open, with the closure unit in particular comprising injection molded plastic, in particular polypropylene or polyethylene terephthalate. Both joining processes preferably take place in one workstep here. The joining process can thereby be carried out particularly fast and simply. Energy is additionally saved since the sheet metal part of the can lid only has to be heated once.

In accordance with a preferred embodiment of the invention, a press is used for the joining process that has a top tool and a bottom tool as well as a hollow

conductor for supplying the electromagnetic alternating field into the region of the can lid for its inductive heating, with the top tool having a shape reciprocal to one side of the can lid and the bottom tool having a shape reciprocal to the other side of the can lid. A particularly good join connection can be established using such an apparatus. The parts to be joined are pressed together by the press so that they are in intimate contact. The electromagnetic alternating field is conducted into the region of the can lid via the hollow conductor and heats the sheet metal part whose heat in turn results in the partial melting of the plastic contacting the sheet metal part.

The hollow conductor particularly preferably has a plurality of ring-shaped or spiral sections that are disposed opposite the joining region of the can lid, in particular a ring-shaped region in the marginal region of the can lid and a spiral region having two, three, or more windings in the middle end region. An advantageous heating of the sheet metal part can be achieved by this design, in particular in the critical marginal region due to the separate ring-shaped region of the hollow conductor.

In accordance with a further advantageous embodiment of the invention, the tool located at the side of the hollow conductor comprises largely shape-stable material, in particular plastic, and the oppositely disposed tool comprises elastic material, in particular elastomeric material. The hollow conductor is safely protected from forces that may occur by the shape-stable material on the side of the hollow conductor. The elastic material on the oppositely disposed side, on the other hand, enables a compensation of production tolerances so that no forces that are too high are produced thereby on the pressing together of the parts.

The largely shape-stable tool is preferably associated with the plastic film. It can additionally preferably be provided with ribs for the introduction of a weakening line into the plastic film during the joining process. A workstep in the manufacture of a can lid can hereby be saved.

In accordance with a likewise preferred embodiment of the invention, the parts to be joined are held together by vacuum during the joining process. An exact fit joining can thereby be ensured. In addition, an advantageous venting is produced that prevents the enclosure of air bubbles between the plastic material and the sheet metal part. With can lids having a microgap between the opening section and the fixed end region, the venting can act on both sides of the end.

It is in particular advantageous for the manufacture of can lids without a microgap to provide at least one of the tools with indentations to produce free spaces that are formed for the reception of possibly enclosed air. Such indentations can preferably be provided in those regions in which enclosed air bubbles are not disruptive, for example in the middle end region with a sufficient spacing from the end margin and from the opening region.

In accordance with a further embodiment of the invention, a rotary indexing table is used to bring the individual elements of the can lid together for the joining process. An advantageous equipping of a press used during joining can thus be achieved.

In accordance with a preferred further development, the rotary indexing table has a vacuum supply for at least one charging station, with the vacuum supply of the individual stations taking place via valves that are actuated by a round distributor. This is particularly advantageous with respect to the distribution of the vacuum.

An embodiment of the invention is represented in the drawing and will be described in the following. There are shown, schematically in each case

Fig. 1 a sectioned, perspective view of a press for use in a method in accordance with the invention;

Fig. 2 a sectioned side view of a part of the press in accordance with the invention;

Fig. 3 a perspective view of an inductor to be used in the apparatus of Fig. 1;

Fig. 4 a side view of the inductor of Fig. 3;

Fig. 5 a plan view of the inductor of Fig. 3;

Fig. 6 a plan view of a can lid,

Fig. 7 a cross-section through the can lid of Fig. 6;

Fig. 8 detail B of Fig. 7;

Fig. 9 detail C of Fig. 7; and

Fig. 10 detail D of Fig. 7.

The press 1 shown in Fig. 1 comprises a lower rack 2 and an upper press part 3 movable relative thereto as well as guide cylinders 4 for guiding the upper press part 3 on the opening and closing of the press. A bottom tool 5 is provided at the upper side of the lower rack 2 and a top tool 6 is provided at the lower side of the upper press part 3. The bottom tool 5 comprises an elastomeric material and has a cavity 7 for receiving a closure element 18 (see Fig. 6) of a can lid 9. In another respect, the bottom tool 5 replicates the shape of the upper side of the can lid 9. The top tool 6 comprises a largely stable-shape plastic and replicates the lower side of the can lid 9.

