

Jan. 29, 1963

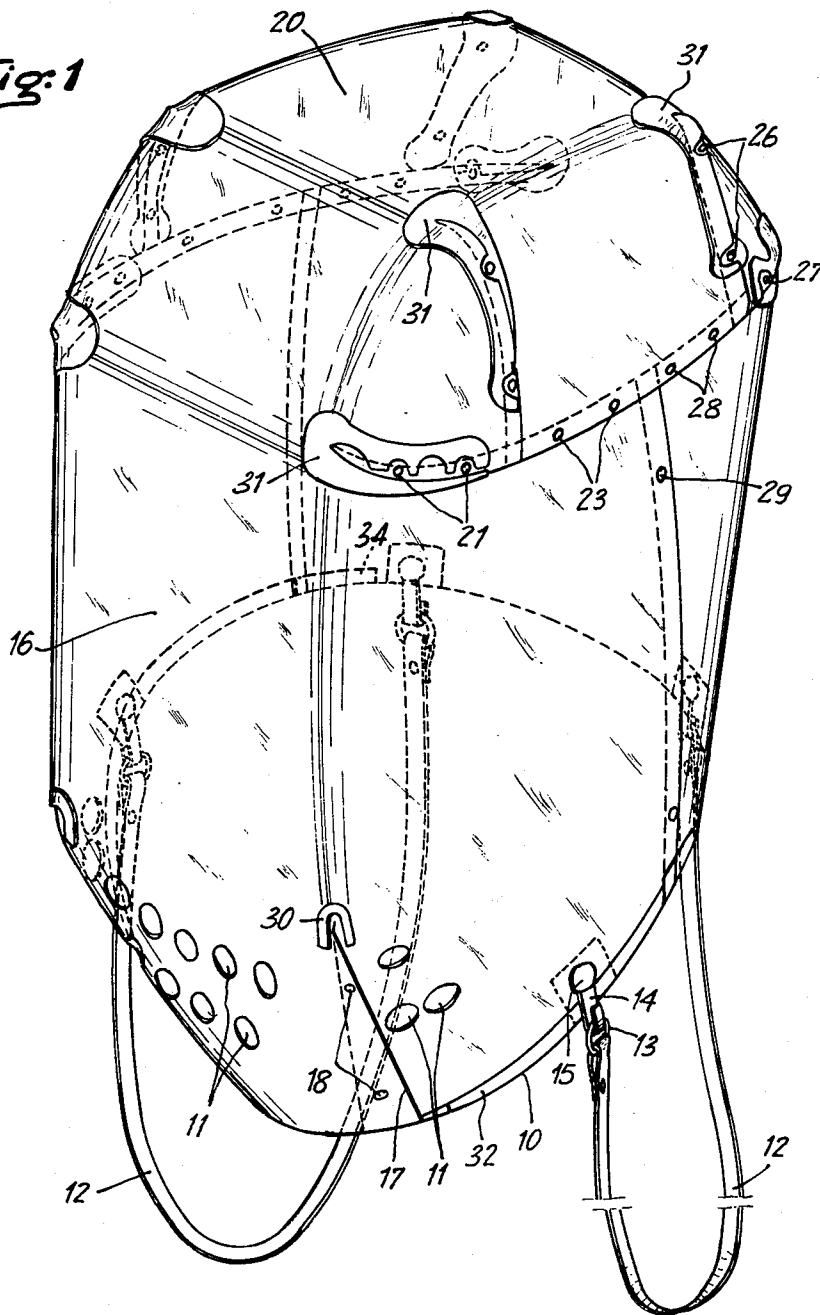
JEAN-PHILIPPE CROUZET  
HEAD-PROTECTING SHELLS AND THE LIKE ARTICLES  
OBTAINED THROUGH DEFORMATION OF SHEETS OF  
SYNTHETIC MATERIAL

