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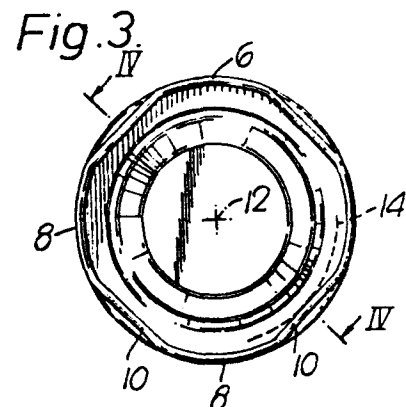
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54 Caps for jars, processes for manufacture of the caps, and dies for carrying out the processes.

57 A cap for a jar, the cap being of sheet metal and (considered in its attitude of use) comprising a top panel (2), a skirt (4) depending from the periphery of the top panel, and an internal continuous circumferential bead (6) on the lower edge of the skirt. Hitherto such a bead has been deformed inwards at intervals to provide internal lugs to engage an interrupted thread, or a continuous bead, on a jar, but the lugs have not performed reliably. In the present cap the bead (considered in plan) consists of alternate arcuate portions (8) and straight portions (10), the arcuate portions being at a uniform radius from a common centre (12), and the straight portions being tangent to a common imaginary circle (14) around that common centre. Dies for the manufacture of the caps include inserts for shaping the straight portions (10).



Foodstuffs which require heat treatment in the container in which they will be sold, jams being an example, are commonly put into jars, which are closed by metal caps. In some cases the jar has an interrupted screw thread, and the  
5 cap is applied and removed by a partial turn, while in other cases the jar has a continuous bead, and the cap is applied, by snapping on and removed by prising off.

About 20 years ago a type of metal cap known as a "twist cap" was introduced, which has the advantage that  
10 such caps can be applied to jars at high speed (see, for example, British Patent Nos. 814 703 and 445 744). The jar neck has an external interrupted multi-start screw thread, and the cap is of sheet metal and (considered in its attitude of use) comprises a top panel, a skirt depending from the-  
15 periphery of the top panel, and an internal continuous circumferential bead on the lower edge of the skirt. At intervals around the circumference, this bead is deformed inwards to provide as many internal lugs as there are starts of the thread. Four, six, and eight lugs and starts are  
20 usual.

We have found that the twist caps currently manufactured involve considerable wastage, because a proportion of the caps are not within required dimensional limits, and also because the lugs are liable to become damaged during the  
25 process of application to a jar. In each case the jar is not properly sealed.

The present invention is concerned with a new shape for lugs on a metal cap, and a new method for making such

lugs, one version of the resulting product being a new cap which can take the place of a twist cap on jars of existing shape. The new cap likewise is of sheet metal and (considered in its attitude of use) comprises a top panel, a skirt  
5 depending from the periphery of the top panel, and an internal continuous circumferential bead on the lower edge of the skirt.

According to the present invention, the bead (considered in plan) consists of alternate arcuate portions  
10 and straight portions, the arcuate portions being at uniform radius from a common centre, and the straight portions being tangent to a common imaginary circle around that common centre.

For use with jars having an interrupted multi-start  
15 screw thread, the lugs on the caps require to be uniformly circumferentially spaced. This means that in a can embodying the present invention, and intended for such use, the points of tangency of the straight portions with the imaginary circle should be uniformly spaced around that circle.

20 The number of lugs, i.e. of straight portions, is matched to the thread on the jar. For smaller sizes, e.g. 53 to 70 mm nominal diameter, four lugs are usual. For a larger size, e.g. 82 mm nominal diameter, six lugs, or even more, may be preferred.

25 For use with a jar having a continuous external circumferential bead, there may be only three lugs, and they are not necessarily uniformly spaced. For example the angles between points of tangency of straight portions with the imaginary circle may be  $60^{\circ}$ ,  $150^{\circ}$ ,  $150^{\circ}$ .