An inductor 10 is arranged in the region of the press. Hollow conductors 11 for supplying an electromagnetic alternating field are guided into the region of the top tool 6 starting from the inductor 10. As can in particular be seen in Figs. 3 to 5, the hollow conductors that in particular consist of copper are shaped to form an outer ring 12 and a spiral 13 arranged within the ring and having a plurality of windings. As can in particular be seen in Fig. 2, the outer ring 12 and the spiral

13 are arranged above the top tool 6. They thereby lie opposite the surface of the can lid 9 to be joined. The copper hollow conductors 11 are in particular water-cooled.

The can lid 9 shown in Figs. 6 to 9 comprises a base body 14 composed of a sheet metal, in particular aluminum or tin plate. The base body 14 comprises a fixed metallic end region 15 and an upwardly pivotable opening section 16 to release an opening region 8. As can in particular be seen in Figs. 8 and 9, the lower side of the can lid 9 is laminated with a plastic film 17. In contrast, a closure element that comprises a sealing frame 19 and a closure unit 20 is arranged on the upper side of the can lid 9. The sealing frame 19 is connected to the fixed end region 15 and the closure unit 20 is connected to the upwardly pivotable opening section 16.

The method in accordance with the invention can be used to manufacture the can lid 9 shown in Figs. 6 to 9 while using the apparatus shown in Figs. 1 to 5. For this purpose, the closure element 18 that is in particular produced in one piece in a deep-drawing process is placed into the bottom tool 5 such that the side facing the can lid 9 faces upward. The base body 14 that had previously had the plastic film 17 applied to its lower side is placed onto the closure element 18. The press 1 is then closed and the induction heating 10 is switched on.

The metallic base body 14 is heated by the supplied energy in that electromagnetic eddy currents are produced therein. The heated base body 14 in turn heats the plastic film 17 and the closure element 18 that are thereby partially melted. A plastic weld connection is thereby produced between the metallic base body 14 and the plastic film 17, on the one hand, and the closure element 18, on the other hand, with a bonding agent preferably being used to improve the plastic weld connection. The bonding agent can here include the same plastic that is used for the plastic film 17 or for the closure element 18. It can here in particular be polypropylene or polyethylene terephthalate.

The top tool 6 can additionally have ribs which are not recognizable here and by which a weakening line is introduced into the plastic film 17 during the pressing

and joining procedure. In addition, indentations can be provided in the top tool 6 to generate free spaces between the plastic film 17 and the metallic base body 14. Enclosed air can hereby be collected in predefined regions of the can lid 9, in particular in regions in which air bubbles are not disruptive such as in the region between the margin of the can lid and its opening region 8. Additionally or alternatively, the press 1 can be provided with a vacuum supply that, on the one hand, holds the parts to be joined together and, on the other hand, can at least largely prevent an enclosure of air. With can lids having a microgap between the fixed end region 15 and the opening section 16 that can be pivoted open, this applies to both sides of the can lid.

A rotary indexing table can be provided for the equipping of the press 1 that has a plurality of stations for putting together the individual parts of the can lid. However, a linear supply for the press 1 can also be provided instead of a rotary indexing table.

After the welding of the plastic film 17 and the closure element 18 to the metallic base body 14 has taken place, the press is opened and the finished can lid 9 is removed.

Reference numeral list

1	press
2	lower rack
3	upper press part
4	guide cylinder
5	bottom tool
6	top tool
7	cavity
8	opening region
9	can lid
10	inductor
11	hollow conductor
12	outer ring
13	spiral
14	base body
15	fixed end region
16	opening section
17	plastic film
18	closure element
19	sealing frame
20	closure unit

Claims

1. A method of manufacturing a can lid (9) composed of a composite material comprising at least one sheet metal part (14), in particular an aluminum part or a tin plate part, and at least one plastic part (17, 18), in particular composed of polypropylene or polyethylene terephthalate,
characterized in that
the plastic part (17, 18) and the sheet metal part (14) are joined together by pressing together and by inductive heating.

2. A method in accordance with claim 1,
characterized in that
the sheet metal part (14) and/or the plastic part (17, 18) are coated with a bonding agent before the joining.

3. A method in accordance with claim 2,
characterized in that
the bonding agent includes the same plastic as the plastic part (17, 18) to be connected to the sheet metal part (14).

4. A method in accordance with any one of the preceding claims,
characterized in that
a fully formed can lid part (14) composed of sheet metal is joined together with a plastic film (17) having a matched shape, in particular a thermally shaped plastic film.

5. A method in accordance with claim 4,
characterized in that
the can lid part (14) is joined together with the plastic film (17) on its one side and with a closure element (18) on its other side that covers an opening region of the can lid (9) and that is in particular composed of injection molded plastic, in particular polypropylene or polyethylene terephthalate.

