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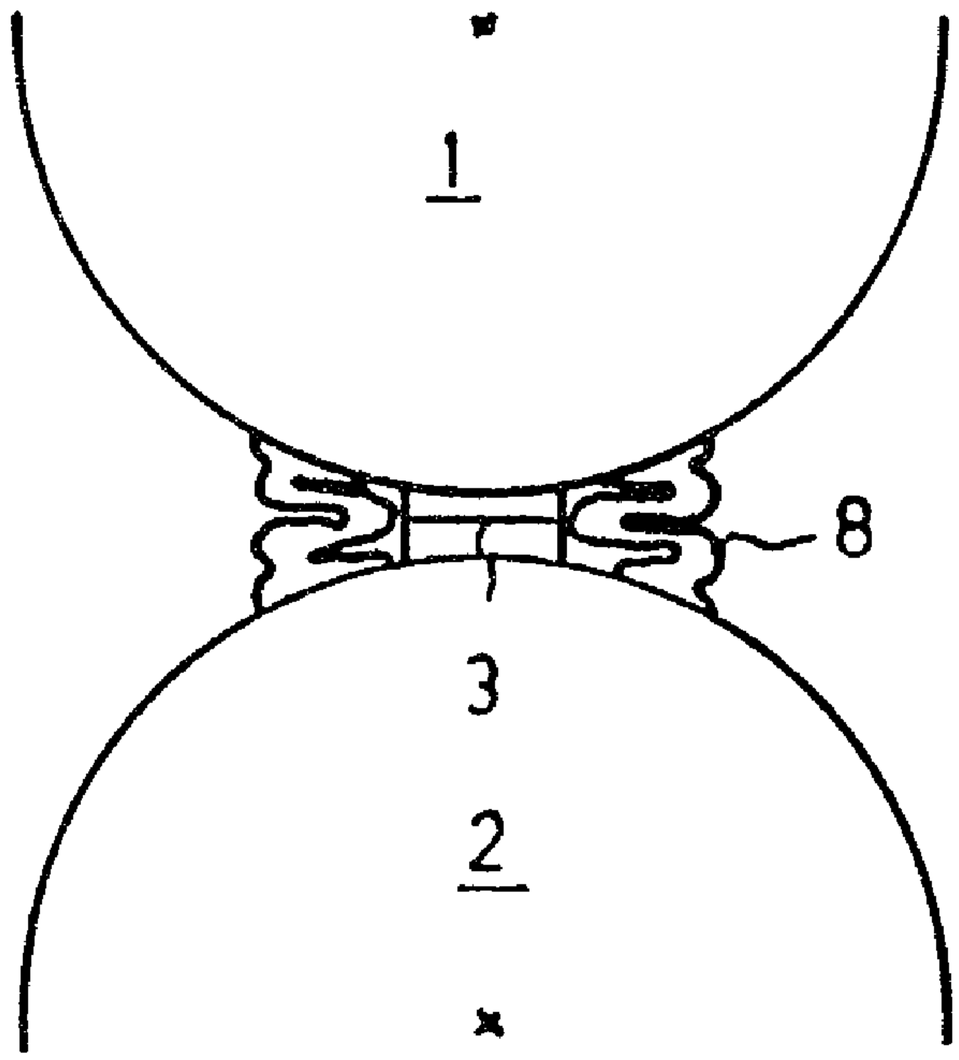
(54) Title: HINGED SNAP CLOSURE MADE OF PLASTICS MATERIAL




(57) Abrégé/Abstract:
A plastic snap hinge closure having tension elements disposed on a plastic closure including a lower part and an upper part which are connected with each other via a main hinge. A desired snap effect is achieved by means of lengths of the tension elements which can be changed by the action of a pull. The tension elements extend in planes between the attachment points. Each tension element has partial sections which cause the change in length. The partial sections are either C-shaped, U-shaped, or O-shaped. The tension elements permit a maximum percentage change of length of each tension element of approximately 10% to 50%.

# Abstract

A plastic snap hinge closure having tension elements disposed on a plastic closure including a lower part and an upper part which are connected with each other via a main hinge. A desired snap effect is achieved by means of lengths of the tension elements which can be changed by the action of a pull. The tension elements extend in planes between the attachment points. Each tension element has partial sections which cause the change in length. The partial sections are either C-shaped, U-shaped, or O-shaped. The tension elements permit a maximum percentage change of length of each tension element of approximately 10% to 50%.

# HINGED SNAP CLOSURE MADE OF PLASTICS MATERIAL

The present invention relates to a plastic snap hinge closure consisting of a lower part and of an upper part connected with it by means of a film hinge, where the closure shell walls in the area of the hinge extend straight or curved and have at least one tension element connected with both closure parts in one piece, and that the at least one tension element has, directly or indirectly, an attachment point on the shell walls of both parts

Plastic snap hinge closures of the above mentioned type are known, for example, from the two European Patent Disclosures Nos. 0 147 423 and 0 291 457 of applicant. In the first mentioned patent disclosure the tension elements are tension straps, which are produced by means of injection molding over consoles on the shell wall of the lower part and of the lid and thus are located in one plane. In the second patent disclosure mentioned the tension straps are disposed extending approximately in or on the shell wall.

In the first mentioned example the said tension straps extend in one plane in the closed position and the attachment points of the tension straps are displaced out of the shell wall by consoles in such a way that they are located parallel to the main axis. In the second example mentioned the tension straps extend in two planes which between them enclose an angle.

Accordingly, the outer sections of each of the tension straps must travel a greater distance during opening than the inner sections of the straps located more closely to the hinge.

In a third variant in accordance with European Patent Disclosure No. 0 056 469 (Wiesinger), instead of tension straps triangular intermediate elements, which verge with their tips into the main hinge, were disclosed.

Regarding an explanation of the operation of the various snap hinge closures, it was believed that the tension straps used

in the two first mentioned patent disclosures would elastically stretch and in this way provide the snap effect. In fact, however, the plastic materials used for plastic closures hardly have the ability of stretching elastically. This means that the snap effect really does not work in this way.

The function in connection with the third variant in accordance with European Patent Disclosure No. 0 056 469 is correctly explained. Here it is pointed out that the action of the snap closure is based on the elastic deformation of the closure in the area of the hinge. This means that in the course of each opening or closing of the closure the shell wall of the lower part or the lid, or of the entire lid, arches in the area of the passage across the dead center position in the course of operation and subsequently is bent back into the relaxed, non-deformed shape.

Of course, this is an undesirable cooperation of forces which are hard to predict and interact in a complex manner. The attainment of the snap action can only be determined empirically and is hard to predict. Easier to predict are the results in connection with snap closures operating by means of a toggle joint, one of the levers of which extends into the surface of the lid and the other in the shell wall of the lid and the lower part. With these closures the snap effect depends on the force required to deform the two levers of the toggle joint. However, a hinge of this type is only suitable for closures having a small spout, where the lid itself does not close off the spout, but a sealing element placed thereon and cooperating with the spout does, since the lid itself can not seal because of the cuts along the toggle joint.

Accordingly it is desired to provide snap hinge closures, the snap effect of which does not depend on the elastic of some arbitrary part of the closure, except for the tension element.

It is an object of the present invention to provide a plastic snap hinge closure where the snap effect can be attained by means of the at least one tension element.

