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(54) **Easy opening closure, container provided with such closure, and apparatus for producing such closure**

(57) The invention relates to an easy opening closure, comprising a closure having a folding rim and a circumferential score line having a score residual (t) over the thickness of the closure in the score line, enclosing a removable central closure part; and a tab connected to the central closure part, which score line has a pop zone in which the tab pops a section of the central closure along the score line and the pop zone comprises a pop ignition zone adjacent to the tab, in clock-wise and anti-clock-wise direction subsequent tear zones in which using the tab the central closure part is torn off from the closure along the score line and eventually looses from the closure, wherein the tear zones comprise each a tear ignition zone adjacent the respective pop zone, and wherein the score residual (t) in the tear ignition zones is reduced relative to the score residual in the pop ignition zone, to a container, provided with such easy opening closure and to an apparatus for producing same.

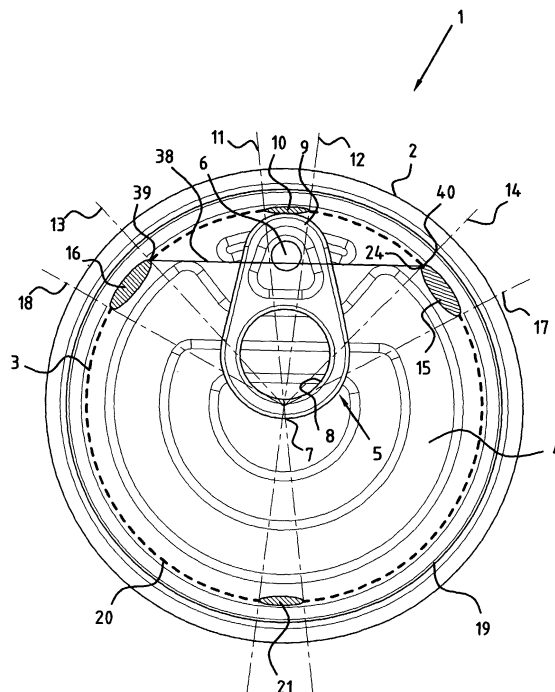


FIG. 1

Description

[0001] The present invention relates to an easy opening closure, to a container provided with an easy opening closure, and to an apparatus for producing such an easy opening closure.

[0002] An easy opening closure is a metal closure in which an opening may be formed by using one or more fingers and without the requirement for using tools. An easy opening closure comprises a closure having a folding rim to be connected to an open end container, and a circumferential score line provided in the closure and enclosing a removable central closure part. This central closure part is provided with a tab which is connected using a rivet to the central closure part. This tab is used for providing an opening in the easy opening closure by popping, tearing off and subsequently loosening the central closure part along the score line from the remaining part of the closure.

[0003] In the first part of the manual opening operation a finger or nail is inserted between the central closure part and the free end of the tab, whereafter that end of the tab is lifted. This lifting movement results in a popping of a section of the central closure as the other lever end of the tab pushes that section inwardly and thereby breaks that section loose of the central closure along the score line and folds that section into the internal of the container provided with the closure. The popping starts in the pop ignition zone which is adjacent or below the pop end of the tab which is remote of the free end of the tab. During lifting of the tab free end the pop end folds the section inwardly. This lifting stops when the free end of the tab extends upwardly from the closure (see fig. 2). At the end of the popping operation the central closure part is broken loose from the remainder of the closure over the pop zone of the score line. At this place between the scored and intact scoreline are the transitions between the pop zone and the adjacent tear ignition zones. The latter are part of the tear zones.

[0004] In the second part of the opening operation this upwardly extending free end of the tab is gripped by one or more fingers and the other part of the central closure is torn loose along the score line. During this tearing operation the score opens simultaneously in a clock-wise and anti-clock-wise direction of the score line.

[0005] The final part of the opening procedure is the tearing off the central closure at the diametral position to the pop ignition zone.

[0006] The tab popping of the closure takes place in the pop zone. The tearing in the clock-wise and anti-clock-wise direction results in the tear zones. The tearing loose of the central closure part from the remainder of the closure takes place in the so called hinge zone.

