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(54) **Mandrel for the production of a container with a shaping that is compressed in its height**

(57) Mandrel, for the shaping of a flat sidewall-segment into the first sidewall (2) of a container, the mandrel comprising a first part (7) and a second part (8) whereas

the second part (8) is axially displaceable relative to the first part (7) to alter the mandrel from an extended length to a reduced length and vice-versa.

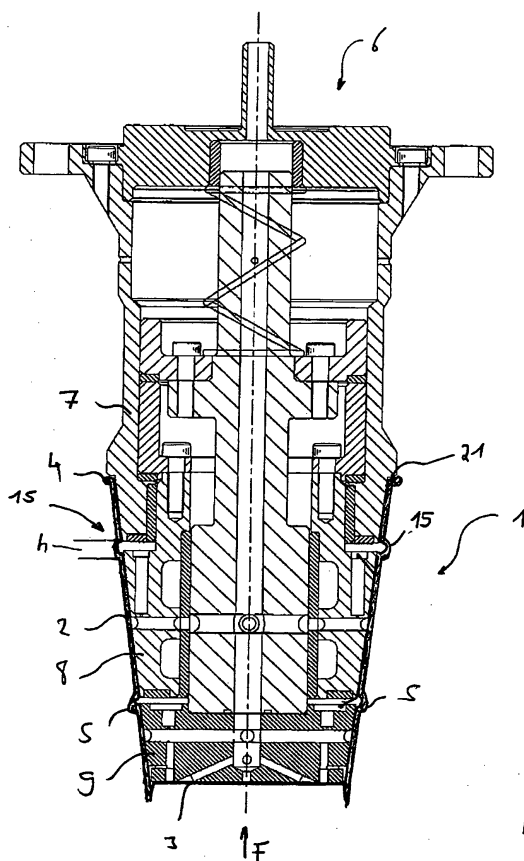


Fig. 2

Description

[0001] The present invention relates to a mandrel for the shaping of a flat segment into a first sidewall of a container.

[0002] Such mandrels are known from the state of the art and can be used to form flat sidewall segments into a plane sidewall of a container. However, the mandrels according to the state of the art are not suitable to produce sidewalls of a container with compressed embossments.

[0003] It was therefore the objective of the present invention to provide a mandrel that allows the production of a sidewall of a container with compressed embossments.

[0004] This objective is attained by a mandrel for the shaping of a flat sidewall-segment into the first sidewall of a container which comprises a first part and a second part, whereas the second part is axially displaceable relative to the first part to alter the mandrel from an extended length to a reduced length and vice versa.

[0005] The present invention relates to a mandrel for the shaping of a flat sidewall segment into the first sidewall of a container. Particularly, the container is a cup in which beverages, especially hot beverages such as coffee or tea or food, especially soup, can be served. This container is preferably made of paper, thick paper, cardboard, fiber-materials, plastic-materials, materials made from renewable and/or biodegradable raw materials or a combination thereof. The container according to the present invention comprises a first sidewall which is preferably conically shaped and which more preferably has at its upper end a rolled rim. The first sidewall is made from a flat segment, preferably a flat cardboard segment, which is subsequently formed, preferably rolled, into its, preferably conically, shape, whereas the ends of the sidewall segment are then attached, preferably glued or sealed to each other. Preferably at its lower end, the sidewall is connected to a base in order to close the container at the bottom. The base is preferably a separate part which is attached, more preferably glued or heat sealed to the lower end of the sidewall container.

[0006] According to the present invention, the first sidewall of the container comprises at least a first shaping which extends at least partially, preferably entirely around the circumference of the first sidewall. This shaping can be directed inwardly and/or outwardly, i.e. towards the content of the container and/or away from the content of the container. This shaping can be produced by any technique known by a person skilled in the art, e.g. by folding or any other method of plastic deformation. Preferably, the shaping is inserted into the segment, preferably the cardboard segment, before it is formed, e.g. rolled around the mandrel into the final shape of the sidewall. More preferably, the shaping is an embossment which is produced for example by applying locally pressure to the sidewall and deforming the material of the sidewall plastically. The shaping can have any form known by a person skilled in the art. However it should

be compressible, at least partially, especially in case an axial-force preferably axial pressure is applied to the sidewall. Preferably the shaping is U-shaped or has at least partially the shape of a segment of a circle.