The present invention provides a plastic snap hinge closure having at least one first film hinge connecting a lower part and an upper part, and at least one tension element having two opposite end portions each attached to a corresponding closure wall of each of the lower part and the upper part, the snap hinge closure further comprising a second film hinge and a third film hinge per each the at least one tension element, the second film hinge formed between the upper part and each the at least one tension element, the third film hinge formed between the lower part and each the at least one tension element, wherein the at least one tension element comprises a plurality of adjacent partial sections forming a strap in a closed position of the hinge closure, wherein each the strap lies within a plane defined substantially between the second film hinge and the third film hinge in the closed position, wherein the adjacent partial sections meanders through a plurality of curved turns within the plane, and wherein during a pivotal movement of the upper part with respect to the lower part, about an axis of rotation of the at least one first film hinge, each the partial section elastically deforms to cause a change in a length of each the partial section.

Further advantageous embodiments of the subject of the invention will be explained in the following description by means of the drawings, wherein:

Fig. 1 is a schematic functional description of the snap effect of a snap hinge closure in accordance with the invention, equipped with a longitudinally changeable tension element;

Figs. 2a and 2b are perspective views of a round snap hinge closure to explain the disposition of the tension elements or of the tension element in relation to the main hinge;

Figs. 3 to 5 show three different embodiments of length-adjustable tension elements at round closures, in the variation a. each in a back lateral view towards the hinge of the closed closure and in b. each in the completely opened state of the same snap hinge closures;

Fig. 6a shows a further variant in connection with a box;

Fig. 6b a perpendicular partial section of the box along the line A - A of Fig. 6a;

Fig. 7 shows the tension element in accordance with Fig. 6 in use with a round closure in its completely open position;

Figs. 8a to d show a structural drawing of the tension element in accordance with Figs. 3a and b in detail, once in a lateral view corresponding to the completely opened position of the closure after manufacture, and

Fig. 8b the same tension element in its position when the closure is completely opened,

Fig. 8c in the dead center position of the closure at maximum stretch, and

Fig. 8d in the completely closed position.

The mode of operation of the closure in accordance with the invention is illustrated in the schematic view in accordance with Fig. 1. The lower part of the closure, which can be placed, for example, on a container, is designated by 1. In the closed position of the closure, the lower part 1 is covered by an upper part 2. In this way the upper part 2 forms a lid or cap on the lower part 1. The two parts 1 and 2 are connected in one piece via a film hinge 3. The film hinge forms the axis of rotation in relation to which the upper part 2 can be pivoted by approximately 180° in respect to the lower part 1. The film hinge 3 is outwardly displaced in relation to the shell wall 6 of the lower part 1 and to the shell wall 7 of the upper part 2 aligned with it. To be able to produce the closure by injection molding in the completely open state, the film hinge 3 must be located outside of the said shell walls. A schematically shown tension element is designated by the reference numeral 8. It has an upper attachment point 4, by means of which the tension element 8 is fastened on the upper part 2, and a lower attachment point 5, by means of which the tension element 8 is fastened on the lower part 1. Because the axis of rotation, formed by the film hinge 3, as well as the upper attachment point 4 of the tension element 8 are fixedly disposed on the closure, the upper attachment point 4 performs an excursion around the film hinge 3 on an arc of a

circle with the radius r. However, the tension element 8 is not fastened in the axis of rotation 3 but on the lower attachment point 5 and therefore attempts to turn around this point. If the tension element 8 could not be elongated, the upper attachment point 4 has to move on an arc of a circle having a radius $\ell$, where $\ell$ corresponds to the length of the tension element 8. The difference between these two radii r and $\ell$ with different axes of rotation inevitably results in a change in the length of the tension element 8. This change in length is shown in the drawing by $\Delta\ell$. This change in length generates the force required for the snap effect. How to design the tension elements so that such a change in length can be effected will be described below. Thus the force with which the closure performs a snap effect depends on relatively simple geometric considerations. In contrast to the snap hinge closures described in the beginning, the hard-to-predict change in the shape of the closure itself does not have any importance in the mode of operation described above. The degree of elasticity can be affected by the design of the tension elements. Maximum change in length $\Delta\ell$ and the location of the dead center position are essentially only dependent from the disposition of the attachment points 4 and 5 in relation to the film hinge 3. In this way the designer has a large degree of freedom in respect to the design of a closure in accordance with the invention. If, for example, in the variant illustrated the two attachment points 4 and 5 are placed further inward while maintaining the length of the tension element 8, the radius r is increased by this and $\Delta\ell$, on the one hand, changes, as well as the angular position of dead center, on the other. The optimization of the snap effect can be derived directly from the drawing without experimentation. If the possible change in length $\Delta\ell$ is comparatively great, the tolerance range regarding the disposition of the attachment points of the tension element is also great. This is in clear contrast to the

plastic snap hinge closures known so far, which only permit a small range of tolerance in respect to the geometric arrangement.

Figs. 2a and 2b each show a snap hinge closure in a perspective view for the purpose of explaining the possible disposition of the snap hinge. The variant according to Fig. 2a shows a relatively narrow film hinge 3, via which the lower part 1 is hingedly connected with the upper part 2, and on both sides a tension element 8, each disposed at the same distance from the film hinge 3. In contrast thereto, the variant in accordance with Fig. 2 shows two film hinges 3 at a certain distance from each other and a centrally disposed tension element 8. In the construction of non-cylindrical plastic closures it is possible to realize different combinations of one or more film hinges with one or a plurality of tension elements.

Three variants of plastic snap hinge closures in accordance with the embodiment of Fig. 2a are shown in Figs. 3a, b to 5a, b, which only differ in the design of the tension elements 8.

If Figs. 3a, 4a, and 5a are considered, which each show the back view of a closed closure, it becomes clear that the attachment points 4, 5 of each individual tension element 8 extend parallel to each other when the closure is closed. However, in Figs. 3b, 4b and 5b the hinge areas of the respective closures are shown in the completely open position of the latter. In this position each of the attachment points 4, 5 extends obliquely to the other. In designing the tension elements 8 it is possible to proceed in such a way that they are located straight in one plane in the completely open position of the closure, as shown in Figs. 3b, 4b and 5b, but are completely relaxed. This would correspond to the manufacturing position. With this disposition of the tension elements, they would already be slightly stretched in the closed position of the closure. Because of this the tension elements exert a certain amount of closing force even in the

closed position of the closure. On the one hand, this increases the snap effect and, on the other, the closing movement is maintained until the last in the course of the snap effect.

The attachment points of the tension elements are each disposed at least approximately aligned with the shell walls in the illustrated examples. However, this is not necessary. The attachment points 4, 5 could also simply verge over into consoles which are produced by injection molding on the shell walls and extend outward from them. This variant will be used particularly if it is desired to dispose the tension elements 4, 5 on a round closure relatively far from the main hinge 3. In this case a variant is also conceivable where the attachment points of the tension elements extend obliquely to each other. The disposition of the tension elements in relation to the main hinge 3 as well as the position of the attachment points 4, 5 in respect to each other will have an effect on the choice of the shape of the tension elements or their partial sections.

The embodiment in accordance with Figs. 3a and b shows tension elements 8 consisting of three partial sections in the shape of the letter C. The three C-shaped partial section constitute a meandering strap extending in a plane between the two attachment points 4 and 5. The change in length of the tension elements 8 is provided by spreading of the partial sections 10. The more the tension elements 8 are stretched, the wider the C-shaped partial sections 10 are spread. The direction of opening of the C-shaped parts 10 alternates in this embodiment. But this not an absolute requirement.

Figs. 4a and b show a variant where the tension elements do not consist of partial sections. While the partial section adjoining the attachment points 4, 5 are semi-elliptical partial sections 11, a completely elliptical partial section 12 is disposed between them. It is of course also possible that a

tension element 8 consists of three such elliptical C-shaped partial sections. It is simply a question of definition, because five C-shaped partial elements could also be recognized just as easily in this shape. The more the tension elements 8 here are changed in their length, the more the elliptical partial sections are stretched into circular elements.