[0007] In general, a metal easy opening closure has a thickness of about 0.17 to 0.30mm. A more specific value of this thickness is dependent on the type of metal of the closure, such as aluminum and tin plate. In the score line the thickness over the closure score, the so

called score residual is generally in the range of 50-90 μm again dependent on the type of metal used and the content of (pressure in) the container. The score residual is conventionally transversally measured in the score line. In a practical embodiment the score residual resides between score lines formed in both surfaces of the closure. If these score lines are not aligned, then the score residual is measured as the shortest distance between the two score lines. In addition, both sides of the easy opening closure is provided with a lacquer having a thickness of about 0.01 mm. The easy opening closures may be produced at high speed up to 400-500 closures per minute.

[0008] The first lift and popping of the easy opening closure using the tab generally requires a popping force. For a tin plate closure of 73 mm diameter this popping force is of about 15-25 N. The tearing off in the tear ignition zones over the clock-wise and anti-clock-wise directions by tearing the tab requires initially a maximum tear force of 30-60 N. When the tearing progresses along the score line the tear force gradually decreases. The total loosening of the central part of the closure requires some force.

[0009] The dimensions of the score residual in the pop ignition zone of the easy opening closure are selected such that it is abuse-proof to an undesired popping of the closure by the tab when on the pop end of the tab a force is affected, such as by end wall stored closures in which orientation an endwall may press on the pop part of the tab. Furthermore, a container provided with an easy opening closure may comprise a pressurized (carbonated) beverage and therefore the easy opening closure as a whole should be able to withstand a burstpressure of about 3-5 bar.

[0010] The present invention has for its object to provide an easy opening closure which possesses an improved handling in that the opening procedure requires less tear force, in particular a smaller initial tear force.

[0011] This is obtained with an easy opening closure according to the invention having a curl rim and a circumferential score line having a score residual (t) over the thickness of the closure in the scoreline, enclosing a removable central closure part; and a tab connected to the central closure part, which score line has a pop zone in which the tab pops a section of the central closure along the score line and the pop zone comprises a pop ignition zone adjacent to the tab, in clock-wise and anti-clock-wise direction subsequent tear zones in which using the tab the central closure part is teared off from the closure along the score line and eventually loosens from the closure, wherein the tear zones comprise each a tear ignition zone adjacent the respective pop zone, and wherein the score residual in the tear ignition zones is reduced relative to the score residual in the pop ignition zone.

[0012] The invention is based on the insight that by reducing the score residual in the tear ignition zone the initial and highest tear force is reduced and the easy

opening closure still meets the requirements for burst pressure and is still abuse-proof.

[0013] The reduction in score residual is maximum at least in that part of the tear ignition zone, which is adjacent to the respective pop zone. For reasons that after popping and at the start of the tearing operation, scoring starts here at the highest tear force. Over the length of the tear ignition zone the score residual may be reduced to a maximum level (that is to a smallest thickness) or may gradually increase from a maximum reduced plateau level, that is the reduction will gradually decrease.

[0014] The end of the pop zone and the start of the tear ignition zone is dependent on the design of the easy opening closure and on the manner in which the popping operation has been carried out. When the popping operation has not been carried out to its full extent and subsequently the tearing operation is started a high tear force may be appreciated during the scoring of the score line in the pop zone. Therefore, it is preferred that the score residual is reduced in a part of the pop zone adjacent to the tear ignition zone.

[0015] The effect of the invention is appreciated when the reduction in score residual is maximum at the beginning of the tear ignition zones. This reduction in the score residual may have the form of an abrupt step or may gradually decrease over a part of the pop zone, but reaches the maximum at least at the transition between the pop zone and the adjacent tear ignition zone. This reduction in score residual (t) is relative to the score residual in the pop ignition zone, which is generally having a higher or highest score residual in order to impart the easy opening closure with abuse-proof properties.

[0016] The reduction in score residual which results in an appreciation of a lower tear force is generally such that the maximum tear force is reduced as from 1N (0.2 lbs), such as 1-15N (0.2 - 3.3 lbs), reductions in maximum tear force of 1-10N (0.2 - 2.2 lbs) or 1-8N (0.2 - 1.8 lbs) are feasible within the gist of the present invention, all in comparison with an easy opening closure which is not provided with the inventive reduction of score residual in at least the tear ignition zones.

[0017] The score residual may be reduced over the score line length in the tear zones, but it may be sufficient that it is only reduced in at least the first part of the tear zone. This reduction is relative to the mid part of the score line in the pop zone because at the interface between the pop zone and tear zone the residual may already be reduced such that at the start of the tear zone the residual score is maximum reduced, the sight where the highest tear force is initially required.

