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BE DE FR GB NL(30) Priority: **19.12.1994 NL 9402151**(71) Applicant: **Van Cromvoirt, Johannes Antonius Maria****NL-5140 AB Waalwijk (NL)**(72) Inventor: **Van Cromvoirt, Johannes Antonius Maria****NL-5140 AB Waalwijk (NL)**(74) Representative: **Jilderda, Anne Ayolt****Octrooibureau LIOC B.V.****P.O. Box 85096****NL-3508 AB Utrecht (NL)**(54) **Bottle-cap combination, and bottle and cap designed for this combination**

(57) The invention relates to a combination of a bottle having a threaded neck and a synthetic resin cap screwed onto the neck of the bottle. The cap comprises a shell portion (8) with an internal screwthread which is suspended from an upper plate (9) of the cap and concentrically surrounds a sealing tag (13) provided at the upper plate of the cap. The end (15) of the tag remote from the upper plate of the cap cooperates with the free

end of the bottle neck. The upper rim of the bottle neck substantially forms part of a conical surface whose apex lies on the centreline of the bottle in a point below the upper rim. The sealing tag narrows towards its free end while bearing with its base portion (14) at least substantially on the shell portion of the cap. The cap is so designed that the tag bears on at least substantially the major portion of said conical surface when the cap has been screwed home on the bottle neck.

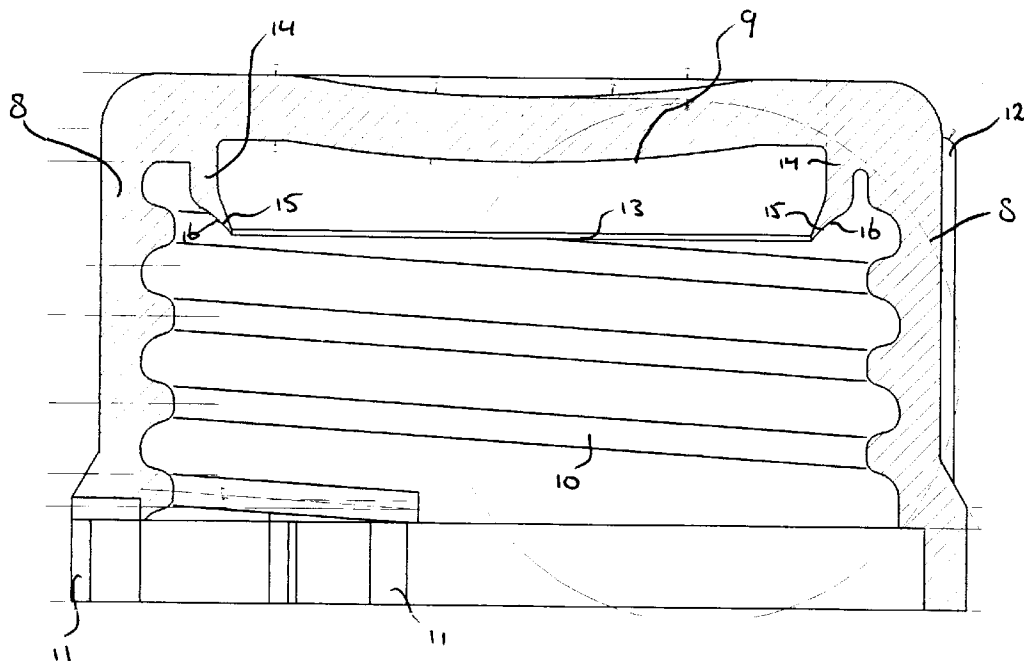


Fig. 3

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Description

The invention relates to a combination of a bottle having a threaded neck and a cap which is screwed onto the neck of the bottle, is made from a synthetic resin, and is provided with an internally threaded shell portion which extends in downward direction concentrically around a sealing tag provided in the cap, of which sealing tag an end facing away from an upper plate of the cap cooperates with a free end of the neck of the bottle, an upper rim of the neck of the bottle forming part at least substantially of a conical shell surface whose apex lies on the centreline of the bottle in a point situated below the upper rim.