[0007] This shaping is now according to the present invention, compressed in its height, i.e. after the compression of the shaping, the sidewall is reduced in its height. Due to the compression of the shaping in its height, preferably the radial extension of the shaping increases at least partially. More preferably, the compression is elastic, i.e. as soon as the deformation force is removed, the shaping retries to resume, at least partially, its original shape. Thus, this preferred embodiment of the present invention, the deformed shaping functions as a spring. Preferably, the mandrel comprises internal means, preferably vacuum to maintain the mandrel temporarily in its collapsed state. After the removal of the compression force applied to the sidewall and/or the base of the container, which also collapses the mandrel from an extended to a reduced length, these internal means assure, that the mandrel does not undesirably resumes its extended shape.

[0008] The shaping of the flat sidewall segment into the first sidewall is made by means of a mandrel. The outer surface of the mandrel coincides with the desired form of the container. Preferably, the mandrel has, at least partially, the shape of a cone.

[0009] According to the present invention, the mandrel, particularly the part of the mandrel, around which the flat sidewall segment is wrapped, comprises at least a first part and a second part, whereas the second part is axially displaceable relative to the first part to alter the mandrel from an extended length to a reduced length and vice versa, i.e. the mandrel has a longitudinal-, preferably a middle-axis, along which, the second part is displaced relative to the first part.

[0010] In a preferred embodiment, the mandrel comprises a third part which is axially displaceable relative to the first part and/or the second part to alter the mandrel from an extended to a reduced length and vice versa.

[0011] Preferably, the displacement of the third part is at least temporarily independent from the displacement of the second part.

[0012] In a preferred embodiment of the present invention, the displacement of the third part takes place prior to the displacement of the second part.

[0013] Preferably, the mandrel comprises means, preferably vacuum-means to improve the frictional connection between the mandrel and the container and/or to draw the container towards the mandrel. Thus, it is assured that the container or parts of the container do not move relative to the mandrel, even if the compression force for the embossments is removed.

[0014] Preferably, the means to improve the frictional connection between the mandrel and the container and the internal means, which maintain the mandrel temporarily in its collapsed state, are connected to one vacuum source.

[0015] Preferably, the mandrel comprises means, which preloads the mandrel into its extended state, i.e. which force the second and/or third part of the mandrel away from the first part and/or away from each other under the formation of a gap, respectively. This means is preferably a spring.

[0016] In another preferred embodiment of the present invention, the mandrel comprises means to eject the container. Preferably these means are pressurized air, which is fed through the same channels as the vacuum is drawn. The pressurized air pushes the container away from the mandrel.

[0017] Preferably the mandrel is conically shaped.

[0018] The invention is now explained according to figures 1-4. This explanation does not limit the scope of protection.

[0019] Preferably, the mandrel comprises means to limit the radial extension of a compressed shaping, especially a shaping, that is directed inwardly.

Figure 1 shows a sectional view of the inventive mandrel.

Figure 2 shows the first sidewall wrapped around the mandrel.

Figures 3a and 3b show details of the inventive mandrel.

Figure 4 shows an embodiment of a container produced with the inventive mandrel.