[0018] The reduction in score residual is generally maximum 25 µm. Practically the reduction is in the range of 5-15 µm. Good reductions in initial tear force are obtainable at 6-9 µm, such as 7-8 µm. This in comparison to the score residual in at least the pop ignition zone where the score residual is generally in the range of 60-90 µm, such as 65-80µm, 70-85µm and 70-80µm.

[0019] In a preferred embodiment the score residual

in the pop ignition zone is higher than in the remainder of the pop zone. Accordingly, the pop force for the initial popping the central closure part is increased but to a level which is still below the maximum initial tear force.

[0020] The formation of the reduced score residual is critical in view of the burst pressure and the requirement for abuse-proof. In a preferred embodiment the reduction in score residual is at least partly formed by a score in the surface of the public side of the closure. A variation in the reduced score residual in at least the tear ignition zones is minimal if the reduction in score residual is at least partly formed between a score in the public facing surface and a score in the surface of the product side of the closure (see Fig. 3B).

[0021] An other aspect of the invention relates to a container which is provided with an easy opening closure of the invention. In this container its end opening is connected to the rim of the easy opening closure by a folding operation of the closure rim and the container rim.

[0022] Finally, the invention relates in an other aspect to an apparatus for producing such easy opening closure. This apparatus is provided with particular means for forming the reduced score residual. To that extent the apparatus is characterized in that it comprises a tool for forming a score in a surface of the closure which has a larger thickness in a tool section for forming the reduction in the score residual. In a preferred embodiment the apparatus comprises a lower anvil and the score is formed in the surface of the product side of the closure.

[0023] Mentioned and other advantages and characteristic features of the easy opening closure, a container provided therewith and an apparatus for producing the closure are illustrated in the following figures illustrating embodiments of the invention although the invention is not considered to be restricted thereto. In the figures:

figure 1 shows a top view of an easy opening closure according to the invention;

figure 2 illustrates the popping operation of the closure;

figure 3A and 3B show two embodiments of the apparatus used for producing the opening closure; and

figure 4 shows the score residual of the easy opening closure of the invention over the clock-wise or anti-clock-wise direction.

[0024] Figure 1 shows an easy opening closure 1. The closure 1 comprises a curl rim 2 which extends over the circumference of the closure 1. Radially inwardly of the rim 2 is provided a score line 3 which encloses a removable central closure part 4. In cross section the central part 4 has a substantially terrass form. The central part 4 is provided with a tab 5 which is connected by a rivet 6 to the central part 4. The tab 5 has a first free end 7 with an opening 8 and a pop end 9.

[0025] The score line 3 comprises several zones. A

pop ignition zone 10 where due to a levering action of the tab 5 the pop end 9 of tab 5 pops the central part 4 inwardly by scoring along the score line 3. Due to an undesired action on the pop end 9 by a load an undesired interaction of the pop end with the score results in an abusive opening of the score. This pop ignition zone 10 lies within the lines 11 and 12 and forms part of the pop zone which lies between the lines 13 and 14. These lines 13 and 14 are defined by a cord 38 extending between the points 39 and 40 where the scoring of the score line 3 stopped at the end of the popping operation by lifting the tab 5 (see figure 2). The pop zone is followed by a tear ignition zone 15 in clock-wise direction and tear zone 16 in anti-clock-wise direction and is limited by the lines 14 and 17 and the lines 13 and 18 respectively. In the tear ignition zones 15 and 16 highest tear forces are encountered. The length of the tear ignition zones 15 and 16 corresponds to a length over which the tear forces reduces to 60-90%, such as 70 or 80% of the maximum value for the tear ignition. The tear ignition zones 15 and 16 are followed by the other parts of the tear zone 19 and 20 and meet in an optional hinge zone 21.

[0026] Figure 2 shows the end of the pop procedure in which the tab popped the score line 3 thereby forming an opening 22. The tab 5 is extending upwardly with its end 7. Over the pop zone between the lines 13 and 14 the central closure part 4 is loose from the remainder of the closure 1.

