(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 018 800**
B1

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **25.08.82**

(51) Int. Cl.³: **H 01 R 4/50**, B 23 P 15/00

(21) Application number: **80301365.5**

(22) Date of filing: **25.04.80**

(54) **Manufacture of tapered bodies and electric connector receptacles made thereby.**

(30) Priority: **26.04.79 GB 7914543**
06.06.79 GB 7919682

(43) Date of publication of application:
12.11.80 Bulletin 80/23

(45) Publication of the grant of the patent:
25.08.82 Bulletin 82/34

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(56) References cited:
DE - A - 1 465 160
GB - A - 944 544
US - A - 2 641 810

(73) Proprietor: **BICC Limited**
21, Bloomsbury Street
London, WC1B 3QN (GB)

(73) Proprietor: **Burndy Corporation**
Richards Avenue
Norwalk Connecticut 06856 (US)

(72) Inventor: **Airey, Benjamin**
197 Newton Road
Lowton Warrington Merseyside (GB)

(74) Representative: **Poole, Michael John et al,**
BICC Limited Patents Department 38 Wood Lane
London, W12 7DX (GB)

EP 0 018 800 B1

Courier Press, Leamington Spa, England.

Manufacture of tapered bodies and electric connector receptacles made thereby

This invention relates to the manufacture of tapered bodies of ductile material comprising two parts each of uniform cross-section extending along opposite sides of and united by at least one web that is wider at one of its ends than the other.

An important application of the invention is in making receptacles for electric tapping connectors in which the parts of uniform cross-section are channels facing inwardly to receive separate electric conductors that are secured and electrically connected by a wedge driven between them.

Such bodies can be made by casting, but for many purposes the mechanical properties of metal (or other ductile material) that has been worked are much superior to cast material. Machining would be prohibitively expensive, and the current technique of bending an initially flat blank to form the parts of uniform cross-section restricts the cross-sectional shapes it is practicable to use (and is applicable only to shapes with a single web). The tapered hollow body can also be a forging, as in US—A—2 641 810.

In the method of the invention, a blank comprising two parts of uniform cross-section extending along opposite sides of and united by at least one web of uniform width is first extruded; and then the web or each of the webs is formed between press tools acting on it to an extent that varies and/or over an area that tapers along the length of the blank so as to increase its width to an extent that varies along the length of the blank.

Preferably the web of the extruded blank is planar and in this case the press tools will reduce its thickness to an extent that varies and/or over an area that tapers along the length of the blank.

If however the extruded blank were formed with a curved web, it would be possible, as an alternative (or a supplement) to reducing its thickness, for the press tools to reduce the curvature of the web to an extent that varies and/or over an area that tapers along the length of the blank; and it will be understood that when the area tapers the curvature can be completely removed over that area.

It will be apparent that a plurality of blanks may be extruded in a continuous length and subsequently sheared or sawn from one another.

Preferably the area of reduced thickness or reduced curvature (or each of the areas if there is more than one) is defined by a raised area on one of the press tools (or corresponding raised areas on both of them), which will ordinarily be approximately triangular with its base at the wider end of the finished body. When the thickness is to be reduced, the raised area is preferably flat or inclined, and preferably the edges of the raised area are oblique.

When the product is an electric connector receptacle into which a co-operating wedge will enter to secure conductors, it is preferably also formed in the pressing operation with ribs or other formations for engaging a projection on the wedge to increase resistance of slackening of the wedge.

The invention is especially applicable to articles of heat-treatable aluminium alloys, which are extruded in nominally half-hard condition, cooled slowly (e.g. in still air) to avoid age-hardening, and heat-treated to the TF condition after forming. It can however be used effectively with other ductile materials, such as for example copper, aluminium bronze and other copper alloys; in some cases the blank could incorporate more than one material.

The invention will be further described, by way of example, with reference to the drawings in which:

Figure 1 is an enlarged end-view of an extruded blank;

Figure 2 is a perspective view of a press tool;

Figures 3 and 4 are an end view and a front view of a finished connector receptacle;

Figure 5 is a cross-section in the line V—V in figure 3; and

Figures 6 and 7 are cross-sections on the lines VI—VI and VII—VII respectively in figure 5;

Figures 8, 9 and 10 are mutually perpendicular views of a wedge for use with the receptacle of figures 3—7;

Figure 11 is a cross-section on the line XI—XI in figure 8;

Figure 12 is an enlarged cross-section on the line XII—XII in figure 10;

Figure 13 is a view, corresponding to figure 5, of a modified design of receptacle; and

Figures 14 and 15 are isometric sketches of two further designs of receptacle.