30 The shape of a cap embodying the present invention, and the preferred method of making it, will be more clearly understood from the description of the following example, with reference to the accompanying drawings, in which:-

Figure 1 is a perspective view from above of the cap;  
35 Figure 2 is a side view of the cap;  
Figure 3 is an underneath view of the cap;

Figure 4 is a section on the line IV-IV in Figure 3;

Figure 5 is a plan of a die for forming the lugs;

Figure 6 is a section on the line VI-VI in Figure 5;

Figure 7 is a plan of an insert for the die;

5 Figure 8 is a section of the insert;

Figure 9 is a side view, with part broken away, of a partly-manufactured cap;

Figure 10 is an enlargement of the part within the circle X in Figure 6;

10 Figure 11 is an enlargement of a part within the circle XI in Figure 8;

Figure 12 is a plan of Figure 11; and

Figure 13 is a section of a die insert on the line XIII-XIII in Figure 12, showing a variation.

15 As shown in Figures 1 to 4, the cap is of sheet metal, and comprises a top panel 2, the exact shape of which is no part of the present invention, a skirt 4 depending from the periphery of the top panel, and an internal continuous circumferential head 6 on the lower edge of the skirt.

20 As shown particularly in Figure 3, the bead in plan consists of alternate arcuate portions 8, and straight portions 10. The arcuate portions are at uniform radius from a common centre 12. The major part of the skirt 4 is a circular cylinder about an axis through this centre 12,  
25 perpendicular to the paper in Figure 3.

There are four arcuate portions 8, and four straight portions 10. In the example shown, the arcuate portions subtend about  $50^{\circ}$  at the centre 12, while the straight portions subtend about  $40^{\circ}$ . The straight portions are tangent to a  
30 common imaginary circle 14 around the centre 12, an arc of that circle being indicated, and the points of tangency are uniformly spaced around the circle 14. The difference between the internal radius of the arcuate portions 8, and the radius of the circle 14 is selected to ensure satisfactory  
35 interengagement in use between the straight portions and the external interrupted multi-start screw thread on the neck of a jar to which the cap is to be applied.

Before the formation of the straight portions 10, which constitute the internal lugs of the cap, a suitably-sized blank of sheet metal is formed, by methods which are no part of the present invention, into the partly-manufactured cap having the shape shown in Figure 9. In this shape, there is a top panel 2, a cylindrical skirt 4' depending from the periphery of the top panel, and an internal continuous circumferential bead 6' on the lower edge of the skirt 4'. This bead 6' is entirely circular in plan, and is only partial, in that the metal, considered in vertical section, is curled through about  $180^\circ$ , while the skirt height is greater than in the finished cap.

This partly-manufactured cap is deformed into the shape shown in Figures 1 to 4 by upward movement of a die shown in Figures 5 to 8 and 10 to 12.

As shown in Figures 5 and 6, the die body 15 is circular in plan, with an annular groove 16 which will accept the bead 6' over those parts which are to become the arcuate portions 8 in the final cap. In channels 19 in the die body are placed four inserts 17, shown in Figures 7 and 8, which serve to deform the parts of the bead 6' which are to become the straight portions 10 in the final cap. The shape of the operative surfaces of the inserts is shown particularly in Figures 11 and 12. The insert includes a groove 18 which is straight in plan. The ends of this groove merge into the ends of the adjacent portions of the interrupted annular groove 16. For this purpose, each insert 17 is accurately located in its channel 19 by its outer end abutting a dowel 20 in the die.

The outer boundary of the groove 18 is extended upwards by a surface having a central convex curved portion 22, and portions 24 in a vertical plane. The curved portion 22 is a small part of a circular cylinder, having its axis inclined, as indicated by the angle  $\alpha$  in Figure 11, upwards and outwards relatively to the vertical centre line 25 of the die. A suitable value for this angle is  $27^\circ 50'$ . The

upper boundary 22a of this surface (at the level indicated by the line a in Figure 11) is substantially a circular arc, which coincides in plan with the outer boundary of the portions of the groove 16 in the die. The lines 22b and 22c in Figure 12 are contours of the surface 22 at the levels indicated by the lines b and c in Figure 11.