A bottle-cap combination is known from British Patent 788,148. In this known combination, the upper rim of the bottle neck is formed by a surface which extends perpendicularly to the centreline of the bottle and which merges close to its inner edge into the inner surface of the bottle neck, which concentrically surrounds the centreline of said neck, via a bend portion with a small radius of curvature. When the cap is screwed home, the tag in a first embodiment bears on the upper rim of the bottle neck in a point situated between its free end and its end fastened to the upper plate of the cap.

In a second embodiment, the tag bears with a point thereof situated between its free end and its end fastened to the upper plate of the cap on the transition between the upper rim of the bottle neck and the inner surface of the bottle neck.

Although such a combination of a bottle and a synthetic resin cap has been known for many years, efforts to render such a combination suitable for bottles whose contents are to be sterilized at high temperature after the cap has been applied have hitherto not been successful. It was found in practice that all such combinations of bottles and caps closing the bottles will leak during sterilization, inter alia owing to the high pressure prevailing in the bottle during sterilization, so that at least part of the contents of the bottle is lost or, which is perhaps an even greater disadvantage, the contents of the bottle are contaminated. This risk of contamination is particularly great in the widely used sterilization process of the contents of bottles in a liquid bath.

Sealing of bottles whose contents (e.g. evaporated milk) are to be sterilized at high temperature has accordingly been effected by means of metal caps until now, each cap being provided with an inlay of a flexible material which is to ensure the sealing between cap and bottle. Such caps are found to have no leaks during sterilization. The use of such caps, however, also has certain disadvantages. A first disadvantage is that a renewed leakproof closing of the bottle by means of this cap is practically impossible once the cap has been removed from the bottle. This is a major disadvantage if the contents of the bottle are not used up in one go. A further disadvantage is that such a cap, which comprises two different materials, i.e. metal and the actual seal-

ing material (usually synthetic resin), does not lend itself to economic recycling, so that these caps end up in the waste heap with the resulting environmental pollution.

A need has accordingly been felt for many years for a bottle-cap combination with which a good sealing can be safeguarded also at the high temperatures and pressures prevailing during sterilization of the contents of the bottle, while the bottle can be effectively closed several times by means of the cap, and in addition the bottle and cap are suitable for repeated use and/or recycling.

According to the invention, these objects can be achieved in that the sealing tag becomes narrower towards its end, and in that a base portion of the sealing tag at least substantially bears on the shell portion of the cap.

It was found in practice that the use of such a combination can guarantee an effective sealing of the bottle at high temperatures and pressures inside the bottle, while at the same time the cap when screwed home is capable of providing an effective sealing of the bottle also after being removed and reapplied several times. Owing to the narrowing of its sealing tag, the cap has a sufficient flexibility at its free end for remaining pressed against the upper rim of the bottle under the influence of the pressure prevailing in the bottle, for example during the sterilization process, so as to guarantee an adequate sealing. Since the base portion of the sealing tag bears at least substantially on the shell portion of the cap, it is avoided that the tag is lifted up under the influence of an elevated pressure inside the bottle along with a resulting bulging out of the upper surface of the cap, which could otherwise adversely affect the sealing. The invention thus provides an effective sealing of the bottle both in the case of an overpressure and in the case of an underpressure prevailing therein.

A glass bottle is highly suitable for repeated use, the more so since the shape of the upper rim of the bottle neck guarantees a good cooperation with the tag of the cap, while in addition this upper rim lies well protected from damage also when no cap is present on the bottle. The invention is not limited to glass bottles, however: bottles of, for example, synthetic resin such as, for example, polycarbonate may equally well be used.

The cap made from synthetic resin, furthermore, is quite suitable for recycling.

The invention will now be explained in more detail with reference to an embodiment of a bottle and cap according to the invention to be used for a combination according to the invention as shown in the accompanying drawing, in which

Fig. 1 is an elevation of the upper portion of a neck of a bottle,

Fig. 2 is a larger-scale cross-section of part of the upper portion of the neck of the bottle, and

Fig. 3 is a cross-section of a cap for a bottle.

The Figures are purely diagrammatic and not true to scale. Some dimensions have been particularly exaggerated for greater clarity.

Fig. 1 shows the upper end of a neck 1 of a bottle or container which is not shown in any detail. The further shape of this bottle or container is immaterial to the invention.