[0027] Figure 4 shows the reduction of the score residual t over the length of the score line 3. The reduction of the score residual in the pop ignition zone 10 is nil. In the tear ignition zone, in particular at the transition 24, the reduction of the score residual is maximum and amounts $8\text{ }\mu\text{m}$ in this embodiment of the closure and forms a plateau 23. In both circumferential directions the score residual t gradually decreases to the plateau 23 in the pop zones (between the respective lines 12 and 14, and 11 and 13) and in the tear ignition zones 15 and 16 gradually increases (curve A). In an other embodiment (for instance when the content of the container is not pressurized) the reduction of the score residual may stay substantially constant in the tear zones 19 and 20 but decrease gradually towards a hinge zone 21 where the scored central point is broken off from the closure (curve B).

[0028] In the pop ignition zone 10 the residual may be increased to about $70\text{ }\mu\text{m}$ to make the closure more abuse-proof. In the hinge zone 21 the residual may also be increased (for instance to about $100\text{-}150\mu\text{m}$ in order to make the closure more injury-proof.

[0029] Finally, figure 3 shows an apparatus 26 for producing an easy opening closure of the invention. The apparatus comprises a score die 27 and lower anvil 28. The lower anvil 28 has a flat anvil surface 29. The upper anvil 27 has a sharp end 30 for making the score line 3 in the closure 1. The score residual (t) shown in the tear ignition zone 25.

[0030] Figure 3B shows an other apparatus 31 for producing an easy opening closure 1 according to the invention. This apparatus 31 comprises a score die 27 with the sharp end 30, but comprises in addition a lower anvil 32 which has a rounded anvil surface 33.

[0031] The closure 1 produced in the apparatus 26 has a public facing surface 34 in which the score line 3 is produced and a product facing surface 35 which is flat in the region of the score 3.

[0032] The closure 1 produced with the apparatus 31 of figure 3B has a score 3 in the public facing surface 34 and a score 36 in the product facing surface 37. In the apparatus 31 the scores may be formed in one step or in two consecutive steps.

[0033] Using both apparatuses 26 and 31 of the invention at high speed production closures of the invention may be produced at standard tolerances.

20 Claims

1. Easy opening closure, comprising a closure having a folding rim and a circumferential score line having a score residual (t) over the thickness of the closure in the score line, enclosing a removable central closure part; and a tab connected to the central closure part, which score line has a pop zone in which the tab pops a section of the central closure along the score line and the pop zone comprises a pop ignition zone adjacent to the tab, in clock-wise and anti-clock-wise direction subsequent tear zones in which using the tab the central closure part is teared off from the closure along the score line and eventually looses from the closure, wherein the tear zones comprise each a tear ignition zone adjacent the respective pop zone, and wherein the score residual (t) in the tear ignition zones is reduced relative to the score residual in the pop ignition zone.
2. Easy opening closure as claimed in claim 1, wherein the reduction in score residual (t) is maximum at least at the transition between the pop zone and the adjacent tear ignition zone.
3. Easy opening closure as claimed in claim 1 or 2 wherein the reduction in score residual (t) decreases gradually as from the transition.
4. Easy opening closure as claimed in claims 1-3, wherein the score residual (t) is reduced in a part of the pop zone adjacent to the tear ignition zone.
5. Easy opening closure as claimed in claim 1 or 2, wherein the reduction in score residual (t) is maximum $25\text{ }\mu\text{m}$, preferably in the range of $5\text{-}15\text{ }\mu\text{m}$, more preferably $6\text{-}9\text{ }\mu\text{m}$, more preferably $7\text{-}8\text{ }\mu\text{m}$.
6. Easy opening closure as claimed in claims 1-5,

wherein the maximum tear force is reduced as from 1N (0.2 lbs), such as 1-15N (0.2 - 3.3 lbs).

7. Easy opening closure as claimed in claims 1-6, wherein the reduction in score residual (t) is at least partly formed by a score in the surface of the public side of the closure. 5
8. Easy opening closure as claimed in claims 1-7, wherein the reduction in score residual (t) is at least partly formed by a score in the surface of the product side of the closure. 10
9. Easy opening as claimed in claims 1-8, wherein the tear zones meet in a hinge zone having a score residual (t) equal or larger than the score residual (t) of the pop ignition zone. 15
10. Container, provided with an easy opening closure of claims 1-9. 20
11. Apparatus for producing an easy opening closure of claims 1-9, comprising a tool for forming a score in a surface of the closure which has a larger thickness in a tool section for forming the reduction in the score residual. 25
12. Apparatus as claimed in claim 11, wherein the tool is a lower anvil for forming a score in the surface of the product side of the closure. 30