In use, when the die with its inserts is forced upwards relatively to the partly-manufactured cap shown in Figure 9, the parts of the skirt 6' which are to become the straight portions 10 are deflected progressively inwards, until they reach the bottom of the groove 18. At the same time, an adjacent portion of the skirt 4' is deflected into a shape which matches the surfaces 22 and 24, that is to say a part-cylindrical inclined surface 26 (Figure 2), and two vertical surfaces 28. Moreover, the upward travel of the die is sufficient to cause the bottoms of the grooves 16 and 18 to increase the curl of the bead, considered in vertical section, from  $180^{\circ}$  to about  $300^{\circ}$  throughout its circumference. This completion of the curl in the same operation as the inward deflection of the portions 10 assists the sheet metal to flow in a manner free of unwanted wrinkles.

Finally, the die is separated from the cap, and the cap retains the shape shown in Figures 1 to 4, as described earlier in this specification.

In Figures 1 to 12 the lower contour of the bead 6 in the finished cap lies in a single plane, and the groove 18 in each die insert is of uniform depth.

Figure 13 shows a modified groove 18a, intended to produce a cap with straight portions tilted at about  $1^{\circ}$  to the plane containing the lower contour of the curved portions. In effect each straight portion is part of a fine-pitch right-hand helix. The advantage of this is that it is easier to start the assembly of the cap with a jar. With straight portions in a common plane, if the circumferential gaps between threads on the jar subtend relatively small angles at the centre compared with the angles

subtended by the threads, then there may be difficulty in assembly. When a cap is lowered onto a jar, the straight portions of the cap each come to rest on the upper flank of a respective one of the threads. If now the  
5 cap is turned, the leading parts of the straight portions may not readily pass below the lower flank of the next thread.

In Figure 13, the major part 26 of the groove 18a has a clockwise angle  $\beta$  of  $1^\circ$ , while a minor part 28 has an anticlockwise angle  $\gamma$  of  $8^\circ$ . The major part 26 produces  
10 the tilted operative part of the respective straight portion of the bead of the cap, while the minor part 28 produces a part of the bead which constitutes a transition to the adjacent arcuate portion.

## Claims

1. A cap for a jar, the cap being of sheet metal and (considered in its attitude of use) comprising a top panel (2), a skirt (4) depending from the periphery of the top panel, and an internal continuous circumferential  
5 bead (6) on the lower edge of the skirt, characterised in that the bead (considered in plan) consists of alternate arcuate portions (8) and straight portions (10), the arcuate portions being at a uniform radius from a common centre (12), and the straight portions being tangent to a common  
10 imaginary circle (14) around that common centre.
2. A cap according to claim 1, characterised in that the points of tangency of the straight portions (10) with the imaginary circle (14) are uniformly spaced around that circle.
- 15 3. A cap according to claim 2, characterised in that the straight portions (10) are tilted at a small angle to the plane containing the lower contour of the curved portions.
4. A process for manufacturing a cap according to claim 1, characterised by comprising: preparing a partly-  
20 -manufactured cap having a cylindrical skirt (4') on the lower edge of which is an internal, continuous, circumferential, partial bead (6'); and thereafter deforming the entire partial head simultaneously into the bead (6) consisting of the alternate arcuate portions (8) and  
25 straight portions (10).
5. A die for carrying out the process of claim 4,



characterised by comprising a die body (15) in which is an interrupted annular groove (16), and inserts (17), each including a second groove (18) which is straight in plan, the ends of each second groove merging into the ends of  
5 the adjacent portions of the interrupted annular groove, and the outer boundary of each second groove (18) being extended upwards by a surface having a central convex curved portion (22), and portions (24) in a vertical plane.

6. A die according to claim 5, characterised in that  
10 the curved portion (22) is a small part of a circular cylinder, having its axis inclined upwards and outwards relative to the vertical centre line (25) of the die.

1/3

Fig. 1.

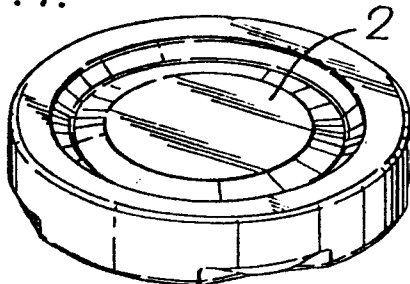


Fig. 2.