6. A method in accordance with claim 5,
characterized in that
both joining processes take place in one workstep.

7. A method in accordance with any one of the preceding claims,
characterized in that
a press (1) is used for the joining process having a top tool (6) and a bottom tool (5) as well as a hollow conductor (11) for supplying an electromagnetic alternating field into the region of the can lid (9) for its inductive heating, with the top tool (6) having a shape reciprocal to one side of the can lid (9) and the bottom tool having a shape reciprocal to the other side of the can lid (9).

8. A method in accordance with claim 7,
characterized in that
the hollow conductor (11) comprises a section that is disposed opposite the reception region of the can lid (9) to be joined, in particular a ring-shaped region (12) in the marginal region of the can lid (9) and a spiral region (13) disposed within the ring-shaped region (12) and having two, three, or more windings in the middle region of the can lid (9).

9. A method in accordance with claim 8,
characterized in that
the tool (6) located at the side of the hollow conductor (11) comprises largely shape-stable material, in particular plastic, and the oppositely disposed tool (5) comprises elastic material, in particular elastomeric material.

10. A method in accordance with claim 9,
characterized in that
the largely shape-stable tool (6) is associated with the plastic film (17).

11. A method in accordance with claim 10,
characterized in that
the tool (6) associated with the plastic film (17) has ribs for introducing a weakening line into the plastic film (17) during the joining process.

12. A method in accordance with any one of the preceding claims,
characterized in that
at least one of the tools (5, 6) has indentations for producing free spaces for receiving possibly enclosed air.

13. A method in accordance with any one of the preceding claims,
characterized in that
the parts (14, 17, 18) to be joined are held together by vacuum during the joining process.

14. A method in accordance with any one of the preceding claims,
characterized in that
a rotary indexing table is used to join together the individual components (14, 17, 18) of the can lid (9) for the joining process.

15. A method in accordance with claim 14,
characterized in that
the rotary indexing table has a vacuum supply for at least one charging station, with the vacuum supply of the individual stations being able to be switched on and off via valves that are supplied with vacuum by a round distributor.