In the manufacture of the receptacle of figures 2 to 7, standard heat-treatment aluminium alloy HE30 is first extruded to the cross-section shown in figure 1 and comprising two channel portions 1, 2 of any desired cross-section and a planar connecting web 3. The channel portions can usefully be formed with splines 4 or grooves and this is advantageous for some electrical connector receptacles. The extrudate is cooled in still air and then cut into individual blanks.

Each blank is then positioned in turn, open side down, on a tool of the form shown in figure 2, with the web 3 on top of the tool the flanges 5,5 loosely received in channels 6 6 in the tool, and an end of the blank against a stop surface 7 on the tool. The blank is now pressed onto the tool using a flat co-operating tool (not shown in the drawings) to reduce its thickness over the area 8 (figures 5—7). Both the width of the

reduced area and the extent of reduction increase steadily from the line 9 to the line 10. The effect of the deformation is to introduce a taper of about eight degrees between the two channels.

Preferably the tool is formed with grooves 11, as shown in figure 2, to form ribs 12 of saw-tooth or other suitable profile extending transversely across the area 8 for reasons explained below.

After forming the now-tapered receptacle is put through the standard heat-treatment to convert it to the TF condition, namely solution treating at 520—530°C followed by quenching in cold water and precipitation heat-treatment at 180°C for 5—6 hours.

At any convenient stage of the manufacturing process, exposed sharp edges and especially the edges 13 that will engage the conductors in use are desirably chamfered.

The co-operating wedge, shown in figures 8—12, is die-cast and has concave wedge faces 14 comprising a main section 15 (figure 10) with a taper angle substantially the same as the taper angle of the receptacle merging into a lead-in section 16 with a slightly larger taper angle. All corners 17 adjoining the wedge faces are generously radiussed.

The side faces 18 of the wedge are slightly convex and each bears at the wider end a ribbed projection 19, so that whichever way up the wedge is inserted in the receptacle, the ribs 12 will be engaged by one of the projections 19. In the preferred design shown, the ribs of projection 19 correspond in spacing and broadly in shape to the recesses between the ribs 12, but the ribs of 19 are of uniform height. When the wedge is driven home, the ribs interlock to increase resistance to slackening of the wedge.

The modified receptacles shown in figure 13 differs in the shape of the area 8; other, similar, variations may be made.

Figures 14 and 15 illustrate the use of an extruded blank with a curved web; the blanks are of the shape shown in dotted lines and are the same in both cases. In the receptacle of figure 14, the press tools act on the triangular area 20 and reduce it to a planar (but oblique) shape, while the areas 21 remain curved substantially as extruded. In that of figure 15, two triangular areas 22 are flattened until they are each coplanar with the contiguous side of the channels 1, 2 respectively and a central triangular area 23 remains curved (though displaced from its original position, except at the extremity of its wide end).

Claims

1. A method of manufacturing a tapered body of ductile metal comprising two parts (1, 2) each of uniform cross-section extending along opposite sides of and united by at least one web (3) that is wider at one of its ends than the other, the method being characterised by the steps of

(i) extruding a blank comprising two parts of uniform cross-section extending along opposite sides of and united by at least one web of uniform width; and then

(ii) forming the web, or each of the webs, between press tools acting on it to an extent that varies and/or over an area that tapers along the length of the blank so as to increase its width to an extent that varies along the length of the blank.

2. A method as claimed in Claim 1 characterised in that the press tools reduce the thickness of the web to an extent that varies and/or over an area that tapers along the length of the blank.

3. A method as claimed in Claim 1 in which the extruded blank is formed with a curved web characterised in that the press tools reduce the curvature of the web (with or without reducing its thickness) to an extent that varies and/or over an area that tapers along the length of the blank.

4. A method as claimed in any one of the preceding claims characterised in that the area of reduced thickness or reduced curvature is defined by a raised area on one of the press tools, or by corresponding raised areas on both of them.

5. A method as claimed in any one of the preceding claims in which the ductile metal is a heat-treatable aluminium alloy, characterised in that the alloy is extruded in a nominally half-hard condition, cooled slowly to avoid age-hardening before the forming step, and heat-treated to the TF condition after forming.