As Fig. 1 shows, a screwthread 2 comprising at least two turns is provided on the outer circumference of the neck 1 of the bottle.

As is shown in more detail in Fig. 2, at least the major portion of the upper rim of the bottle is formed by a portion of a conical surface 4 whose apex is situated on the centreline of the bottle in a point below the upper rim. The apex angle of this conical surface is obtuse, will in general lie between 145° and 155°, and is preferably approximately 150°.

At the inside of the neck, a ledge 5 extending perpendicularly to the centreline of the neck merges into the conical surface 4. Near the outer side of the neck, the upper rim 4 merges via a rounded portion 6 into the outer surface of the neck on which the screwthread 2 is provided.

In contrast to a usual screwthread, which has a regular undulating shape, the screwthread here is of a more angular design, approximating a trapezium-shaped thread.

Given a usual embodiment of a bottle neck with an external diameter of the screwthread of $27.4 \text{ mm} \pm 0.3 \text{ mm}$ and a diameter of $25 \text{ mm} \pm 0.3 \text{ mm}$ in the bottom of the screwthread, the angle α enclosed by the lower flank of the screwthread turn and a plane extending perpendicularly to the centreline of the bottle neck is approximately 15°. The angle β enclosed by an upper flank of the screwthread turn and a plane extending perpendicularly to the centreline of the bottle neck is preferably approximately 20° here.

The radius of curvature a between the bottom of the screwthread and the lower flank of the screwthread is preferably approximately 0.6 mm, as is the radius of curvature b between the lower flank of the screwthread and the crown of the screwthread. The radius of curvature c between the crown of the screwthread and the upper flank is preferably approximately 0.8 mm.

In such an embodiment of the bottle neck, the width of the ledge 5 is approximately 0.25 mm and the width of the rim 4, measured in a direction perpendicular to the centreline of the bottle, is approximately 1.8 mm.

Evidently, the above values are given by way of example only and are susceptible of modification without departing from the spirit and scope of protection of the invention.

The cap 7 depicted in Fig. 3 is manufactured in one piece from a suitable synthetic resin material. The cap has a shell portion 8 which is suspended from an upper plate 9. The shell portion 8 is provided with an internal thread 10 mating with the screwthread 2.

A break-off band 11 which is known per se is provided

at the lower side of the shell, which band will grip behind the collar 3 when the cap is screwed onto the bottle for the first time and will be torn off the remaining portion of the cap when the cap is subsequently removed, thus indicating that the bottle has been opened at least once after initial filling and sealing.

In some cases the thickness of the cap shell 8 increases a little in a direction away from the upper plate 9 in that the outer surface of the cap is given a tapering shape. Furthermore, ridges 12 may be present on the outer circumference of the cap, arranged at regular interspacings and extending parallel to the centreline of the cap, which ridges on the one hand reinforce the cap shell 8 and on the other hand facilitate screwing and unscrewing of the cap.

A skirt-type sealing tag 13 concentrically surrounded by the shell portion 8 merges into the lower side of the upper plate. The boundary walls of the base portion 14 of the tag 13 merging into the upper plate extend at least substantially parallel to the centreline of the cap in the unloaded state shown in Fig. 3. The base portion 14 bears at least substantially on the shell portion 8 of the cap so as to counteract an undesirable lifting of the sealing tag 13 if the upper plate 9 of the cap should bulge out under pressure.

The lower, free end 15 of the tag 13 tapers into a sharp point, the boundaries of this tapering end being somewhat curved towards the centreline of the cap. The sealing tag 13 thus has a curvature because the tag 13 has a concave gradient over a range 16 facing the upper rim of the bottle. Such a curvature is found in practice to counteract an undesirable crumpling of the skirt when the cap is screwed on, which improves the quality of the sealing. The sharp taper of the sealing tag towards its end gives the portion of the tag 13 bearing on the upper rim of the bottle a sufficient flexibility and resilience for remaining firmly pressed against the upper rim under the influence of an overpressure inside the bottle, while it is not lifted off the upper rim in the case of an underpressure inside the bottle. The sealing tag 13 thus provides an adequate sealing which prevents an inadvertent contamination of the contents of the bottle under all circumstances which may arise, for example, in the course of a sterilization process.