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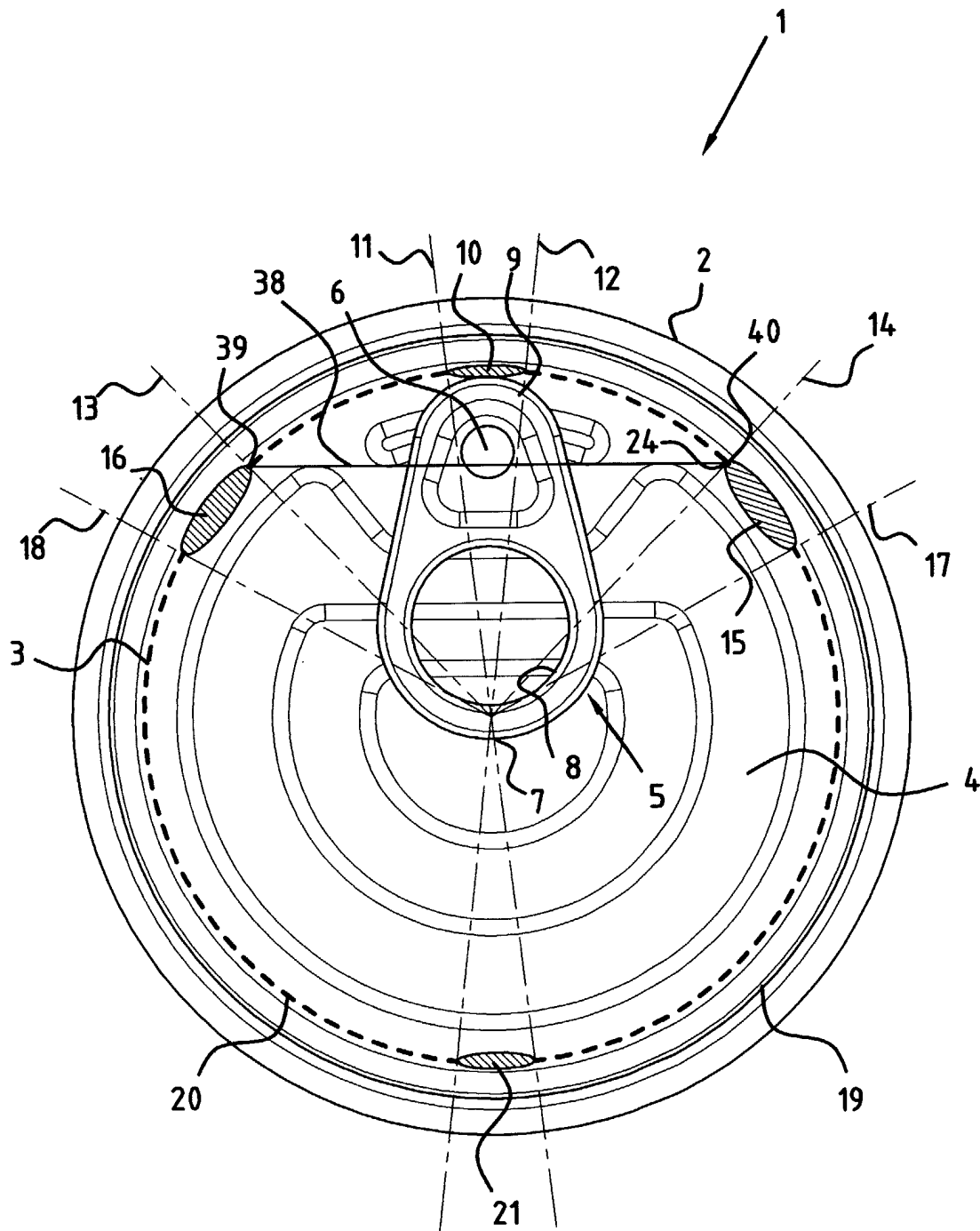