Fig.1

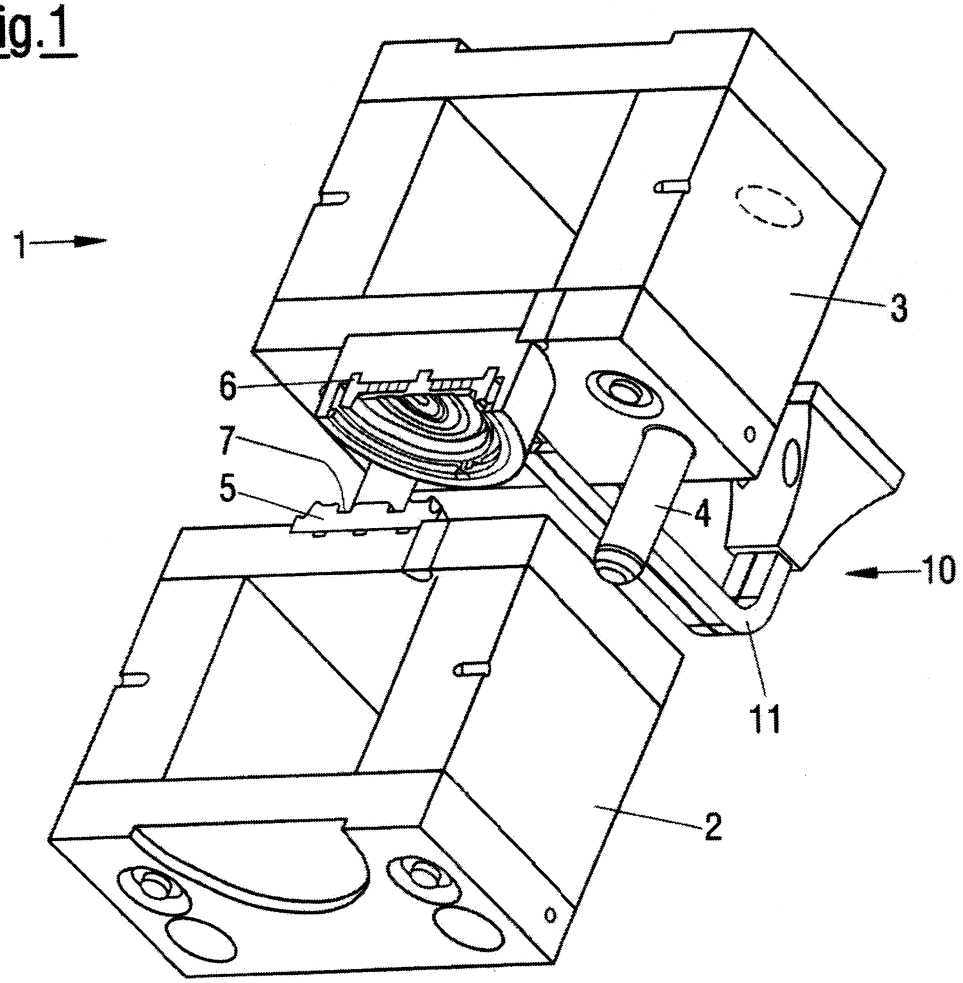


Fig.2

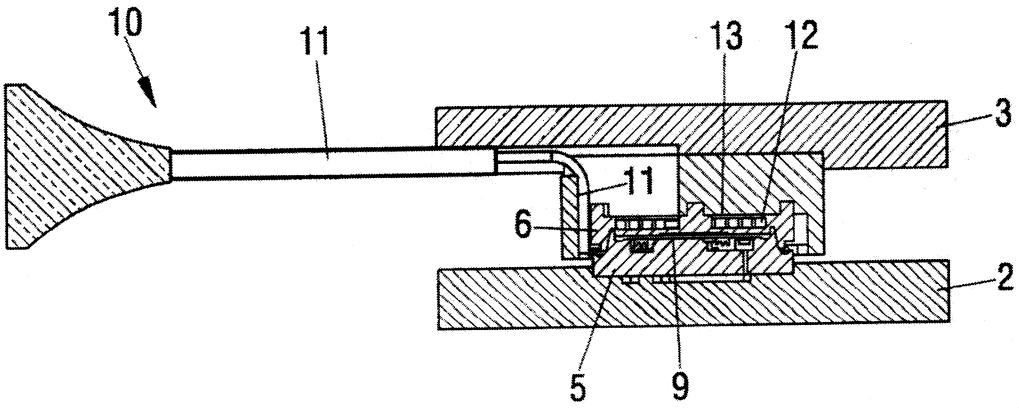


Fig.3

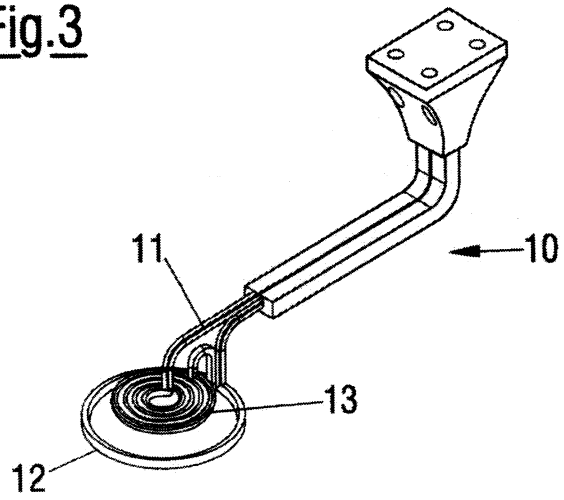


Fig.4

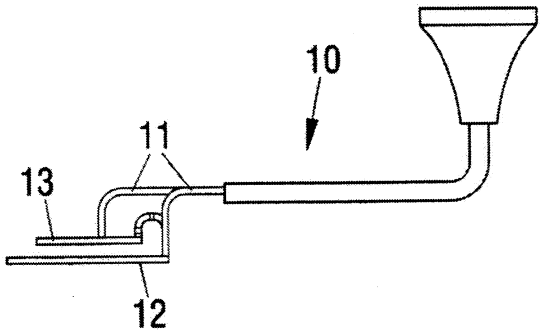


Fig.5

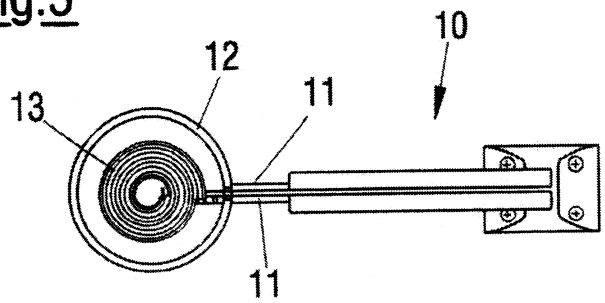


Fig.6