3,075,200

Filed Feb. 18, 1960

2 Sheets-Sheet 1

**Fig. 1**



Jan. 29, 1963

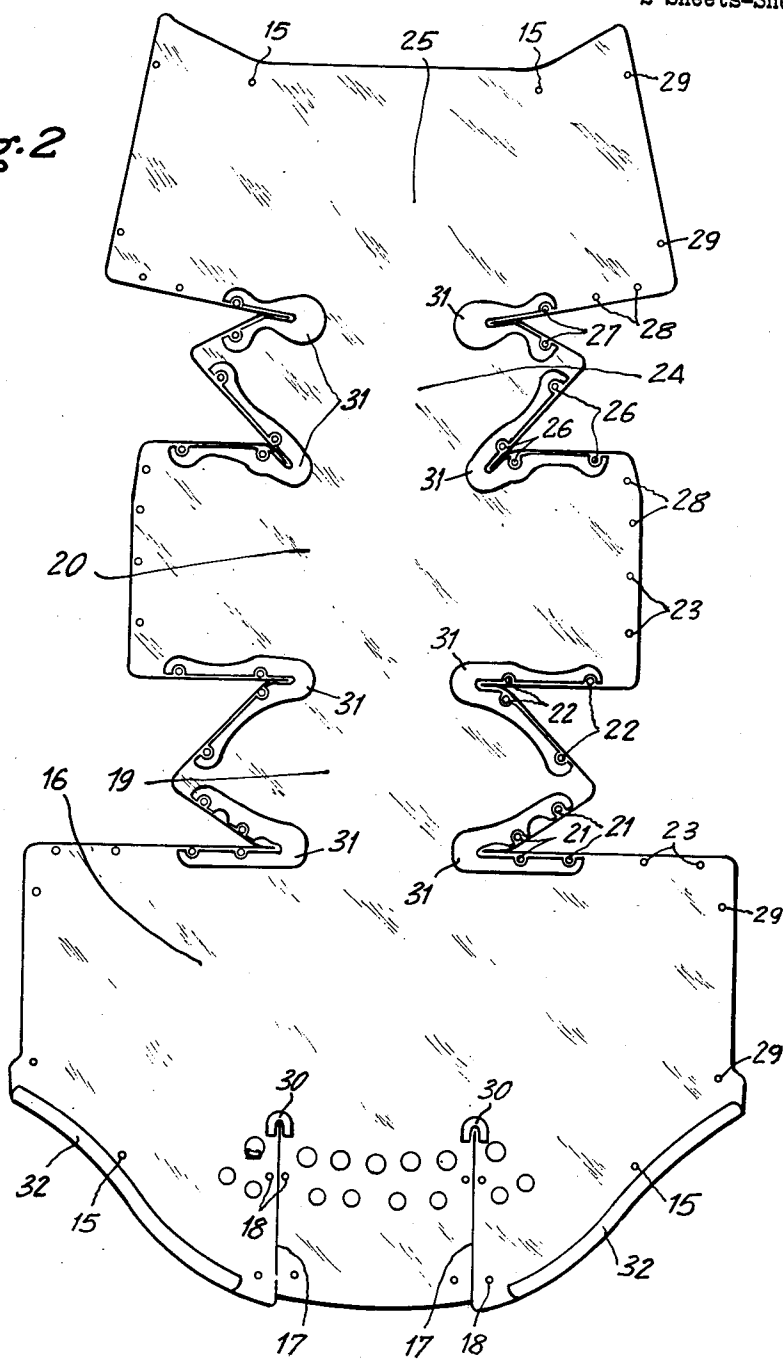
JEAN-PHILIPPE CROUZET  
HEAD-PROTECTING SHELLS AND THE LIKE ARTICLES  
OBTAINED THROUGH DEFORMATION OF SHEETS OF  
SYNTHETIC MATERIAL

3,075,200

Filed Feb. 18, 1960

2 Sheets-Sheet 2

Fig. 2



1

3,075,200

## HEAD-PROTECTING SHELLS AND THE LIKE ARTICLES OBTAINED THROUGH DEFORMATION OF SHEETS OF SYNTHETIC MATERIAL

Jean-Philippe Crouzet, 128 Blvd. Malesherbes, Paris, France

Filed Feb. 18, 1960, Ser. No. 9,559

Claims priority, application France Oct. 8, 1959

3 Claims. (Cl. 2-3)

My invention has for its object articles made out of sheets of semi-rigid synthetic material, such as that sold under the registered trade name Rhodoid, or the like, said articles being obtained through deformation of previously cut sheets and the shaping of which is obtained through bending and twisting.

My invention is applicable chiefly to the shells adapted to form a head-gear or helmet protecting the wearer's head against cold and unclement weather, said helmet enclosing the wearer's head and engaging the wearer's shoulders as described in my copending application claiming priority of my French patent filed on December 18, 1956 and published under No. 1,163,519 (U.S. Ser. No. 648,252 and 732,402, now U.S. Patent Numbers 2,988,749 and 2,989,049, respectively).

The articles obtained in this manner show the drawback of being very brittle when subjected to cold. As a matter of fact, the thickness of the sheet used is limited, so as to provide the yieldingness ensuring a sufficient bending capacity, said thickness being, for instance, equal to  $\frac{1}{10}$  of a mm. But, it is found that under the action of the shocks transmitted to such a sheet, either directly or indirectly, the inner edges of the reentering sections of the cut out outline of the sheet may lead to initiating cracks, since the inner strains produced by the deformation are maximum along said edges.

The free edges of the deformed semi-rigid sheets, such, for instance, as those surrounding the openings of the shell are also liable to crack and the same is the case for the sections weakened by rivets and which may, under the action of the tensioning stresses transmitted to them, break open the sheet between its edge and a rivet or between successive rivets.