FIG. 1

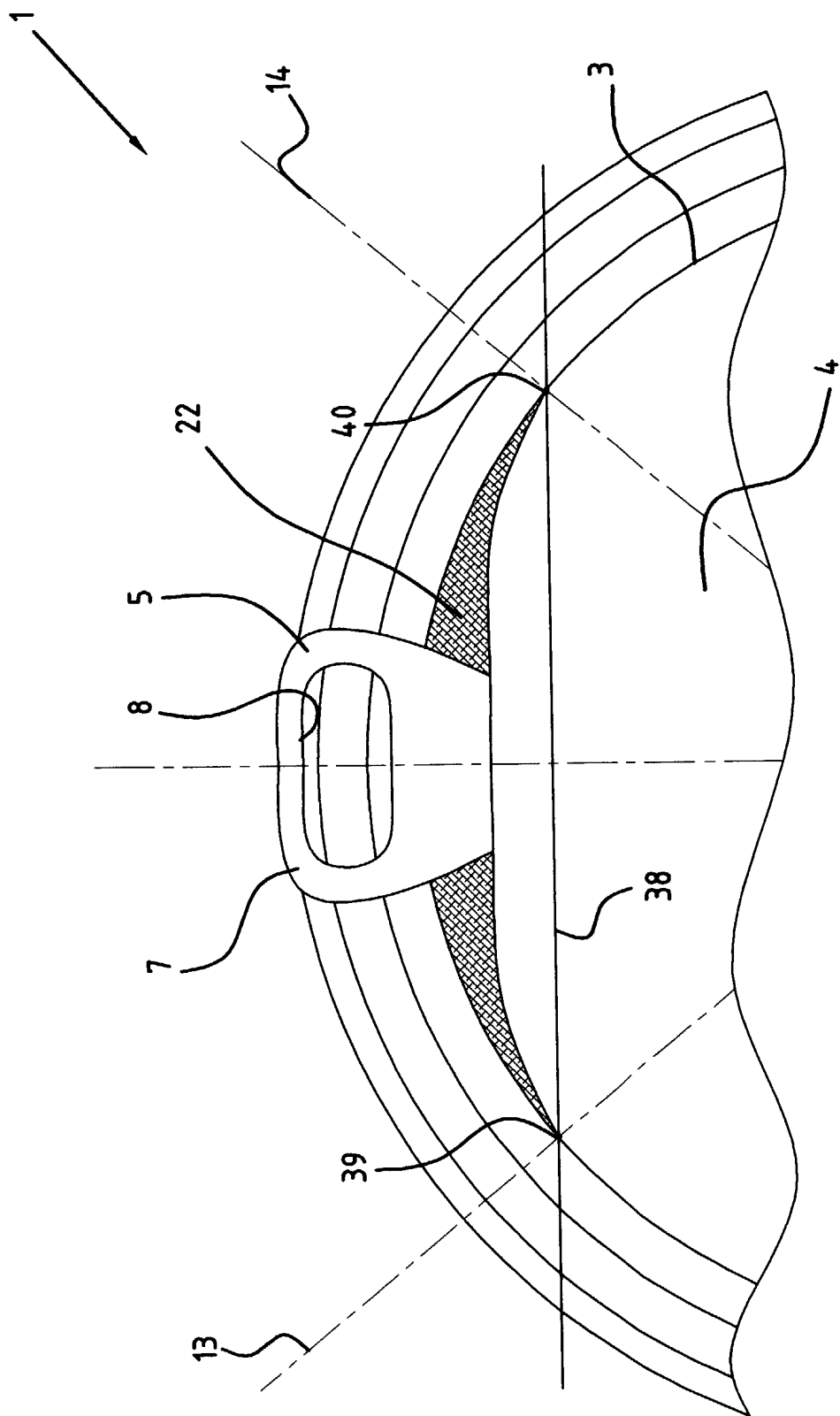