[0020] Figure 1 shows the inventive mandrel 6, which comprises two fixation means 13, here holes, which allows the fixation of the mandrel for example to a frame. The inventive mandrel 6 comprises a first, preferably stationary, part 7, a second part 8 and a third part 9. Whereas the second and/or the third part are at least temporarily independently axially displaceable relative to the first part 7, i.e. the third part is displaceable relative to the second part 8 and the second part is displaceable relative to the first part, preferably together with the third part 9. Due to the displacement of the third part 9 relative to the second part 8, gap 19 is closed and due to the axial movement of the second part 8 relative to the first part 7, the second gap 20 is closed. The relative movement of the third part relative to the second part and the movement of the second part relative to the first part allow the compression of shapings, preferably embossments in the sidewall of the container whereas the height of the gap 19 and 20 determines the degree of compression of the shapings. As can be seen from figure 1, the first gap 19 has a smaller height than the second gap 20. Thus, the shaping in the vicinity of gap 19 will be less compressed than the shaping around the second gap 20. The second- and/or the third part can be axially displaced independent from each other, whereas preferably the third part is firstly displaced relative to the second part and then the third part and the

second part are jointly displaced relative to the first part. Force F takes care of the axial displacement of the second and third part. This force F can impact directly on the third part of the mandrel and/or can be transferred via the base and/or the sidewall to the mandrel. In order to maintain the mandrel in its compressed state, the mandrel comprises internal means 12 which are explained in more detail according to figures 3a and 3b. As soon as the shapings 5, 15 have been compressed and the mandrel has been collapsed, it is desirable to remove the compression force F from the container. Since, as already mentioned above, the compressed shapings 5, 15 have a spring like behavior i.e. they tend to resume their uncompressed shape after force F has been removed, means to maintain the shapings in their compressed state have to be provided. This is in the present case carried out by vacuum means, which have a vacuum source and inlet means 10.1, here one or more channels. The vacuum sucks the sidewall 2 and/or the bottom 3 towards the mandrel and thus assures, that the container does not move unintentionally relative to the mandrel.

[0021] Figure 2 shows the mandrel according to figure 1 with a container placed around it. As can be seen, the container comprises a sidewall 2, which is wrapped around the mandrel and which has a shape that coincides with the outer surface of the mandrel. At its upper end, the sidewall 2 comprises a rim 4 which is placed against a holding means 21 of the mandrel 6.

Furthermore, the sidewall comprises first embossment 5 which is located at the height of gap 19 and a second embossment 15 which is placed at the same height as the second gap 20. Figure 2 shows the embossments 5, 15 of the cup in their uncompressed state, i.e. with a relatively large height h. In order to compress the shapings 5, 15 a force F is applied to the bottom of the cup. This force firstly compresses the first shaping 5 while at least essentially simultaneously displacing the third part relative to the second part and thereby closing gap 19. During this part of the process and subsequently, vacuum is drawn via the vacuum means 10.1. This assures, that the sidewall 2 and the bottom 3 of the container 1 are in very close contact with the surface of the mandrel and that the frictional force between the inner surface of the cup and the outer surface of the mandrel is increased so that the container does not move relative to the mandrel. Additionally, this vacuum assures that, once one gap 19, 20 has been closed, it maintains in this closed state. After the first embossment 5 has been compressed and the first gap 19 has been closed, the third part 9 and the second part 8 are jointly moved axially relative to the first part 7. By this movement, the second gap 20 is closed and thereby the second shaping 15 is compressed, i.e. reduced in its height h. In the vicinity of gap 20 also means 12, here vacuum means, are provided to maintain the gap 20 in its closed state.

[0022] The vacuum 10 assures that, even in case force F is removed, the mandrel as well as the embossments of the sidewall of the container 1 remains in their com-

pressed state.

[0023] Figure 3a and 3b show the means to maintain gap 20 in its closed state. This means is essentially a vacuum channel 12 and inlay 14. Figure 3a shows gap 20 in its extended state. Figure 3b shows gap 20 in its closed state. As soon as the gap 20 has been closed, the inlay 14 seals the area around the vacuum channel 12 and thus a force is created that sucks the second part 8 towards the first part 7 so that the gap 20 is not unintentionally increased, even though spring 11 forces the part 7, 8 apart. As soon as the vacuum is released, the gap is automatically increased by the spring 11 to an extent as depicted in Fig. 3a.