The embodiment in accordance with Figs. 5a and b shows tension elements almost identical to those in Figs. 3a and b. Only the partial sections 10 are disposed differently.

Fig. 6 shows that the use of the snap hinge closure in accordance with the invention is not limited to the employment of round or otherwise shaped closures of containers. In this case the snap hinge in accordance with the invention is fixed on a can 20. The lowerr can body 21 is connected with the can lid 22 via the main hinge 23. The two tension elements disposed on both sides of the main hinge 23 are identified by the numeral 28. Each tension element 28 consists of four U-shaped partial elements 24. In contrast to the embodiments of the tension elements described so far, the partial sections 26 in this case do not extend within the plane formed between the attachment points 24 and 25, but they meander in an accordion-like manner out of the plane between the two attachment points. In the example shown, the tension elements consist of several U-shaped partial elements which adjoin each other in such a way that they have an area which is rounded towards the inside in respect to the closure and have a level area towards the outside in respect to the closure. In this case the level areas 30 are disposed in such a way that in the closed state of the closure they are located in an aligned plane together with the shell walls. However, the rounded areas 31 of the partial sections 26 extend somewhat into the box in respect to the shell wall. Such an embodiment of the tension elements is not only suitable for boxes, but also for closures which are fixed on a

container. In this variant embodiment of the tension element, too, the change in length is achieved by spreading of the U-shaped partial elements 26. Although not required, the tension elements can be formed by film hinges 32 in the area of the attachment points 24, 25. This has the advantage that the tension elements 28 always extend nicely in the plane between the two attachment points, regardless of the opening position of the closure or the lid 22. This in particular simplifies the design of the injection mold. If such a tension element 28 is attached to a round closure, such as illustrated in Fig. 7, in the completely opened state of the closure the partial sections 26 form a fan-shaped strap which can be changed in length.

A tension element 8 in accordance with the embodiment of Fig. 3a is shown in detail in Figs. 8a to 8d. Fig. 8a a is a partial view of the closure in the area of the hinge. The illustration corresponds to the position during injection molding, where the closure is completely opened. Again the lower part 1 is connected with the upper part 2 via a film hinge. In this case the tension element 8 extends completely level and the attachment points 4, 5 are disposed in recesses 14, 15 in the upper and lower part. The same situation is shown in Fig. 8b in a view on the top of the tension strap. The drawing plane is that plane which is formed through the attachment points 4 and 5. If the distance between the centers of the two attachment points 4 and 5, located on the line B - B, is measured, it can be seen that in this position the distance is shortest. In the real example, shown here in a scale of 10:1, this distance a is 4.7 mm. However, in Fig. 8c, in which the closure is shown in its dead center position, the tension element 8 is changed to its greatest length, i.e. the individual partial elements are spread the widest. In this case the distance a has increased to 6.6 mm. This corresponds to an increase of approximately 40%. In the closed

position of the closure shown in Fig. 8d, the distance between the two attachment points 4, 5 is still 5 mm. Accordingly, the tension element 8 is still under stress even in the closed position of the closure. In respect to the relaxed position in accordance with Fig. 8a or Fig. 8b, the change in length still is more than 6%. The maximum elastic change in length of the tension elements will be advantageously selected to be between 10 and 50%. But this depends to a large extent on the geometric conditions. In addition to the percentage change of length, however, the pulling force exerted by the tension element is of importance. This is affected on the one hand by the geometric design of the tension element and, on the other, by the material strength of the partial sections. So that no deformation of the closure itself occurs, it is practical to make the wall thickness of the partial sections considerably less than the wall thickness of the shell walls in the area of the attachment points. If the percentage of the maximum elastic change in length is chosen too small, the snap effect only takes place in the range of dead center. As a lower limit, a 10% change in length in the area of dead center would be sensible.

As already shown by the few selected examples in accordance with the attached drawings, the choice of the different variants in the design of the closures in accordance with the invention is almost unlimited. This is a very important advantage, especially for plastic snap hinge closures. Almost every manufacturer of cosmetic products, food or technical chemicals desires a special design adapted to the packaging of his products. The designer now actually has almost unlimited possibilities available with the help of the instant hinge.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A plastic snap hinge closure having at least one first film hinge connecting a lower part and an upper part, and at least one tension element having two opposite end portions each attached to a corresponding closure wall of each of said lower part and said upper part, the snap hinge closure further comprising a second film hinge and a third film hinge per each said at least one tension element, said second film hinge formed between said upper part and each said at least one tension element, said third film hinge formed between said lower part and each said at least one tension element;

wherein said at least one tension element comprises a plurality of adjacent partial sections forming a strap in a closed position of said hinge closure;

wherein each said strap lies within a plane defined substantially between said second film hinge and said third film hinge in said closed position;

wherein said adjacent partial sections meanders through a plurality of curved turns within said plane; and

wherein during a pivotal movement of said upper part with respect to said lower part, about an axis of rotation of said at least one first film hinge, each said partial section elastically deforms to cause a change in a length of each said partial section.

2. A closure in accordance with claim 1, wherein each of said at least one first film hinge is positioned on a console protruding outward with respect to said corresponding closure wall of each of said lower part and said upper part.

3. A closure in accordance with claim 1, wherein said second film hinge and said third film hinge of said at least one tension element are aligned with said closure walls.

4. A closure in accordance with claim 1, wherein said second film hinge and said third film hinge of said at least one tension element are positioned parallel to each other.

5. A closure in accordance with claim 1, wherein said second film hinge and said third film hinge of said at least one tension element are positioned at an angle with respect to each other within said plane in said closed position.

6. A closure in accordance with claim 5, wherein there are two of said at least one tension element which are symmetrically positioned on both sides of said at least one first film hinge which hingedly connects said lower part and said upper part.

7. A closure in accordance with claim 1, wherein each partial section of said at least one tension element extends arcuately in said plane between said second film hinge and said third film hinge in said closed position.

8. A closure in accordance with claim 7, wherein said partial sections arcuately verge into each other and form said continuously elastic strap which meanders in said plane between said second film hinge and said third film hinge in said closed position.

9. A closure in accordance with claim 7, wherein each said partial section is C-shaped.

10. A closure in accordance with claim 7, wherein each said partial section is U-shaped.

11. A closure in accordance with claim 7, wherein each said partial section is O-shaped.

12. A closure in accordance with claim 7, wherein said partial sections of said at least one tension element are positioned so that they meander in a serpentine fashion in said plane between said second film hinge and said third film hinge in said closed position.

13. A closure in accordance with claim 1, wherein there are two of said at least one first film hinge and one of said at least one tension element, said one tension element

positioned between said two first film hinges wherein said two first film hinges hingedly connect said lower part to said upper part.

14. A closure in accordance with claim 1, wherein there is one of said at least one first film hinge and two of said at least one tension element, each said tension element is positioned on opposite sides of said one first film hinge which hingedly connects said lower part and said upper part.

15. A closure in accordance with any one of claims 1 to 14, wherein a material thickness of said partial sections is significantly less than a wall thickness of said closure walls in an area of said second film hinge and said third film hinge.

16. A closure in accordance with any one of claims 1 to 15, wherein said at least one tension element is elastically deformable between 2% and 25% of an at rest length of said one tension element.