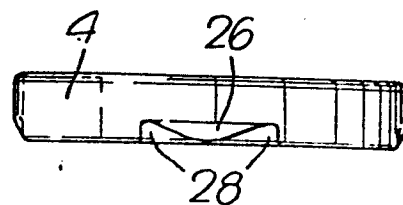


Fig. 3.

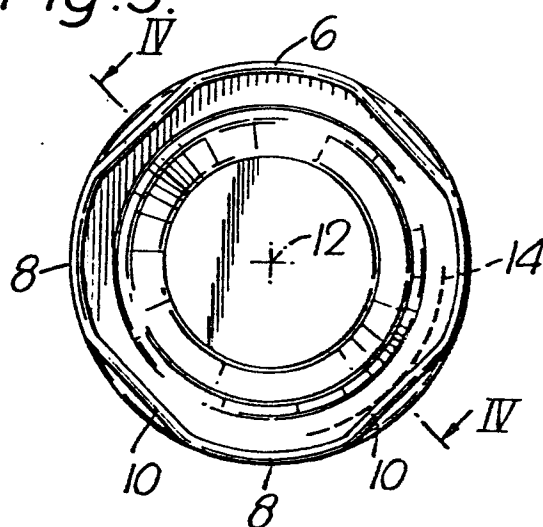


Fig. 4.

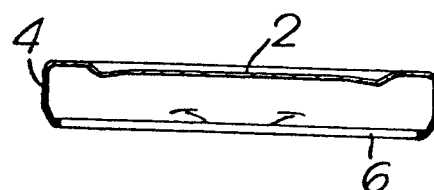


Fig. 5.

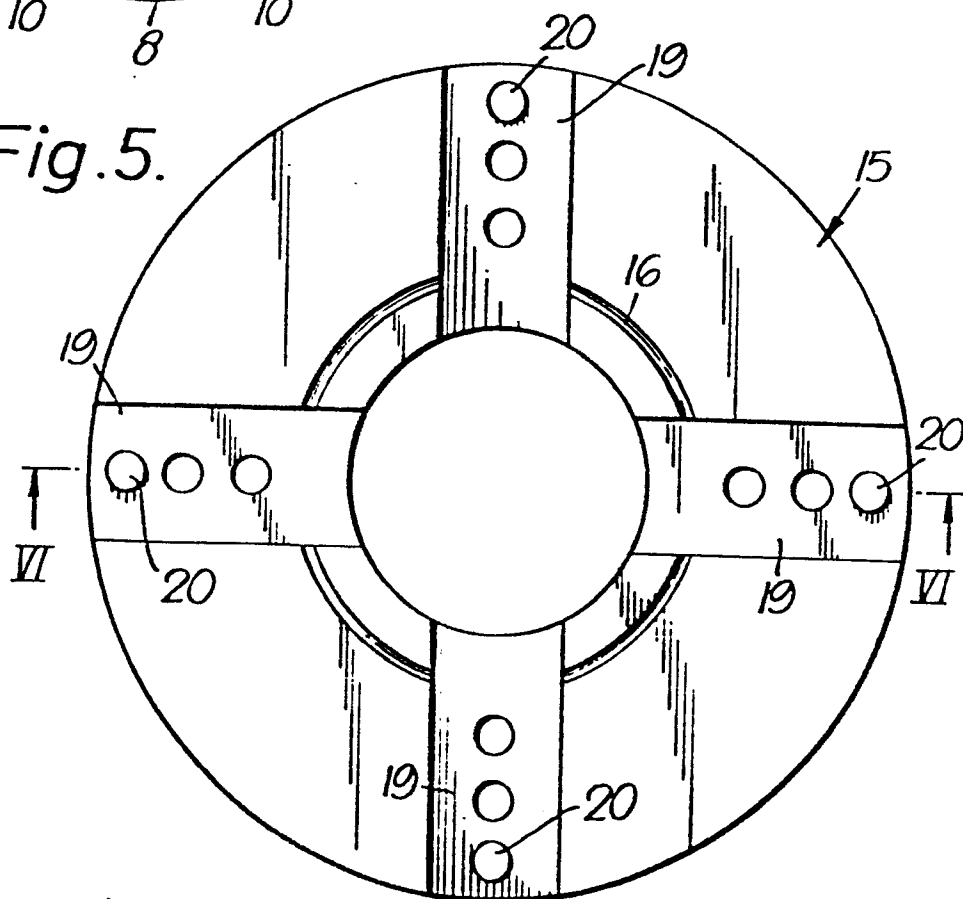


Fig. 6.