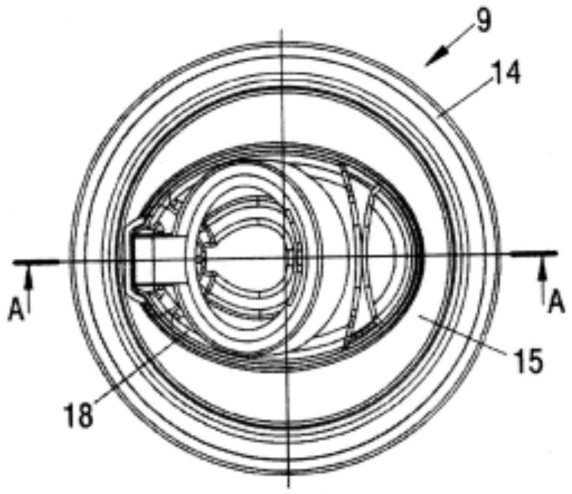
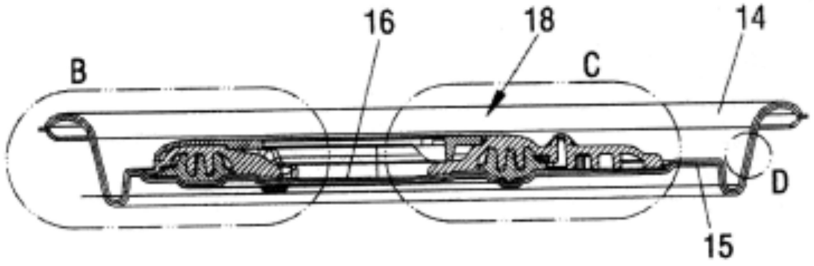
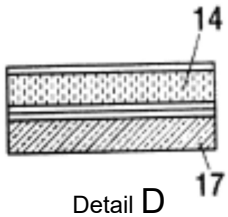


Fig.7



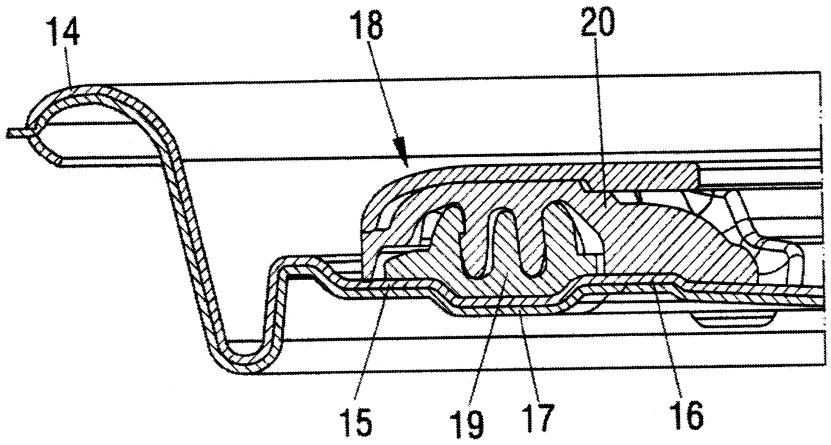
Section A-A

Fig.10



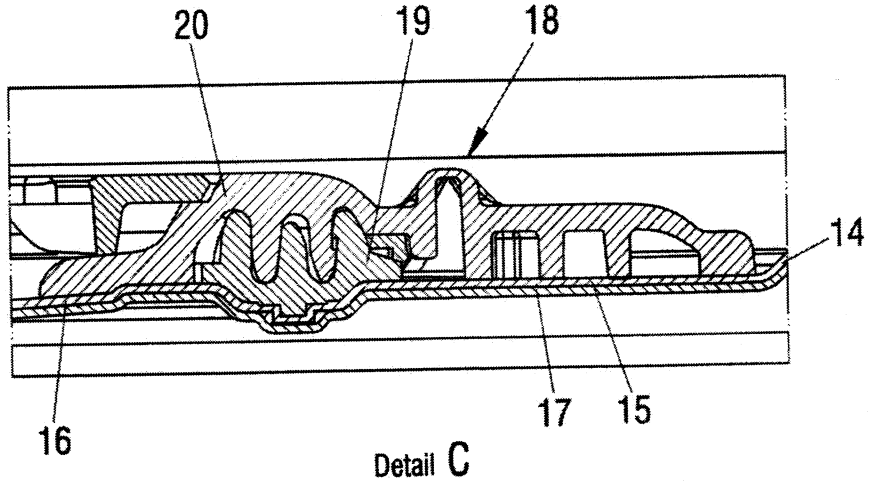
Detail D

Fig.8



Detail B

Fig.9



Detail C