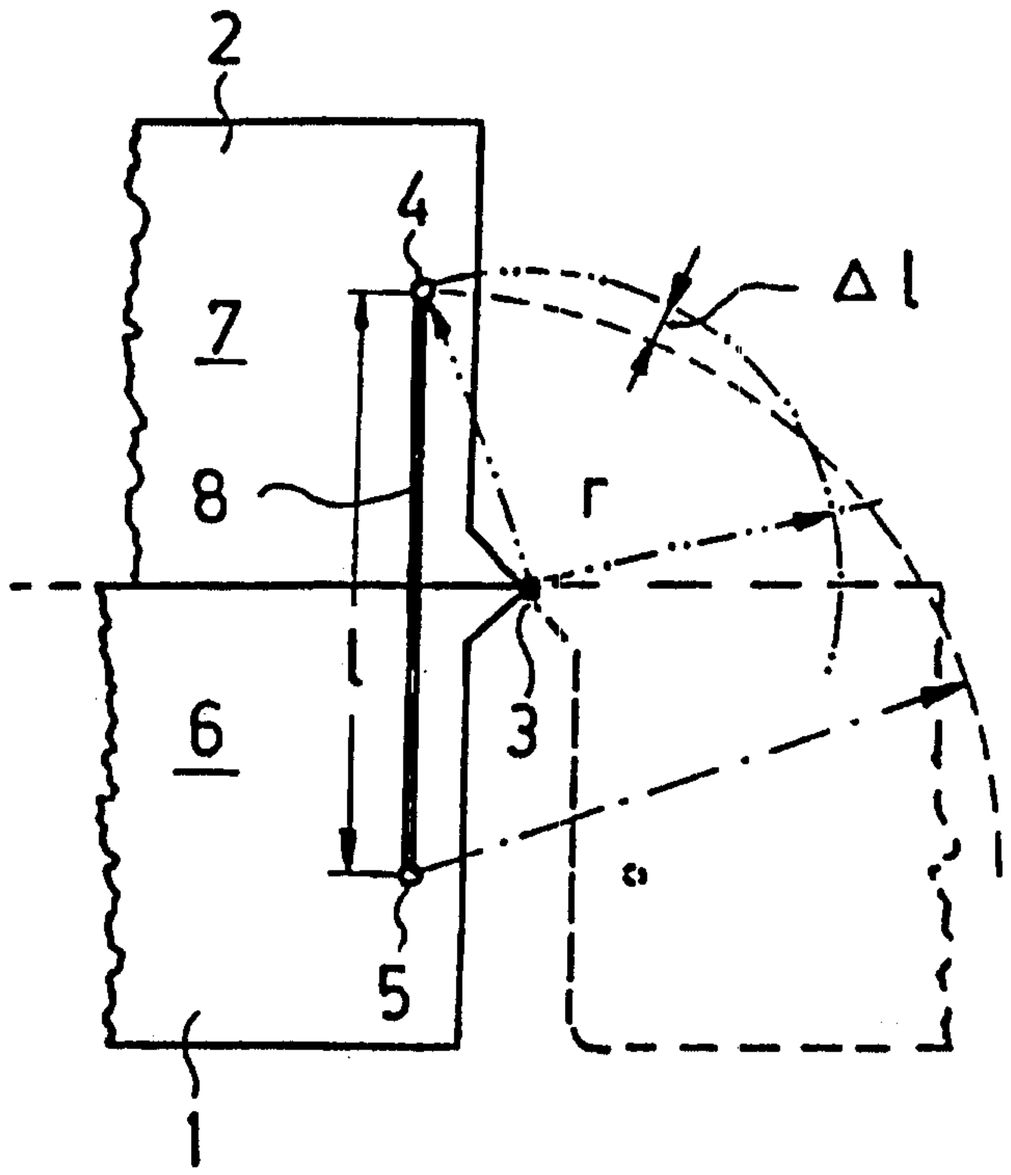



FIG. 1

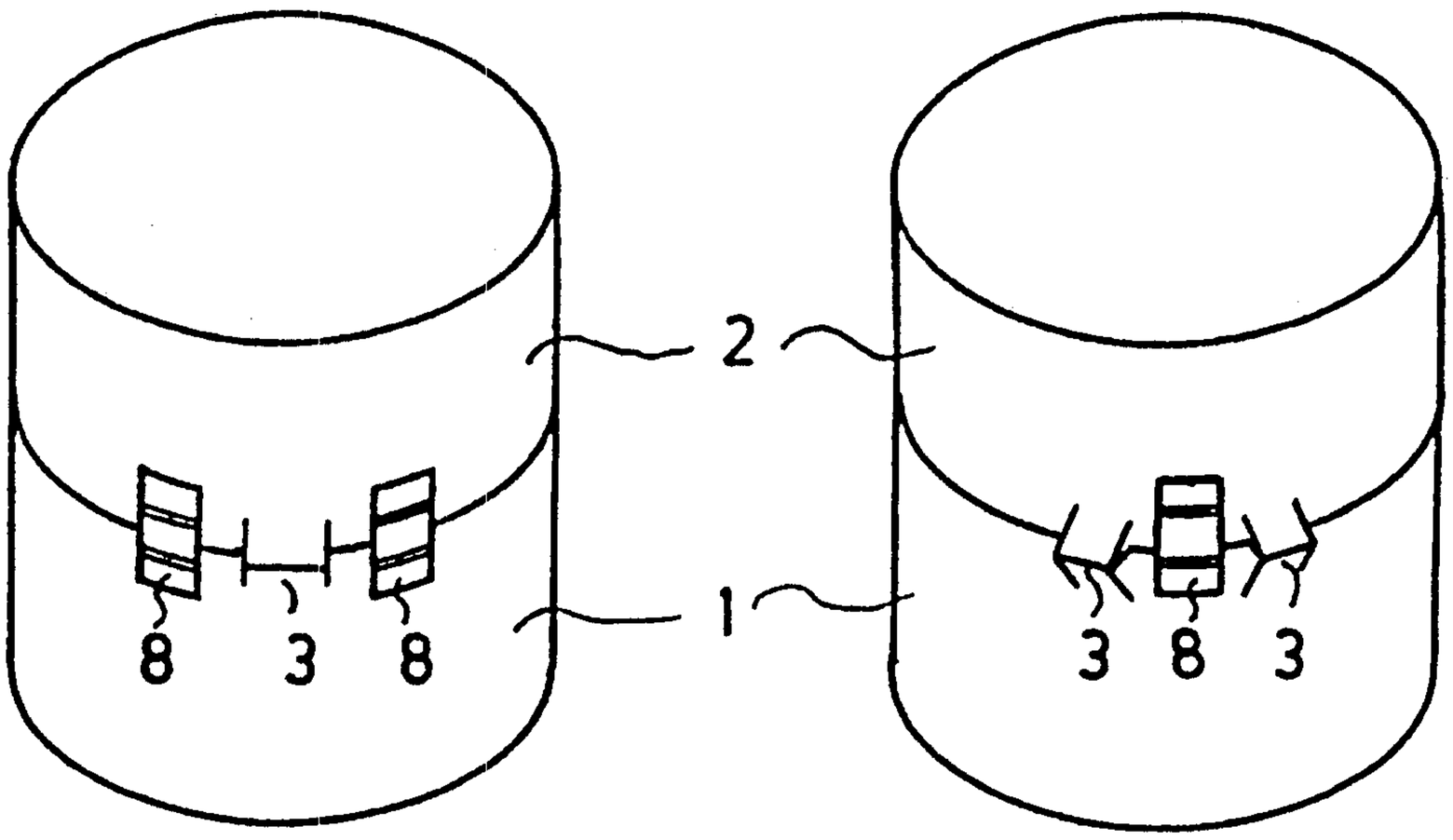



FIG. 2a

FIG. 2b

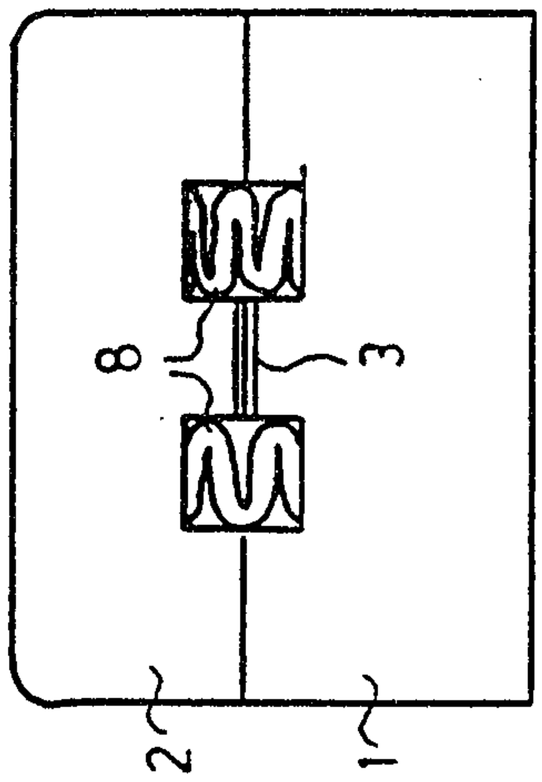



FIG. 5a