6. An electric connector receptacle made by the method claimed in any one of Claims 1—5 characterised in that the connector receptacle is formed in the pressing operation with ribs or other formations for engaging a projection on a co-operating wedge to increase resistance to slackening of the wedge.

Patentansprüche

1. Verfahren zum Herstellen eines konischen Körpers aus duktilem Metall, der zwei Teile mit jeweils konstantem Querschnitt (1,2) aufweist, die sich an gegenüberliegenden Seiten mindestens eines Steges (3) erstrecken und durch diesen miteinander verbunden sind, wobei der Steg am einen Ende breiter als am anderen Ende ist, gekennzeichnet durch folgende Verfahrensschritte:

(i) Stangpressen eines Rohlings, der zwei Teile mit konstantem Querschnitt aufweist, die sich an gegenüberliegenden Seiten mindestens eines gleichmäßig breiten Steges erstrecken und durch diesen miteinander verbunden sind, und anschließend

(ii) Ausbilden des Steges bzw. jedes Steges zwischen Preßwerkzeugen, die darauf in unterschiedlichem Maße und/oder über eine in Längsrichtung des Rohlings sich ver-

jüngende Fläche einwirken, so daß die Breite des Rohlings über seine Längsrichtung in unterschiedlichem Maße vergrößert wird.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Preßwerkzeuge die Dicke des Steges in unterschiedlichem Maße und/oder über eine in Längsrichtung des Rohlings sich verjüngende Fläche verringern.

3. Verfahren nach Anspruch 1, bei dem der stranggepreßte Rohling einen gekrümmten Steg aufweist, dadurch gekennzeichnet, daß die Preßwerkzeuge die Krümmung des Steges (mit oder ohne Verringerung dessen Dicke) in unterschiedlichem Maße und/oder über eine in Längsrichtung des Rohlings sich verjüngende Fläche verringern.

4. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß die Fläche verringerter Dicke oder verringerter Krümmung durch eine erhabene Fläche an einem der Preßwerkzeuge oder durch korrespondierende erhabene Fläche an beiden Preßwerkzeugen ausgebildet wird.

5. Verfahren nach einem der vorstehenden Ansprüche, bei dem das duktile Metall eine wärmebehandelbare Aluminiumlegierung ist, dadurch gekennzeichnet, daß die Legierung in zunächst halbfestem Zustand stranggepreßt, zur Vermeidung von Aushärtung vor dem Verformungsschritt langsam abgekühlt und nach der Verformung zum Überführen in den TF-Zustand wärmebehandelt wird.

6. Elektrische Steckverbindungshülse, hergestellt mit dem Verfahren nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß die Steckverbindungshülse im Preßvorgang mit Rippen oder anderen Ausbildungen versehen wird, die mit einem Vorsprung an einem mit ihr zusammenwirkenden Keil in Eingriff kommen, um ein Lockern des Keiles zu erschweren.

Revendications

1. Procédé de fabrication d'une pièce à côtés inclinés en métal ductile, constituée par deux parties (1, 2) chacune de section transversale uniforme, s'étendant le long de côtés opposés a d'au moins une partie intermédiaire (3) qui est plus large à l'une de ses extrémités qu'à l'autre, et reliées par cette partie intermédiaire, procédé caractérisé en ce qu'il consiste (i) à extruder une ébauche comprenant deux parties de section transversale uniforme s'étendant le long de côtés opposés d'au moins une partie intermédiaire de largeur uniforme, et reliées par cette dernière, puis (ii) à former la partie intermédiaire, ou chacune des parties intermédiaires, entre des outils de presse agissant sur elle dans une mesure qui varie et/ou sur une surface dont les côtés sont inclinés suivant la longueur de l'ébauche de manière à augmenter sa largeur dans une mesure qui varie suivant la longueur de l'ébauche.

2. Procédé selon la revendication 1, caractérisé en ce que les outils de presse réduisent l'épaisseur de la partie intermédiaire dans une mesure qui varie et/ou sur une région dont les bords sont inclinés suivant la longueur de l'ébauche.