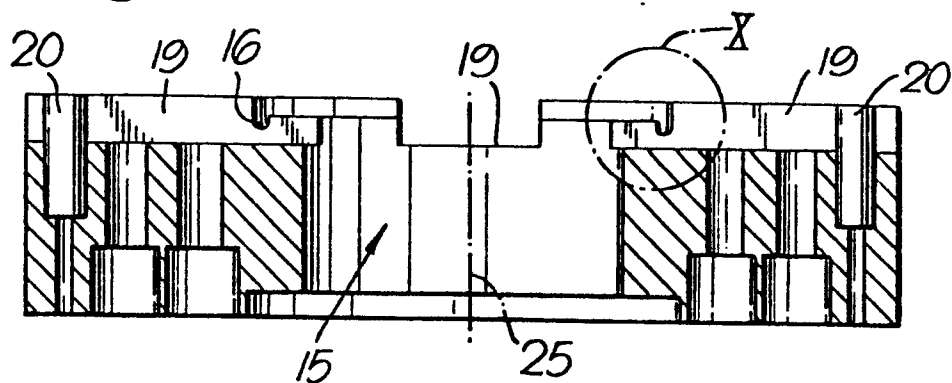


Fig. 7.

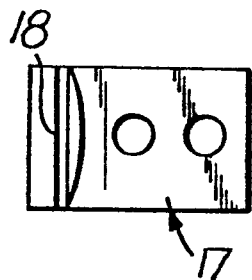


Fig. 8.

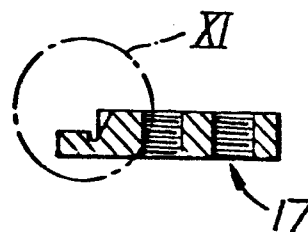


Fig. 9.

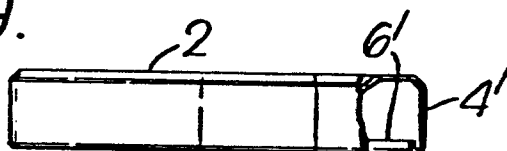


Fig. 10.

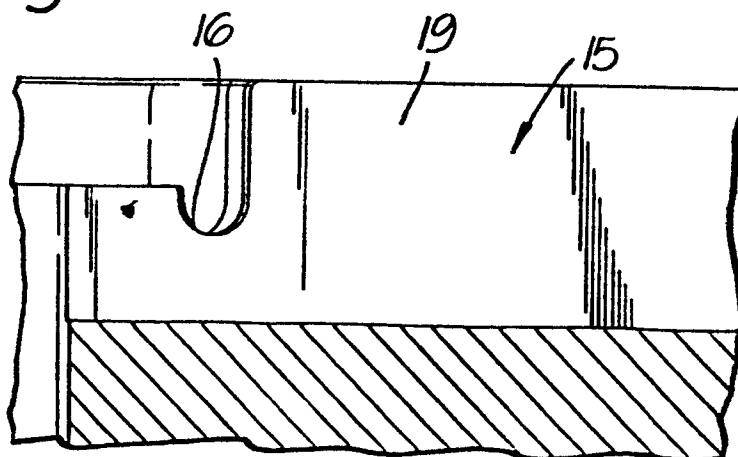


Fig. 11.

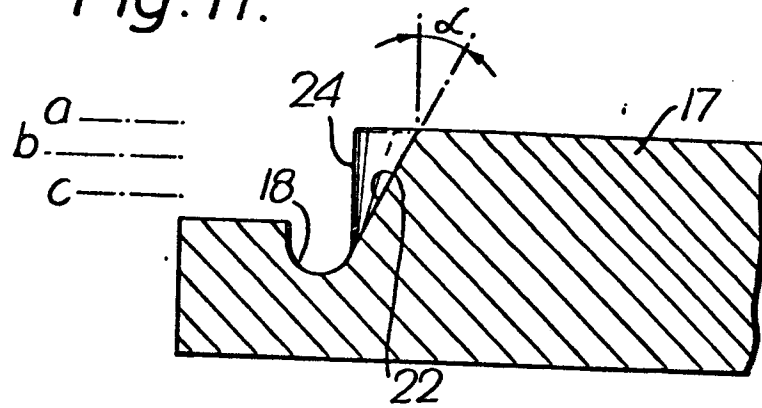


Fig. 12.