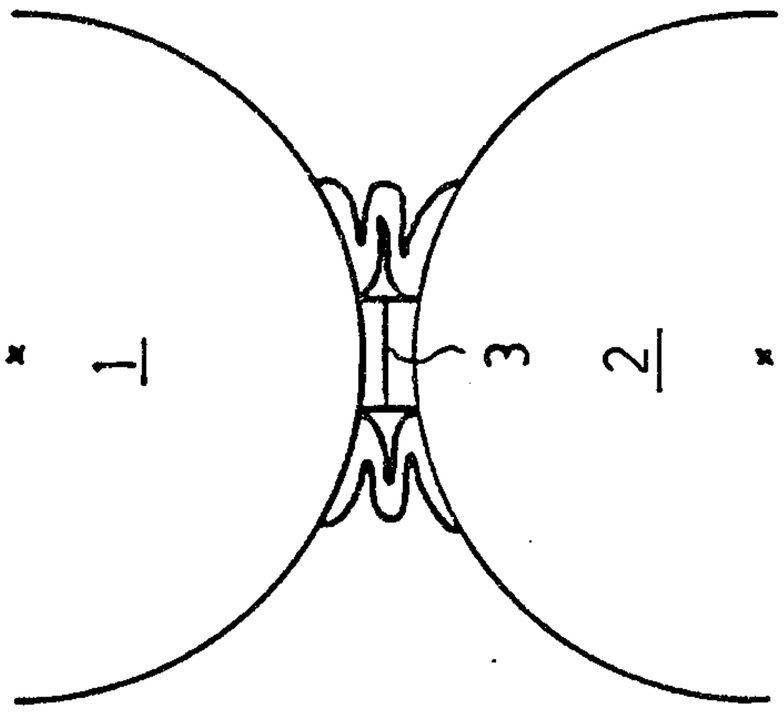



FIG. 5b

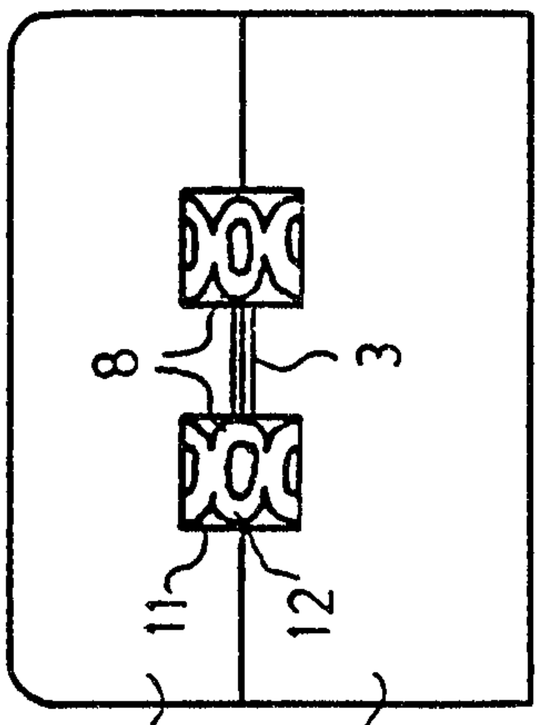



FIG. 4a

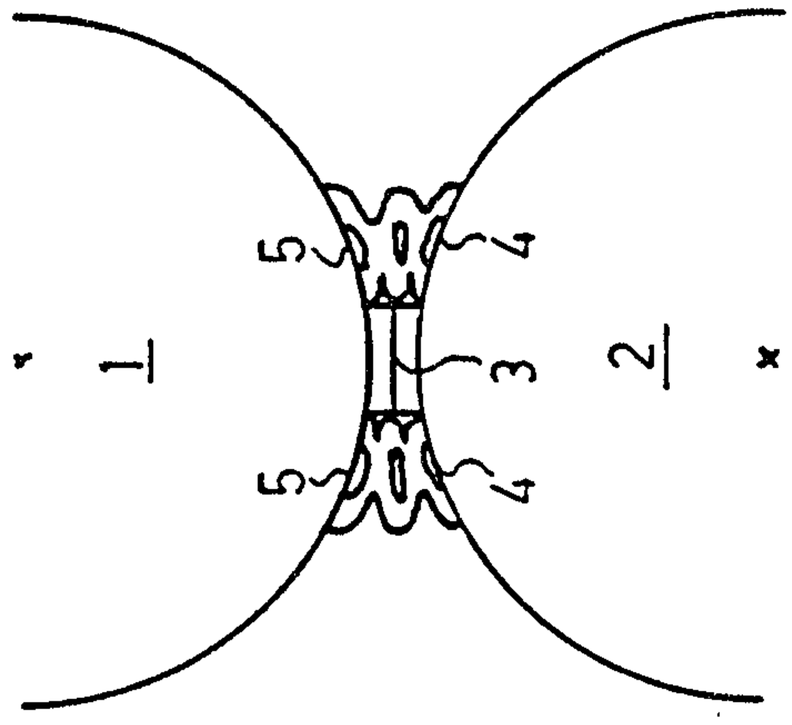



FIG. 4b

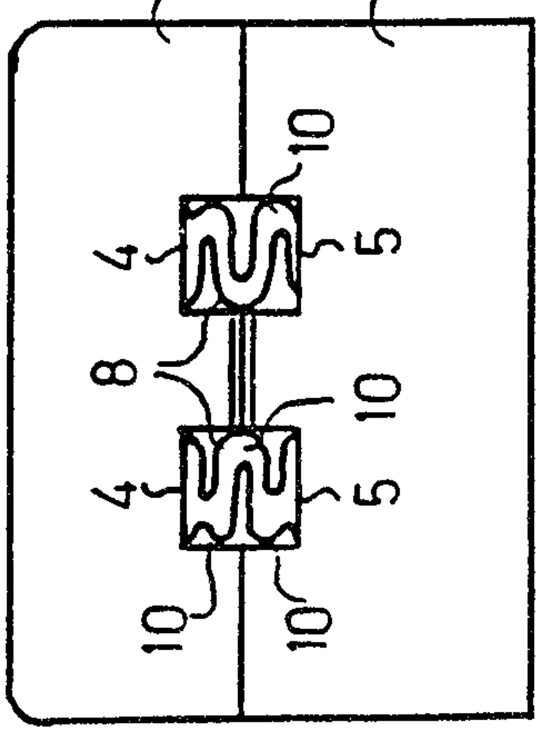