3. Procédé selon la revendication 1, dans lequel l'ébauche extrudée est formée avec une partie intermédiaire incurvée, caractérisé en ce que les outils de presse réduisent la courbure de la partie intermédiaire (avec ou sans réduire son épaisseur) dans une mesure qui varie et/ou sur une région dant les bords sont inclinés suivant la longueur de l'ébauche.

4. Procédé selon l'une quelconque des revendications précédentes, caractérisé en ce que la région d'épaisseur réduite ou de courbure réduite est définie par une partie en relief sur l'un des outils de presse, ou par des régions en relief correspondantes sur les deux.

5. Procédé selon l'une quelconque des revendications précédentes, dans lequel le métal ductile est un alliage d'aluminium pouvant être traité à chaud, caractérisé en ce que l'alliage est extrudé dans une condition de demi-dureté nominale, refroidi lentement pour éviter le durcissement par viellissement avant l'opération de formation et traité thermiquement dans la condition TF après mise en forme.

6. Partie femelle de connecteur électrique réalisée selon le procédé de l'une quelconque des revendications 1 à 5, caractérisée en ce que la partie femelle de connecteur est formée dans l'opération sur presse avec des nervures ou autres formations pour engager une partie en saillie sur une cale coopérante afin d'augmenter la résistance au desserrage de la cale.

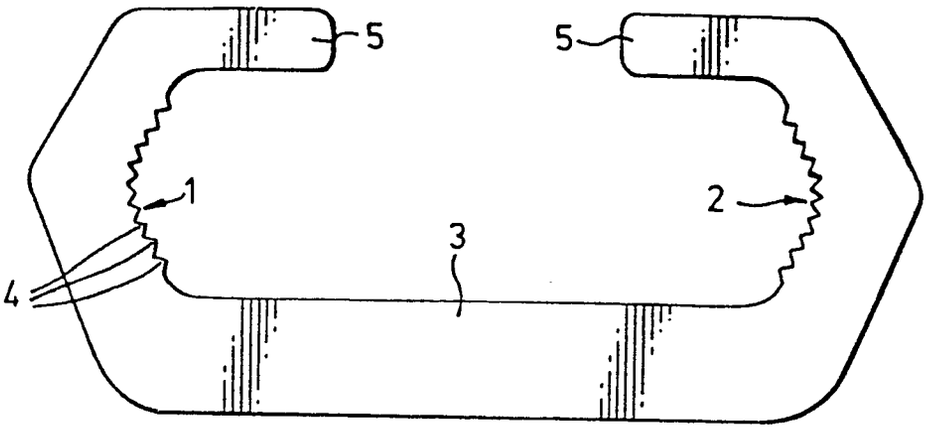


Fig.1.