[0024] Figure 4 shows an embodiment of a container, here a cup, that can be produced with the inventive mandrel 6. The cup comprises a first sidewall 2 which has two shapings 5, 15 at different height and at its upper end a rolled rim 4. The opposite end of sidewall 2 is connected to a base 3. In order to maintain the shapings 5, 15 in their compressed state as depicted in Figure 4, a second sidewall is utilized which is connected preferably glued or sealed in the connection areas 17, 18 to the first sidewall. Due to this second sidewall 16 shapings 5, 15 cannot resume their original uncompressed state. The second sidewall 16 is wrapped around and attached to the first sidewall after the shapings 5, 15 have been compressed and after the compression force and especially the means that utilize the compression form has been removed. As already said above, the mandrel and the container are then held in their compressed state by means of vacuum. Since the means that utilize the compression force F are then removed, the surfaces to attach the second sidewall to the first sidewall are accessible and the second sidewall can be wrapped around and glued to the first sidewall in the connection areas 17, 18. As soon as the second sidewall is rigidly connected to the first sidewall, the container is removed from the mandrel. This is utilized by compressed air, which is provided via the same channels as the vacuum.

List of reference signs:

[0025]

1	Container, cardboard container, cup
2	first sidewall
3	base, bottom
4	rim
5	first shaping, first embossment
6	mandrel
7	first part
8	second part
9	third part
10	means to improve the frictional connection between the mandrel and the cardboard- container, vacuum means, means to eject the container
10.1	inlet for the vacuum
11	spring means

12	holding means
13	connection means
14	inlay
15	second shaping, second embossment
16	second sidewall
17	connection point, connection area
18	connection point, connection area
19	first gap
20	second gap
21	holding means, stopper
F	Force to collapse the mandrel
h	height of the shaping 5, 15

15 Claims

1. Mandrel, for the shaping of a flat sidewall-segment into the first sidewall (2) of a container, **characterized in, that** it comprises a first part (7) and a second part (8) whereas the second part (8) is axially displaceable relative to the first part (7) to alter the mandrel from an extended length to a reduced length and vice-versa.
2. Mandrel according to claim 1, **characterized in, that** it comprises a third part (9) which is axially displaceable relative to the first part (7) and/or the second part (8) to alter the mandrel from an extended length to a reduced length and vice-versa.
3. Mandrel according to claim 2, **characterized in, that** displacement of the third part (9) is at least partially independent from displacement of the second part (8).
4. Mandrel according to claims 2 and 3, **characterized in, that** the displacement of the third part (9) takes place prior to the displacement of the second part (8).
5. Mandrel according to one of the preceding claims, **characterized in, that** it comprises means (10, 10.1), preferably vacuum, to improve the frictional connection between the mandrel and the container and/or to draw the container towards the mandrel.
6. Mandrel according to one of the preceding claims, **characterized in, that** it comprises internal means (12), preferably vacuum, to maintain the mandrel temporarily in its collapsed state.
7. Mandrel according to claims 4 or 5, **characterized in, that** the means (10, 10.1) and the means (12) are connected to one vacuum-source.
8. Mandrel according to one of the preceding claims, **characterized in, that** it comprises means (11) to preload the mandrel in its extended state.