Now, my invention has for its object to glue or otherwise secure over the semi-rigid sheet before it is deformed reinforcing strips extending along the edges of the cut out parts forming a reentering angle in the outline of the sheet to be shaped; each reinforcing strip is constituted by a layer of synthetic material, the thickness of which is substantially equal to that of the actual sheet, while the breadth of each reinforcement is at a maximum at a point in registry with the point of the cut out part showing a minimum radius of curvature, such as, for instance, the bottom of the cut out parts forming a reentering angle. The breadth of said reinforcements is variable and ranges substantially between 6 and 12 mm. According to a further feature of my invention, these reinforcements or supplementary reinforcements surround at least the portions of the edges of the rivet holes subjected to the highest straining and they extend also at least partly along the free deformed edges of the sheet.

I have found that the articles made of a shaped semi-rigid sheet secured by rivets, chiefly a sheet of the material sold under the above-mentioned registered trademark Rhodoid and including such reinforcements, are mechanically very resistant and do not break under the action of shocks.

In the case of rivet holes, the reinforcements, even if they surround only partly said rivet holes, increase the rigidity of the part of the hole edge which is not reinforced and absorb the stresses transmitted to the latter and to which said non-reinforced part is thus subjected.

2

My invention has also for its object, by way of novel articles of manufacture, the articles made of semi-rigid sheets of synthetic material and, chiefly, head-gear shells serving as helmets for protection against cold weather and including reinforcements constituted by a layer of synthetic material glued chiefly along the edges of the reentering angles formed along the outline cut in the sheet forming the article considered as also along the parts of the sheet which are weakened and its free deformed edges.

I will now describe an embodiment of my invention as applied to a protecting head-gear shell, reference being made to the accompanying drawings, wherein:

FIG. 1 is a perspective view of the head-gear shell provided with reinforcements.

FIG. 2 is a view from above, on a reduced scale, of the sheet of Rhodoid material provided with its reinforcements before its final deformation into the shape illustrated in FIG. 1.

The protecting shell or helmet illustrated in FIG. 1 forms a transparent casing surrounding the wearer's head and engaging, through its lower open end, the wearer's shoulders and the upper part of his back and of his chest, the arrangement including furthermore in its front section ports 11 which allow the outer air required for breathing purposes to enter the helmet.

The arrangement is held in position by elastic bands 12 adapted to pass underneath the wearer's armpits, said bands terminating with rings 13 engaging hooks 14 secured at 15 to the shell in the vicinity of its lower edge along the lateral front and rear portions of the latter.

The shell illustrated, of a generally ovoid shape, is obtained starting from a semi-rigid sheet of transparent synthetic material, such as that sold under the registered trademark Rhodoid, the thickness of which sheet is equal to about  $\frac{1}{10}$  of a mm. Each sheet is cut out so as to produce a surface 16 adapted to form the front of the shell together with the adjacent sections of the side wall. The lower part of the front surface is turned inwardly, as provided by the cuts 17 which allow an overlapping of the edges of the cuts which are held in position through the introduction in the perforations 18 of rivets or the like securing means. The aerating ports 11 are provided in said surface 16 in the vicinity of the cuts 17 and between the latter.

In prolongation of the central part of said surface 16 and opposite cuts 17, the sheet is cut and forms a surface 19 of a generally hexagonal shape, the deformation of which provides a connecting surface between the front lateral surface 16 and a surface 20 forming the parietal section of the shell. The surface 20 is substantially rectangular. The assembly of the surface 19 with the upper edge of the surface 16 is obtained through registration between the openings 21 through which rivets or the like extend to hold the surfaces fast together. Similarly, the assembly between the rear oblique edges of the surface 19 and the front transverse edges of the parietal surface 20 is provided through openings 22 and corresponding securing means.

The sides of the parietal surface 20 are connected with the lateral outer sections of the surface 16 through securing thereof together in registry with the openings 23 which are caused to register in said surfaces. It is however obvious, from a mechanical standpoint, that this securing together of the surfaces provides only a pseudo-cylindrical deformation of the elements, which leads to only negligible internal stresses with reference to the pseudo-spherical deformations arising upon registration of the openings 21 and of the openings 22 for insertion of securing means therethrough.

In its rear section, the shell is made in a similar manner and the parietal surface 20 extends into a surface 24

in the shape of an irregular hexagon which, in its turn, is rigid with a further surface 25 adapted to form the rear portion of the shell. The surface 24 is subjected, after securing of its front edges through the openings 26 with the rear edges of the parietal surface 20 and through the openings 27 of its rear edges with the cooperating edges of the rear surface 25, to a pseudo-spherical deformation producing a substantial inner straining. In contradistinction, the connections through rivets or the like 28 extending in cooperating perforations in the lateral sections of the parietal surface 20 and the front lateral edges of the rear surface 25 and through the rivets passing through the openings 29 in the rear lateral sections of the front surface 16 and the lateral sections of the rear surface 25 produce only pseudo-cylindrical deformations and, consequently, reduced internal stresses.