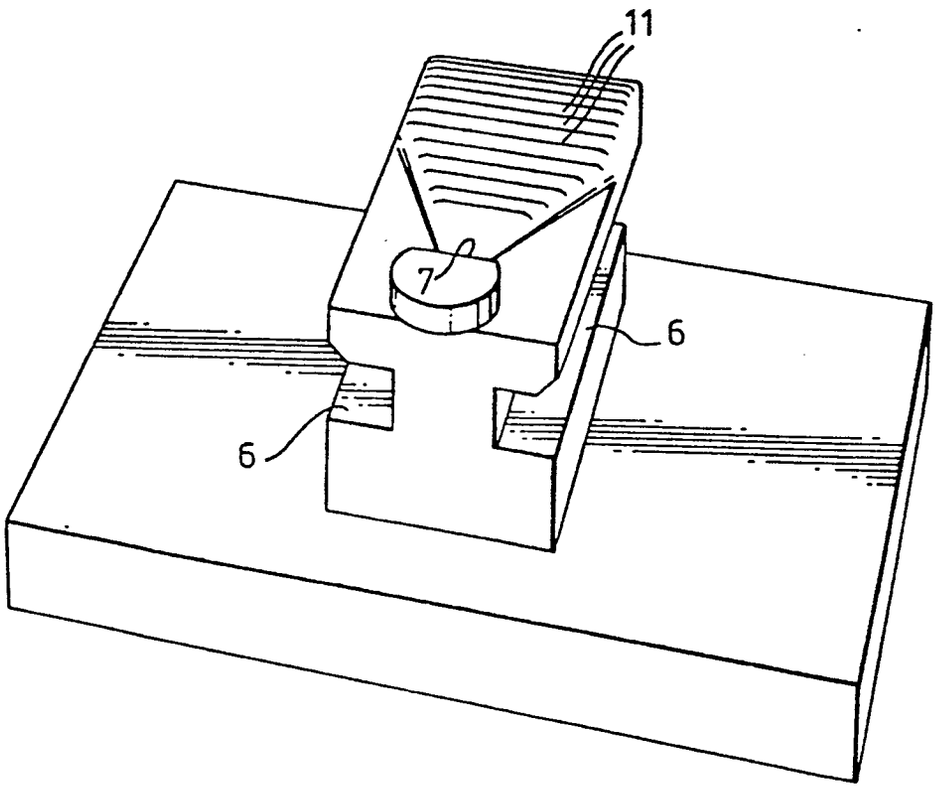


Fig.2.

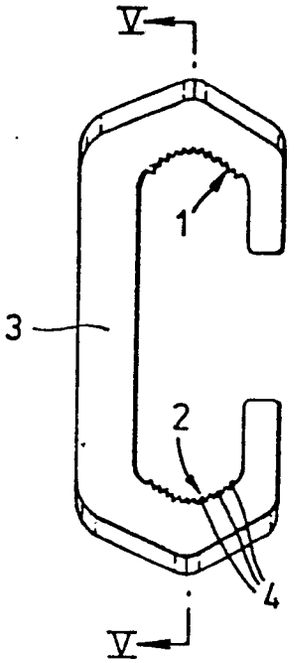
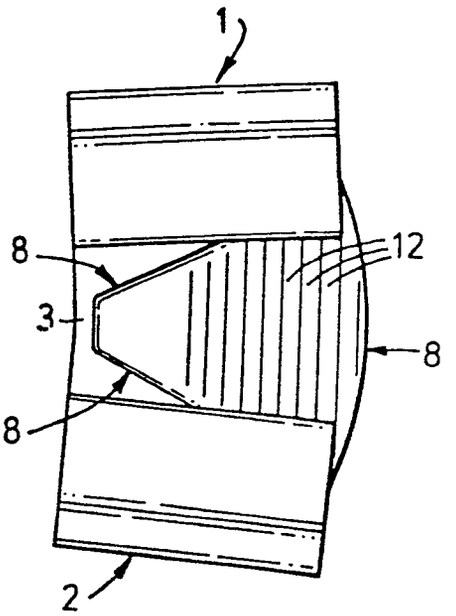


Fig. 3.

Fig. 4.



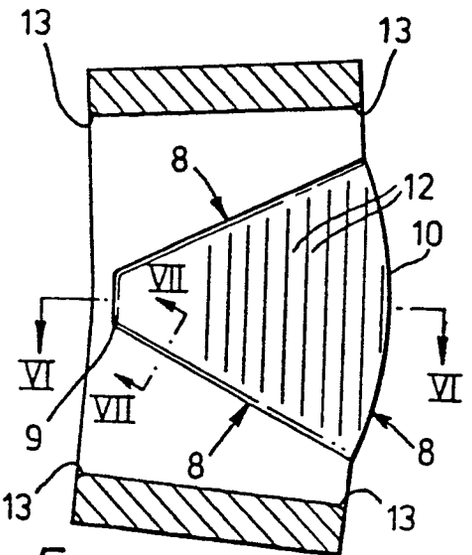


Fig. 5.

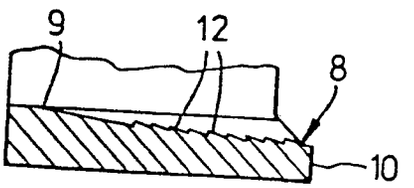


Fig. 6.

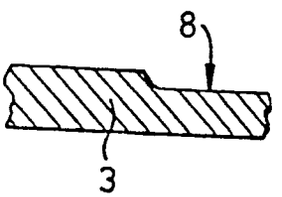


Fig. 7.

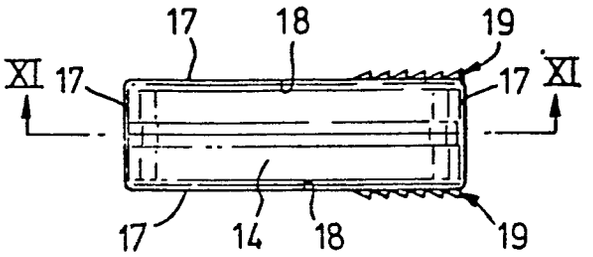


Fig. 8.