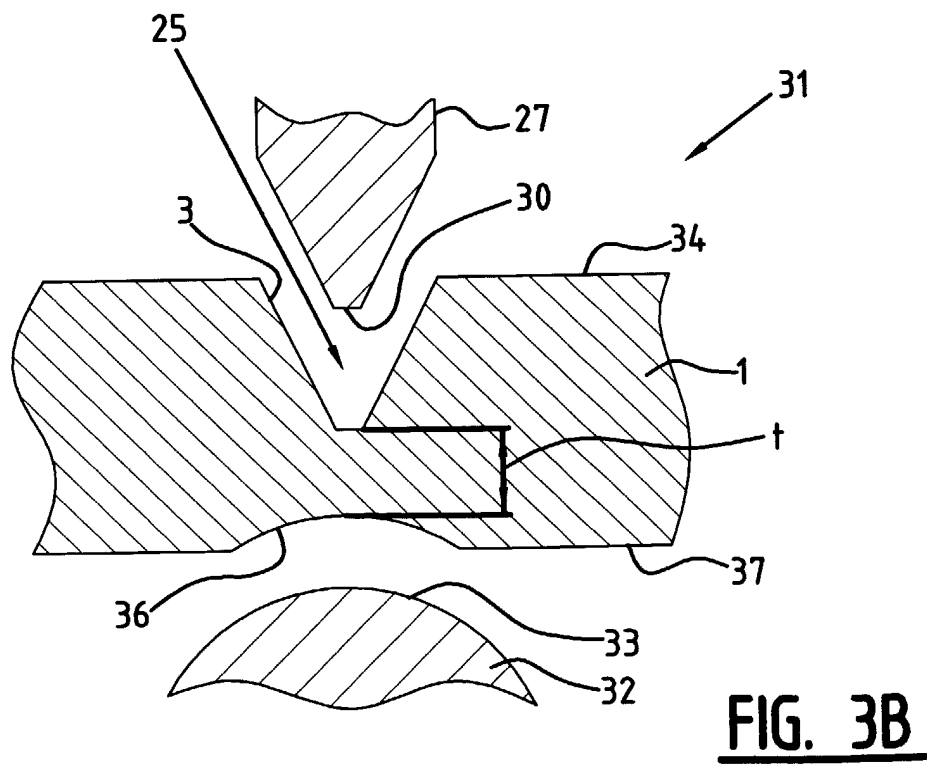
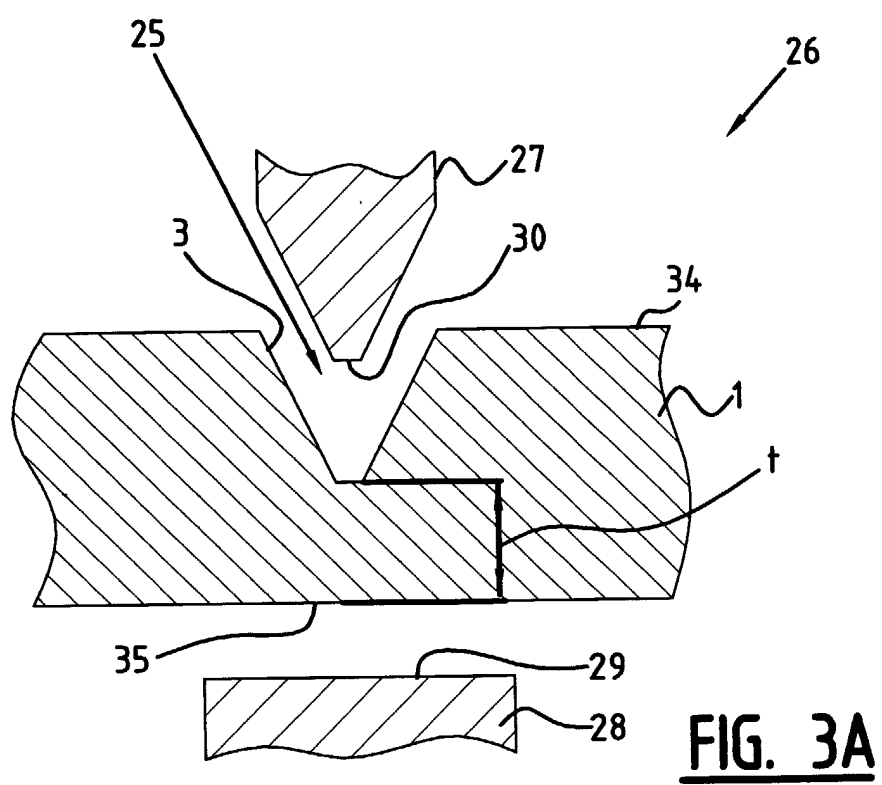