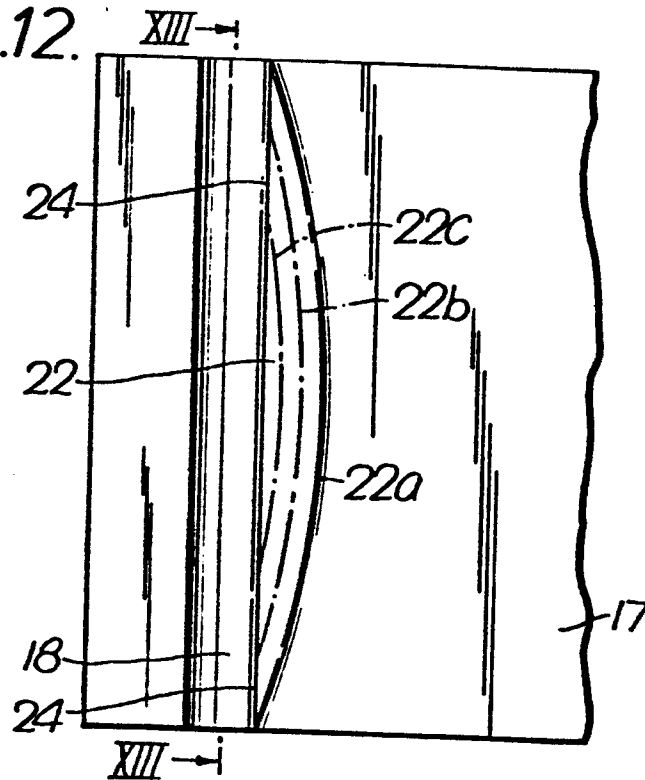
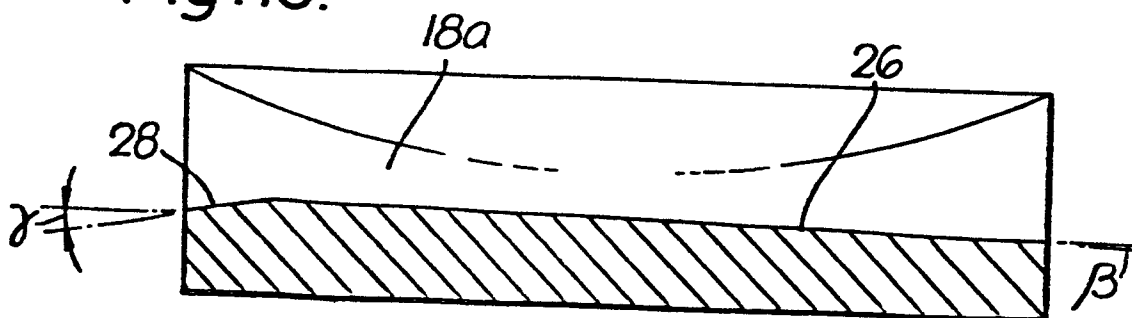


Fig. 13.





European Patent  
Office

# EUROPEAN SEARCH REPORT

0008502

Application number  
EP 79 30 1494

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. <sup>3</sup> )
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	<u>FR - A - 1 385 956</u> (GRACE) * Page 3, right-hand column, lines 7-58; page 4, left-hand column, lines 1-24; figures 1,2,4,6 *	1,2,4	
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A, D	<u>GB - A - 814 703</u> (WHITE CAP COMP.)	1	
A, D	<u>GB - A - 445 744</u> (TENNANT)	1	
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			TECHNICAL FIELDS SEARCHED (Int.Cl. <sup>3</sup> )
			B 65 D B 21 D
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
			& member of the same patent family. corresponding document
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 15-11-1979	Examiner BAERT