If so desired, at least the side of the sealing tag provided with the concavity 16 may be intentionally roughened, for example, in that an injection mould of the cap is provided with a suitable roughness at least locally by means of spark erosion. In that case the tag will bear on the upper rim of the bottle with microscopically small projections which will slightly soften and flow out in the case of a major temperature rise, thus forming a bacteriological sieve which counteracts bacteriological contamination of the contents of the bottle.

With the cap 7 screwed home onto the neck 1 of the bottle, the lower portion 15 will bear on the conical surface forming the upper rim 4 of the bottle, while the free end 15 of the tag 13 does not, or at least substantially

not, project into the interior of the bottle neck.

The neck of the bottle and/or the cap may be provided with suitable abutment means whereby it is safeguarded that the cap can always be brought into a desired end position relative to the bottle neck(!), also in the case of mechanized tightening of the cap.

It was found in practice that the above bottle-cap combination is suitable for holding liquids or similar substances which are to be sterilized at elevated temperature after the bottle has been closed by means of the cap. A good sealing of the bottle is found to be achieved also in cases where sterilization takes place in a water bath, bottles being usually passed through a water bath then in which first the temperature is increased and subsequently gradually decreased. The cooperation between the tag and the upper rim of the bottle provides a satisfactory seal during this. If the high pressure prevailing inside the bottle during the operations should cause the upper surface of the cap to tend towards a somewhat convex shape, a good contact between the tag and the upper rim of the bottle will nevertheless be guaranteed because the pressure acting on the tag 13 will keep the lower end of the tag pressed against the upper rim 4 of the bottle which has an upward slope towards the exterior.

Furthermore, the embodiment of the cap and the screwthread described above prevents the cap from being pressed off the screwthread on the bottle neck, also if the synthetic resin of the cap should become more plastic owing to the high temperature.

Although the invention was described in detail above with reference to only a single embodiment, it will be obvious that the invention is by no means limited to the example given. On the contrary, many variations and designs are possible to those skilled in the art within the scope of the invention. Thus the invention may be applied not only to an ordinary closing cap, but also to a cap in or on which a pouring device is provided. A swivelling spout may be provided, for example, in a central portion provided for the purpose in the upper surface, in which case the sealing tag is suspended, for example, only from a point half-way the cap height.

Claims

1. A combination of a bottle having a threaded neck and a cap screwed onto the neck of the bottle, made from a synthetic resin, and provided with an internally threaded shell portion which extends in downward direction concentrically around a sealing tag provided in the cap, of which sealing tag an end facing away from an upper plate of the cap cooperates with a free end of the neck of the bottle, an upper rim of the neck of the bottle forming part at least substantially of a conical shell surface whose apex lies on the centreline of the bottle in a point situated below the upper rim, characterized in that the seal-

ing tag becomes narrower towards its end, and in that a base portion of the sealing tag at least substantially bears on the shell portion of the cap.

2. A combination as claimed in Claim 1, characterized in that, with the cap in the screwed-home position, the free end of the sealing tag bears on the upper rim of the bottle such that, with the cap screwed onto the neck of the bottle, the sealing tag bears on said conical surface over at least the major portion of this conical surface.
3. A combination as claimed in Claim 1 or 2, characterized in that in the unloaded state the boundary surfaces of the portion of the tag merging into the upper plate of the cap extend at least substantially parallel to the centreline of the cap, while the boundary surfaces of the lower portion of the tag, which tapers into a sharp end, have a curved gradient curving towards the centreline of the cap.
4. A combination as claimed in Claim 2 or 3, characterized in that the external diameter of the cap increases gradually in a direction away from the upper plate of the cap.
5. A combination as claimed in any one of the preceding Claims, characterized in that ridges are provided on the outer circumference of the cap at regular mutual interspacings and extending at least substantially parallel to the centreline of the cap.
6. A combination as claimed in any one of the preceding Claims, characterized in that the upper rim of the bottle neck is provided at its inner circumference with a narrow ledge which extends at least substantially perpendicularly to the centreline of the bottle.
7. A combination as claimed in any one of the preceding Claims, characterized in that a lower flank of a screwthread turn on the bottle neck encloses an angle of approximately 15° with a plane extending perpendicularly to the centreline of the neck.
8. A combination as claimed in any one of the preceding Claims, characterized in that an upper flank of a screwthread turn on the bottle neck encloses an angle of approximately 20° with a plane extending perpendicularly to the centreline of the bottle.
9. A combination as claimed in any one of the preceding Claims, characterized in that the sealing tag is intentionally roughened at least at its side facing towards the upper rim of the bottle.
10. A combination as claimed in any one of the preceding Claims, characterized in that the sealing tag has a curvature owing to the fact that the tag has a con-