FIG. 2



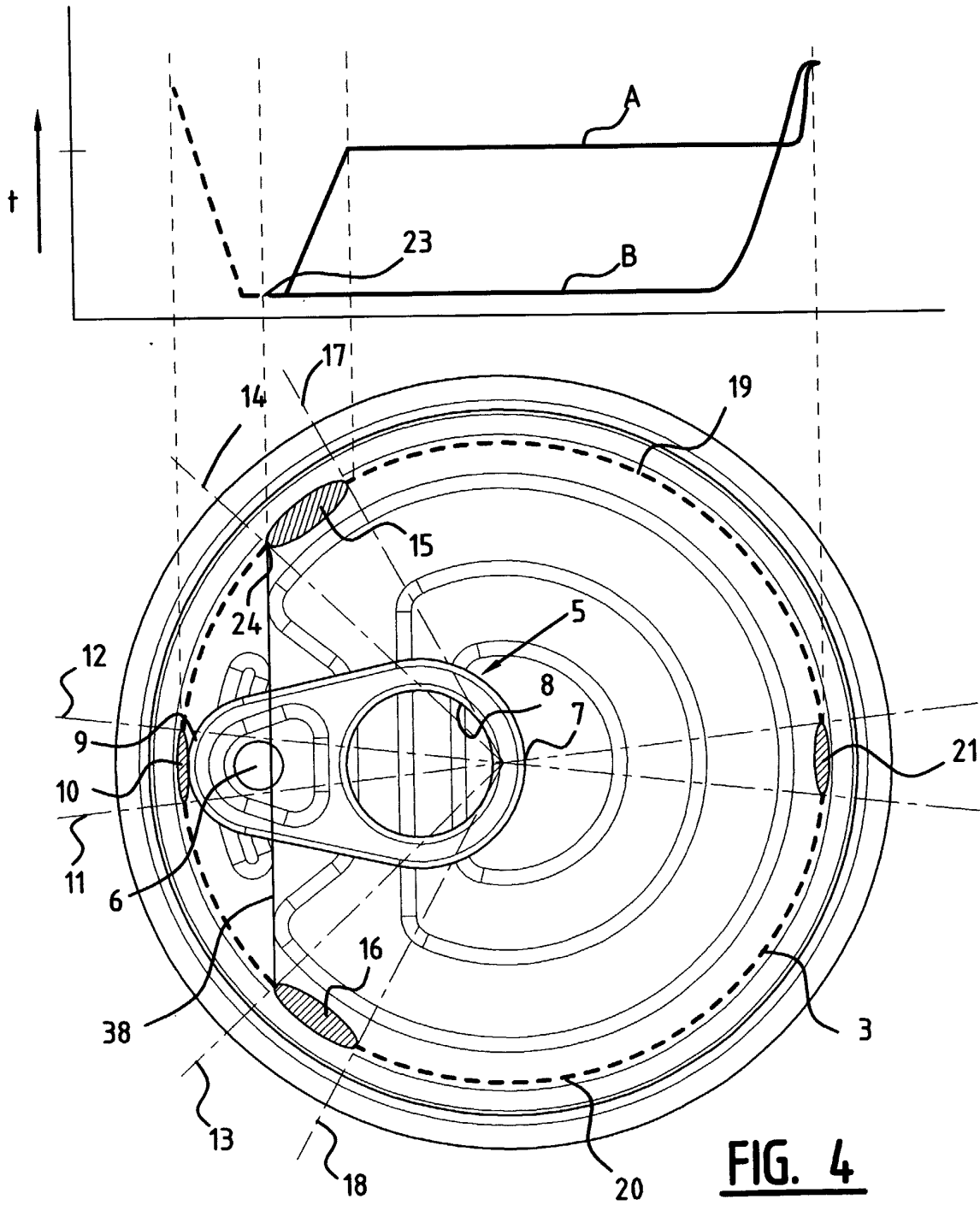


FIG. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 01 20 4232

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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 3 December 2002	Examiner Fournier, J
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			

EPO FORM 1503 03.82 (P04C01)



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EUROPEAN SEARCH REPORT

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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			

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Application Number

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



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**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
EP 01 20 4232

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-10

Subject I (claims 1-10) relates to an easy opening closure comprising a closure having a folding rim, a circumferential score line, a removable central closure part and a tab connected to the central closure part. Claim 10 relates to a container provided with an easy opening closure of claims 1-9.

2. Claims: 11-12

Subject II (claims 11-12) relates to an apparatus comprising a tool for forming a score in a surface of a closure. The problem solved by these claims is to provide a scoring apparatus with means for forming a reduction in the score residual.

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

EP 01 20 4232

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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