9. Mandrel according to one of the preceding claims,
characterized in, that it comprises means to eject
the container.

10. Mandrel, **characterized in, that** it is conically 5
shaped.

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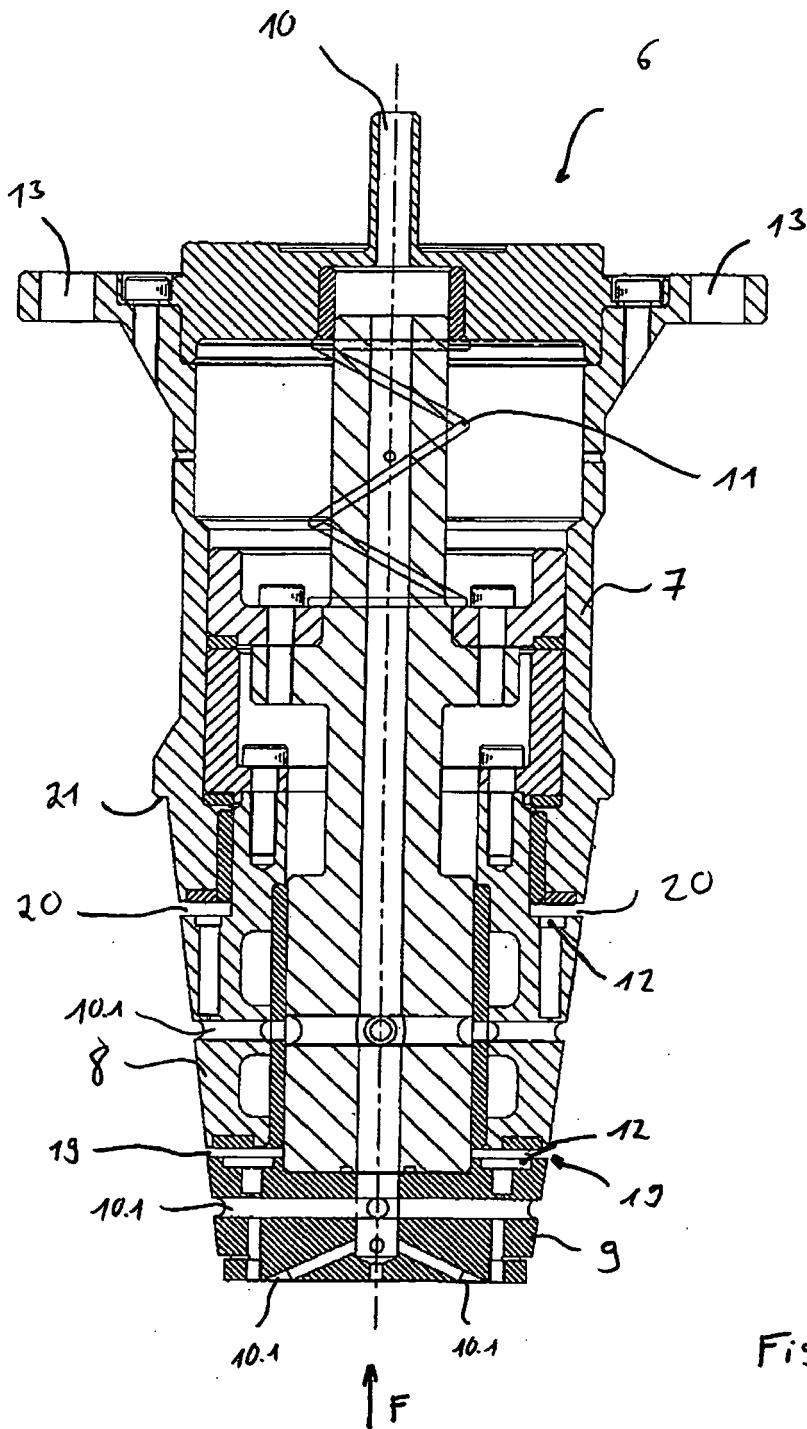
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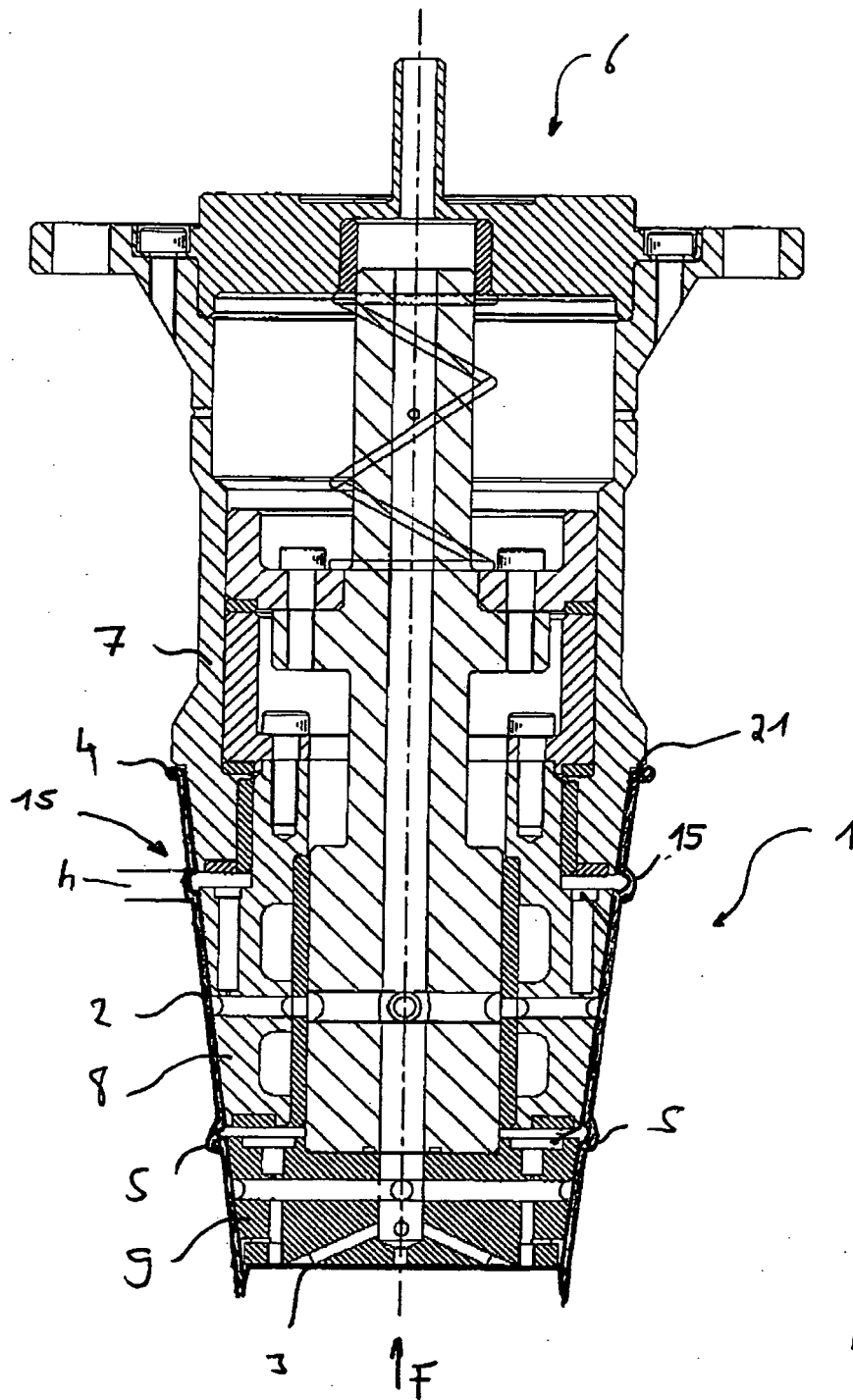
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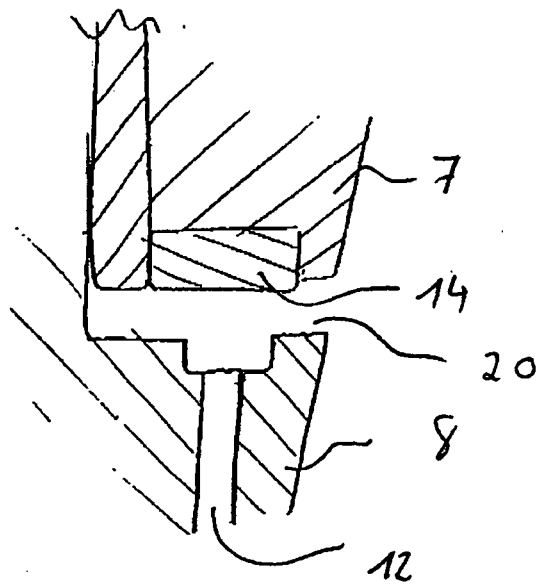