cave gradient over part of its length at the side facing the upper rim of the bottle.

11. A bottle obviously designed for use in a combination as claimed in any one of the preceding Claims.

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12. A cap obviously designed for use in a combination as claimed in one of the above Claims 1 to 9.

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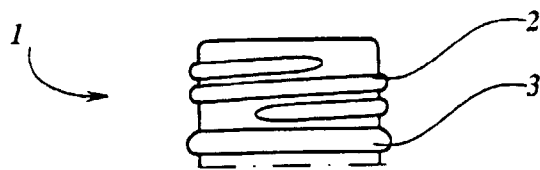


Fig. 1

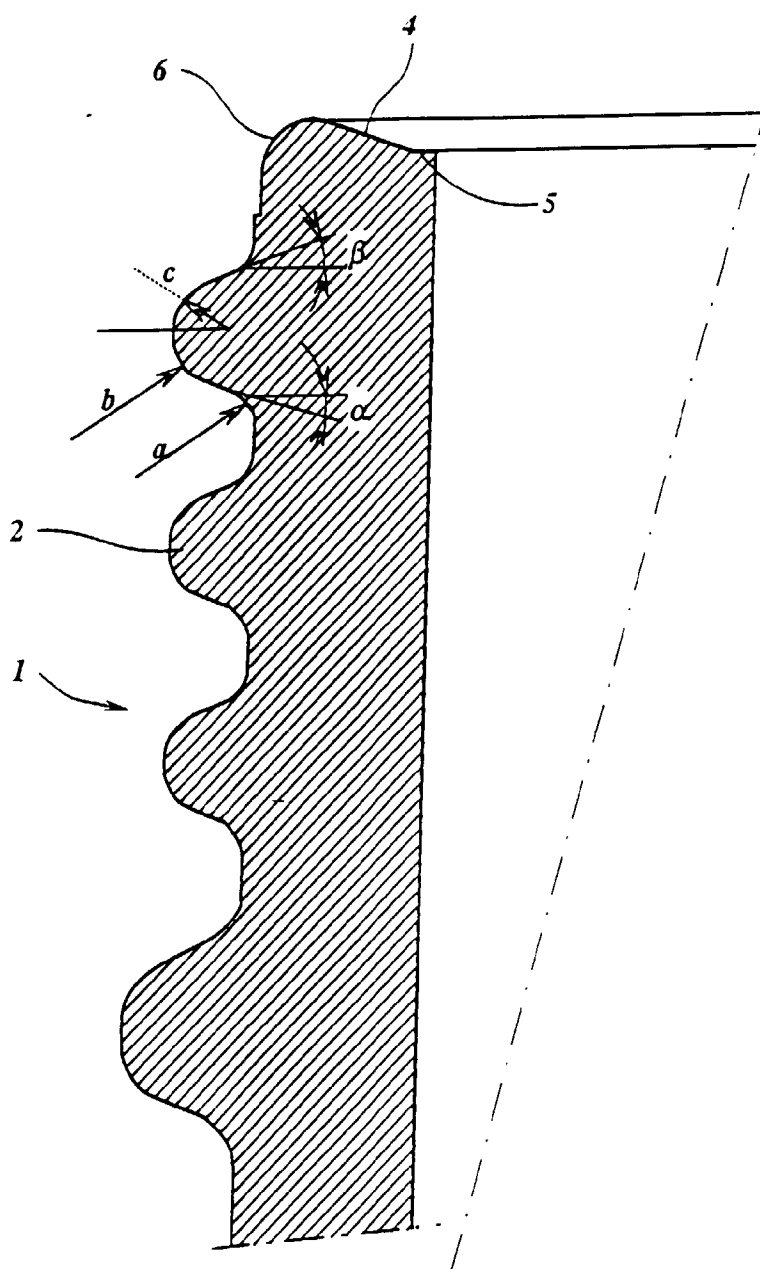


Fig. 2

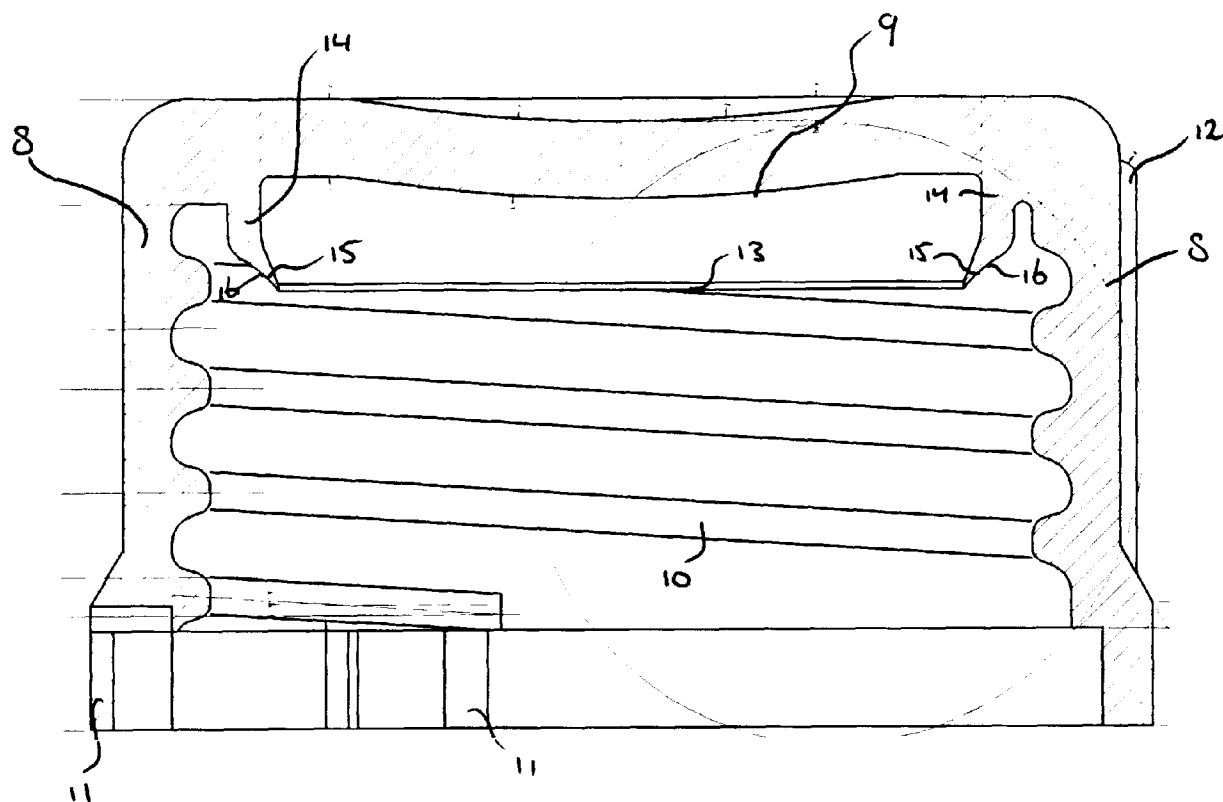


Fig. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 95 20 3542

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	GB-A-1 073 124 (GIBSON ASSOCIATES INC.)	11,12	B65D41/04
Y	* figures 1,4 *	1-3,5	

Y	FR-A-1 270 357 (MILTON KESSLER)	1-3,5	
	* figures 1-3 *		

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	* figures *		

A	DE-A-20 04 861 (G. JOLY)	4-6	
	* figures 1,2 *		

A	US-A-4 450 973 (THURSTON TOEPPEN)	5,9	
	* figures *		

The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		28 March 1996	Martin, A
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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