FIG. 3a

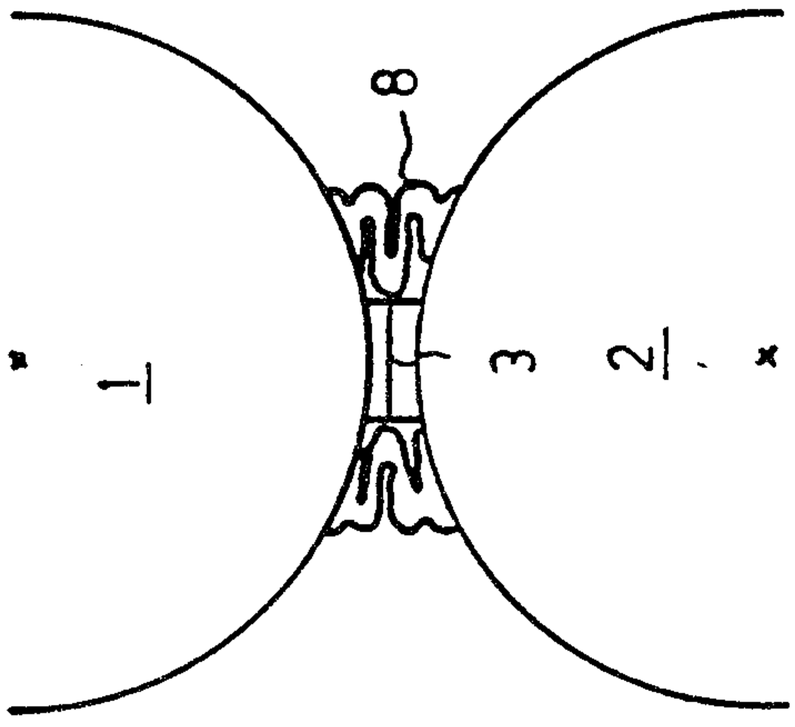



FIG. 3b

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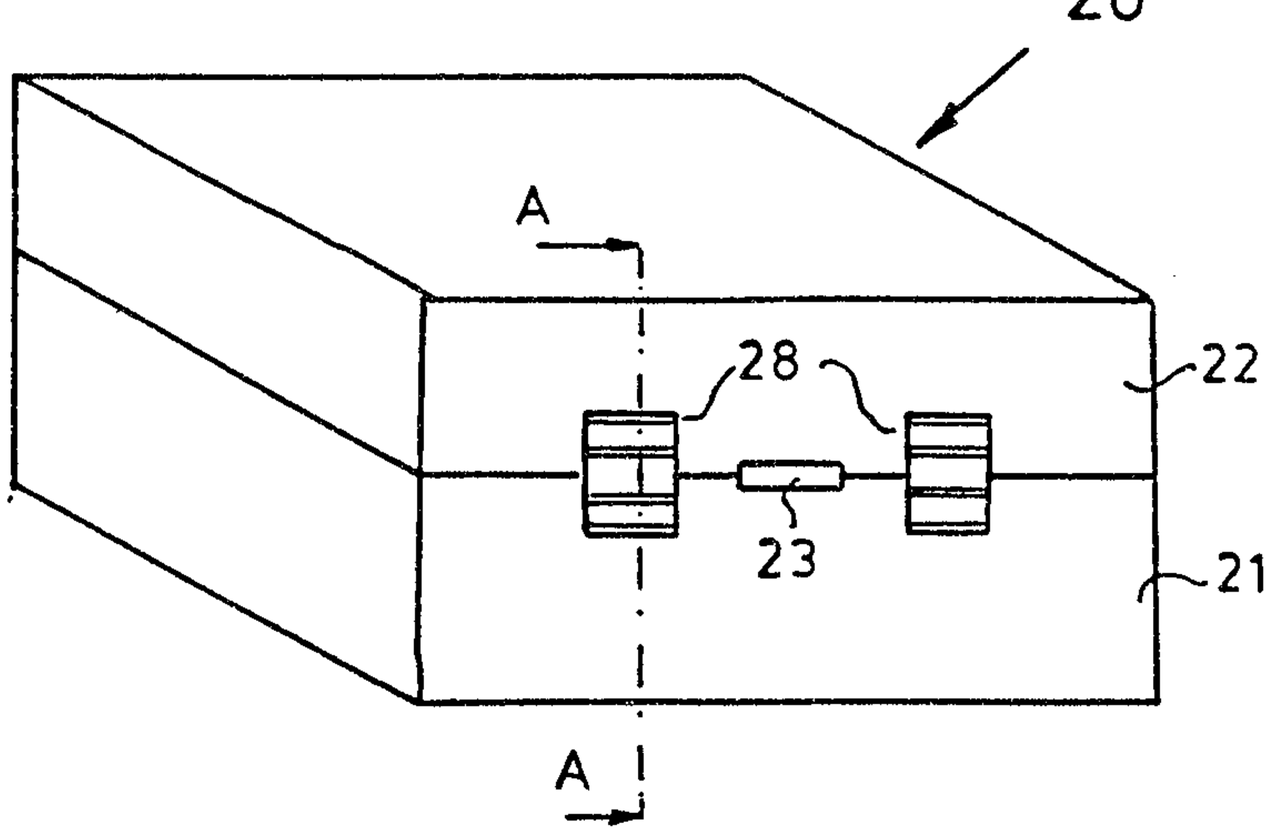