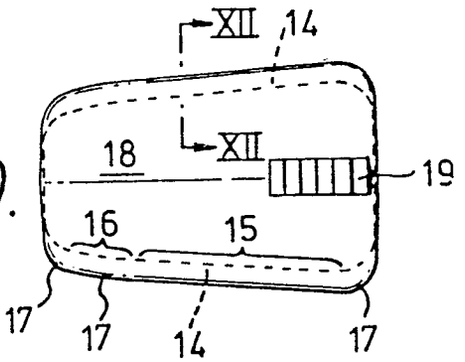


Fig. 10.

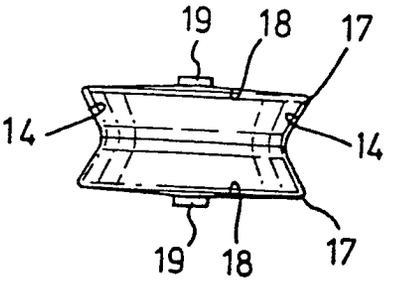


Fig. 9.

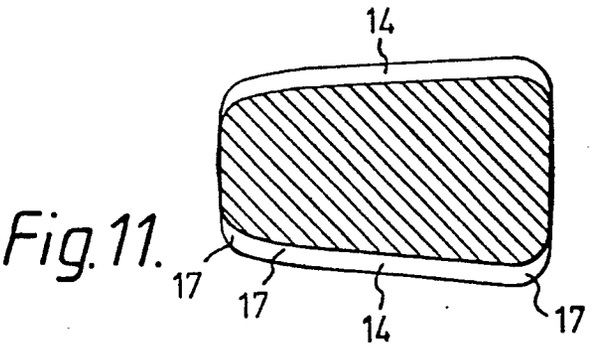


Fig. 11.

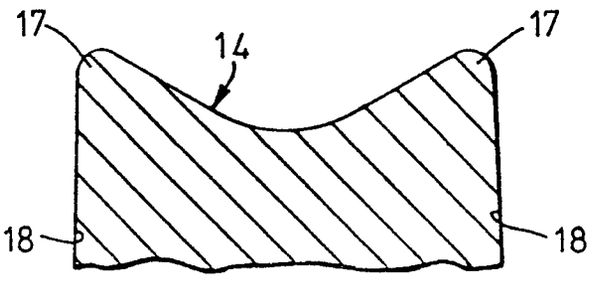


Fig. 12.

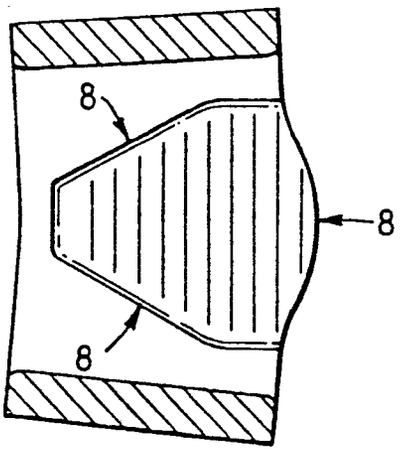


Fig. 13.

Fig.14.

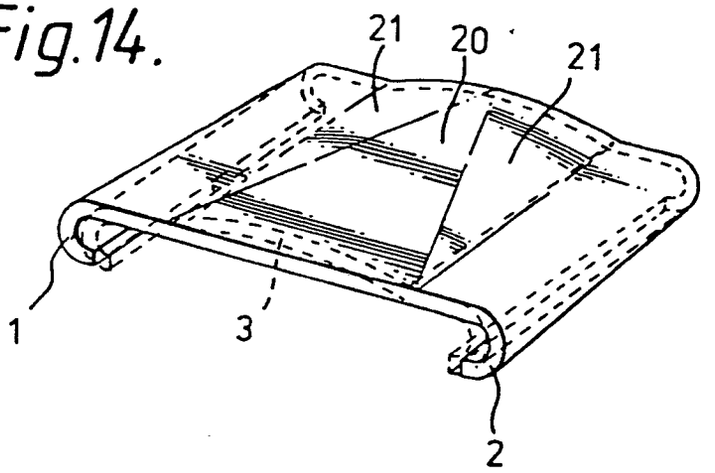


Fig.15.