The internal strains appearing in the surfaces thus constituted are at a maximum at the apices of the cuts providing for a connection between a pseudo-spherical surface and another pseudo-spherical surface having two radii of curvature or a pseudo-cylindrical surface having a single radius of curvature.

In the embodiment described, the brittleness ascribable to such internal strains results in the formation of initiating breaks at the bottom of the cuts 17, on the one hand and, on the other hand, in the bottom of the angle separating the surface 19 from the other surfaces 16 and 20 and the surface 24 from the surfaces 20 and 25.

In order to cut out such initiating breaks and the damage which may occur in the case of fortuitous shocks, there are provided, in conformity with my invention, reinforcements constituted by strips cut in a semi-rigid sheet of plastic material, such the Rhodoid referred to hereinabove, having a thickness of about  $\frac{1}{10}$  of a mm., said strips being glued to outwardly facing areas of the main sheet.

At the inner end of each cut 17 is thus glued an arcuate strip 30, while, at the apex of the reentering angles between the surfaces 19 and 16 or 20, on the one hand, and between the surfaces 20 and 24 or 25, on the other hand, reinforcing strips 31 are positioned. The breadth of the strips 31 varies between 6 and 12 mm. and it reaches a maximum in registry with the apices of the corresponding angles. Said reinforcing strips 31 surround also, at least partly, on the side of the sheet with which they are rigid, the openings or perforations 21, 22, 26 and 27 adapted to be engaged by rivets or the like connecting means. Similar reinforcements in the shape of strips 32 extend also along the lower lateral edges of the front section, or surface 16.

After the final assembly, two reinforcements 34 (FIG. 1) are glued inwardly and along the lower edge in registry with the line of connection between the front and rear surfaces.

As clearly shown in FIG. 1, the reinforcements, as also the surfaces rigid therewith, are subjected, upon assembly, to an intense mechanical deformation, chiefly in registry with their broadest cross-section, but the considerable thickness obtained through their superposition over the actual main sheet prevents the initiation of cracks and breaks and all the more so by reason of the superposition and gluing together of independent layers. It should be

remarked that such an extra thickness, if extended throughout the surface of the main sheet, would prevent the pseudo-spherical and pseudo-cylindrical deformations inherent to the shaping of the article.

Of course, the embodiment disclosed by way of example is capable of various modifications within the scope of the accompanying claims, while the method described for producing a helmet or head-gear is applicable, as well, within the scope of said claims, to various types of articles.

What I claim is:

1. A head-protecting helmet to encompass the head comprising an elongated sheet of semi-rigid synthetic material including a first section defining a substantially rectangular configuration, a second section defining a substantially hexagonal configuration, a third section defining a substantially rectangular configuration, said second section being interposed between said first and third sections along common sides therebetween and having reentering angles between the free sides of said second section and outward extensions of the common sides of the first and third sections, a fourth section defining a substantially hexagonal configuration, a fifth section defining a substantially rectangular configuration, said fourth section being interposed between said third and fifth sections along common sides therebetween and having reentering angles between the free sides of said fourth section and outward extensions of the common sides of the third and fifth sections, reinforcing strips of semi-rigid material having a thickness substantially equal to that of said elongated sheet disposed on the surface thereof surrounding the apex of each of said reentering angles and along each free side and outward extension thereof to reinforce these portions when and after the thus constituted elongated sheet is formed into said head-protecting helmet, means for maintaining said reinforcing strips on said elongated sheet, and fastening means disposed along the edges of the sides of each of said sections to fasten these edges together in overlapping relation to thereby provide said head-protecting helmet.

2. A head-protecting helmet according to claim 1 in which said means for maintaining said reinforcing strips on said elongated sheet comprise glue.

3. A head protecting helmet according to claim 1 in which said first section has disposed in the side opposite to the common side thereof at least two parallel cuts that are substantially perpendicular to the opposite side, said reinforcing strips being disposed at the inward end of each cut and said fastening means being disposed along the edges of each cut to maintain the edges in overlapping relation when the helmet is formed to provide an inwardly turned portion of said first section.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

|           |          |               |
|-----------|----------|---------------|
| 1,576,023 | Barberis | Mar. 9, 1926  |
| 1,795,866 | King     | Mar. 10, 1931 |
| 2,289,858 | Angrave  | July 14, 1942 |
| 2,620,477 | Ackerman | Dec. 9, 1952  |

##### FOREIGN PATENTS

|         |               |               |
|---------|---------------|---------------|
| 798,277 | Great Britain | July 16, 1958 |
|---------|---------------|---------------|