FIG. 6a

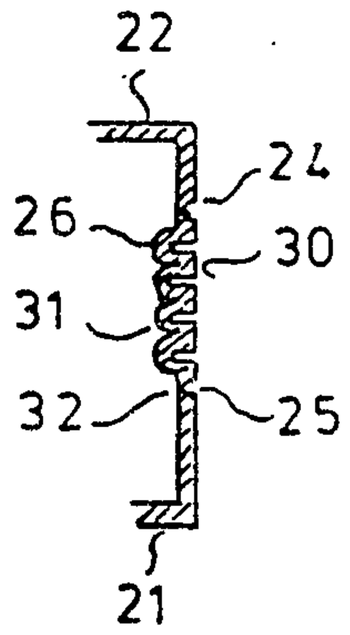


FIG. 6b

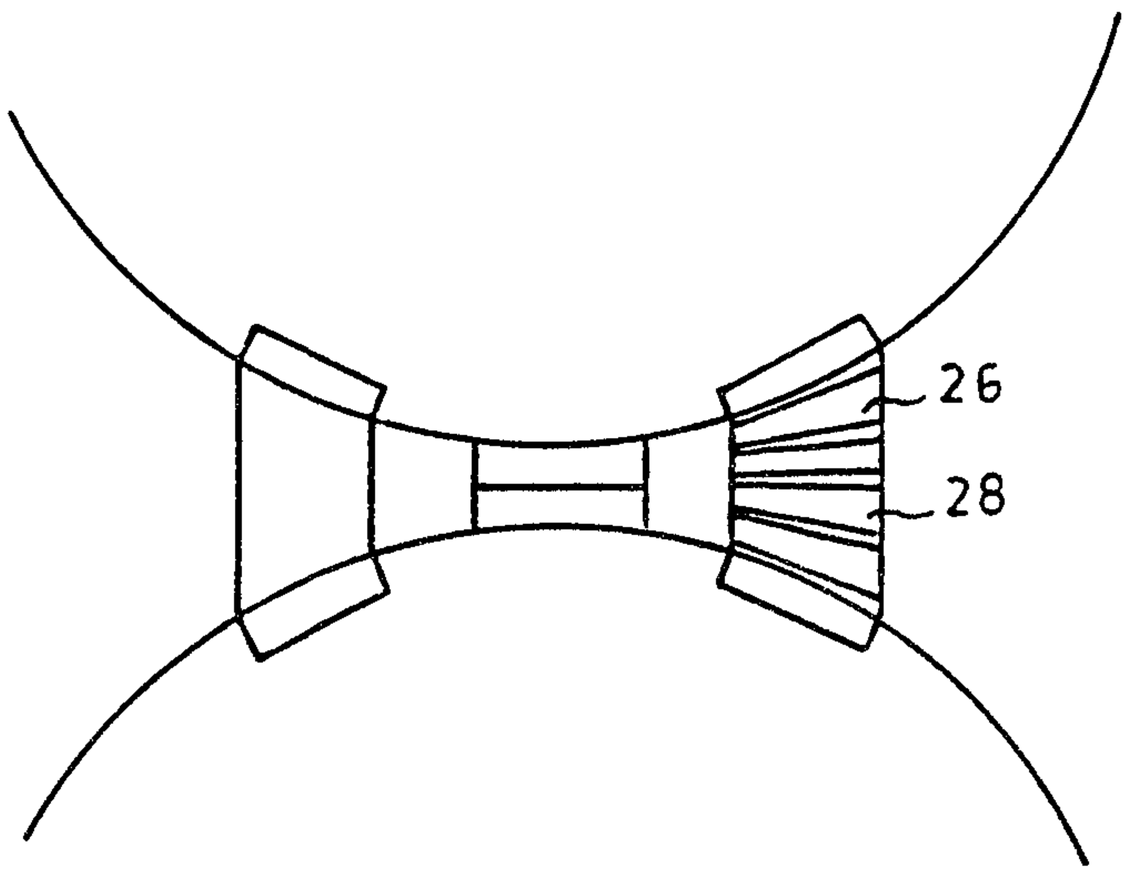


FIG. 7

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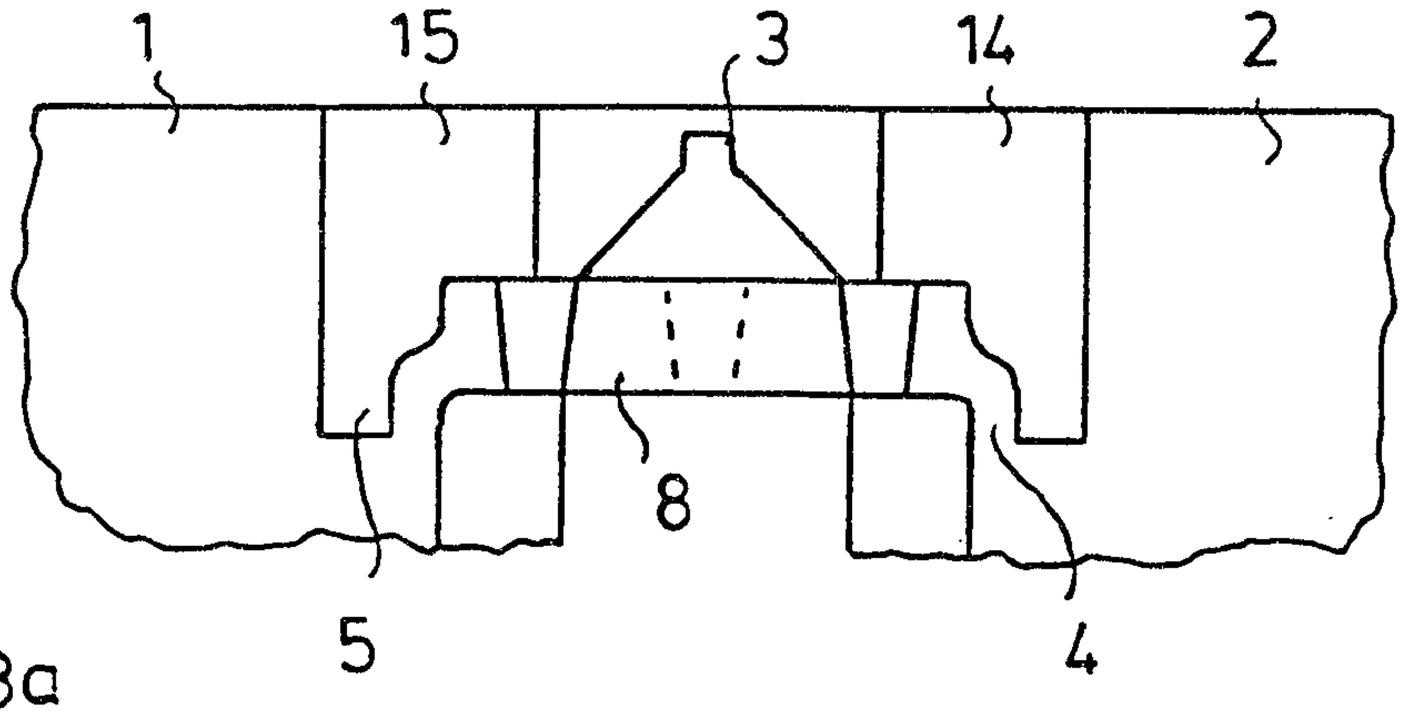