Fig. 3a

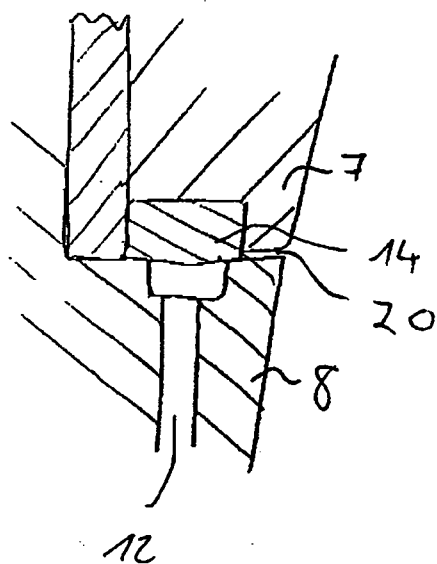


Fig. 3b

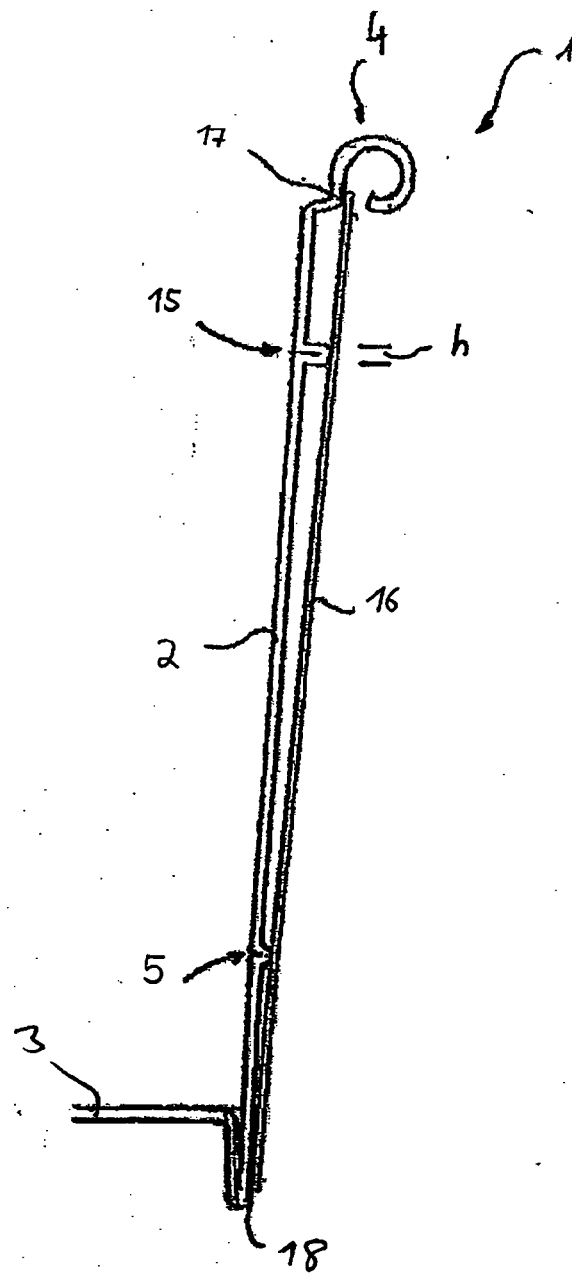


Fig. 4