FIG. 8a

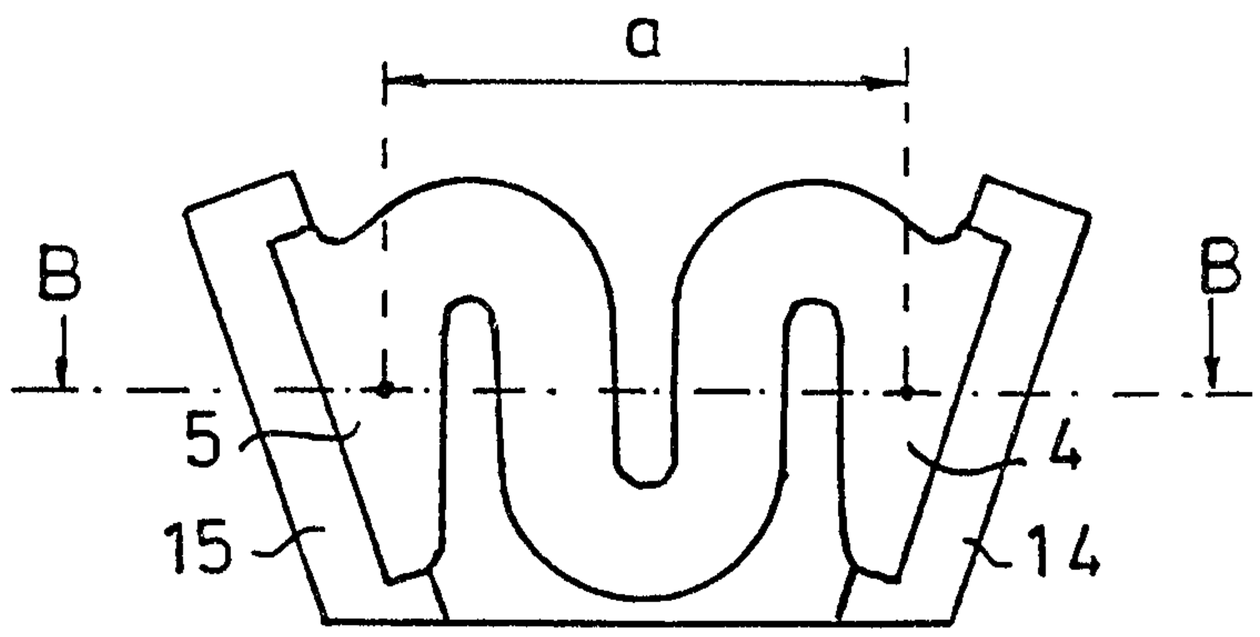


FIG. 8b

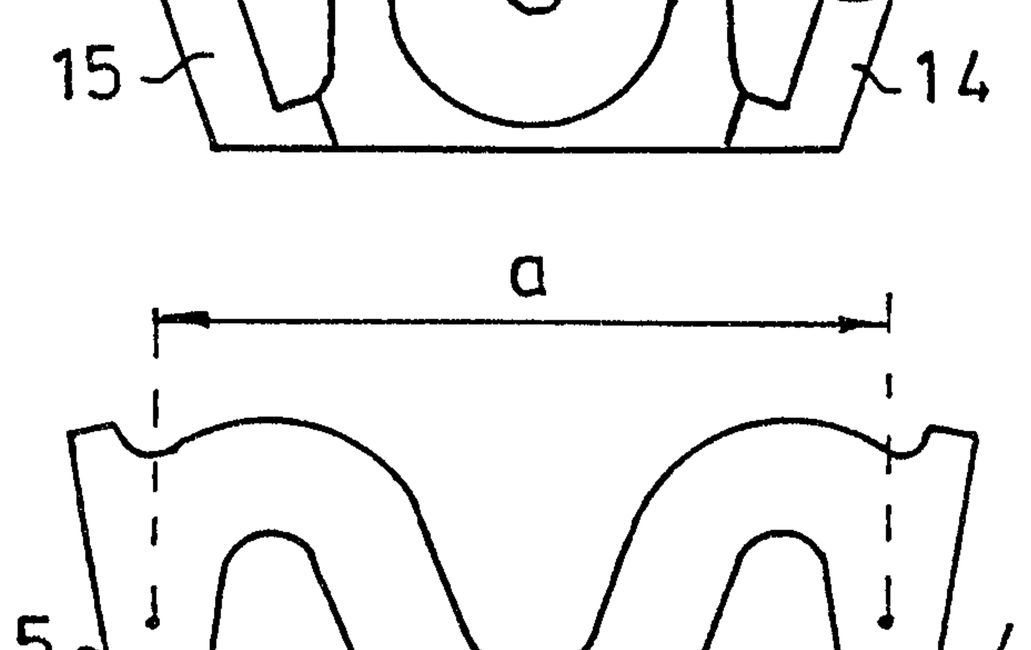


FIG. 8c

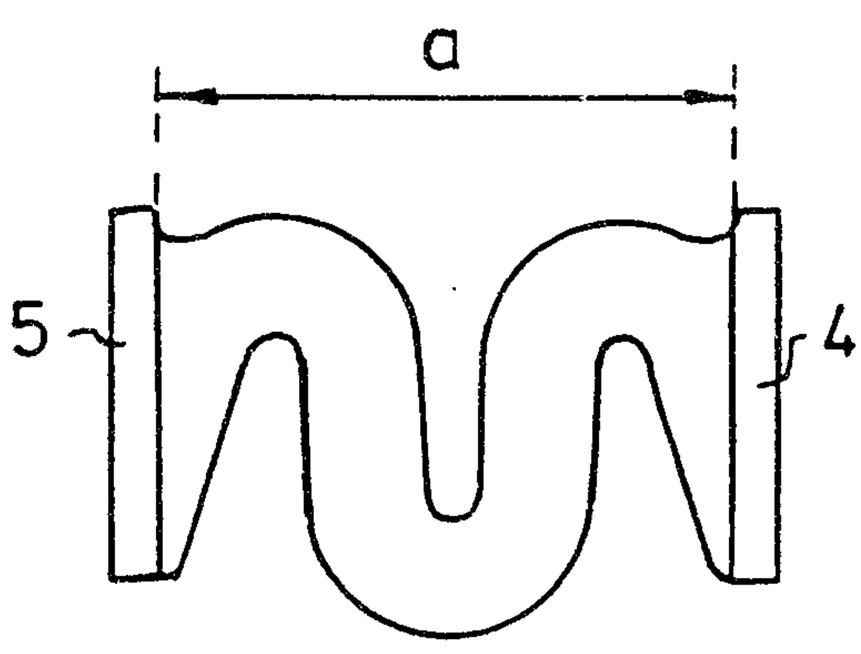


FIG. 8d

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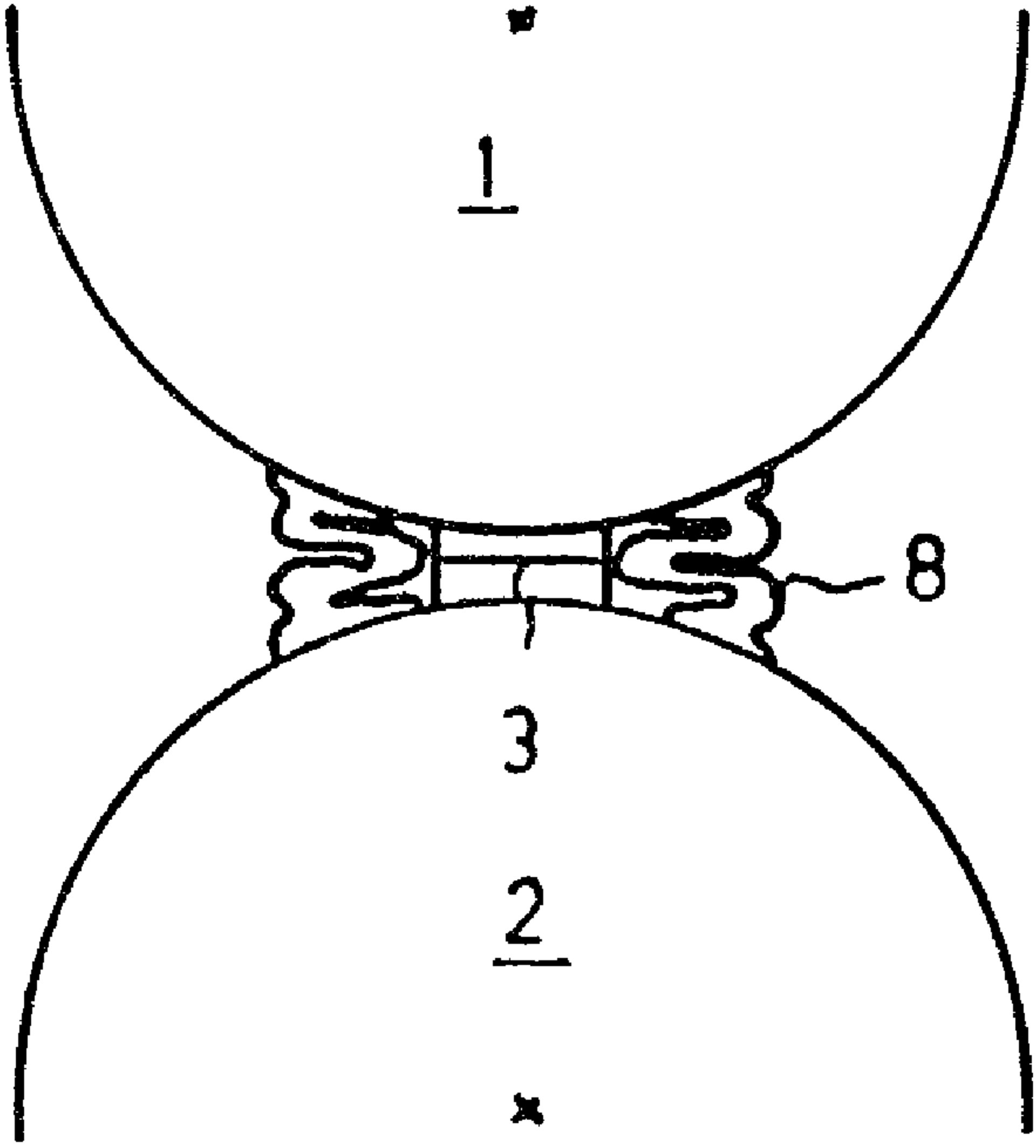
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