Nov. 2, 1971 M. THEODORE ET AL 3,616,463

SHOCK ABSORBING HELMET

Filed July 6, 1970 2 Sheets-Sheet 1

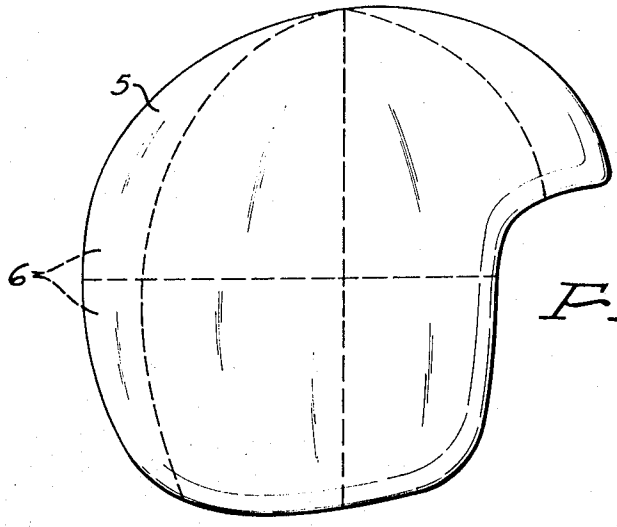


Fig. 1

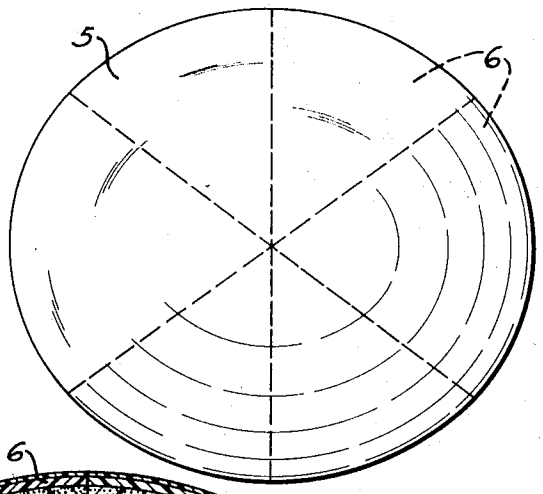


Fig. 2

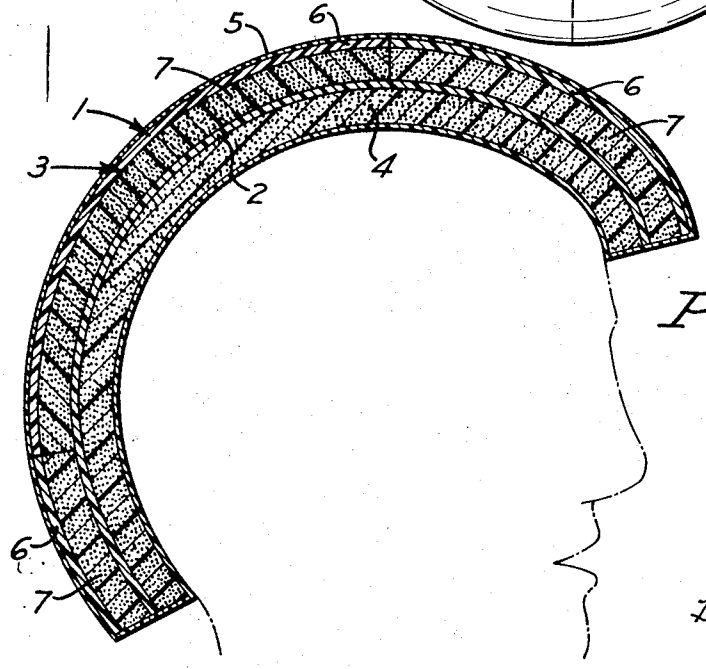


Fig. 3

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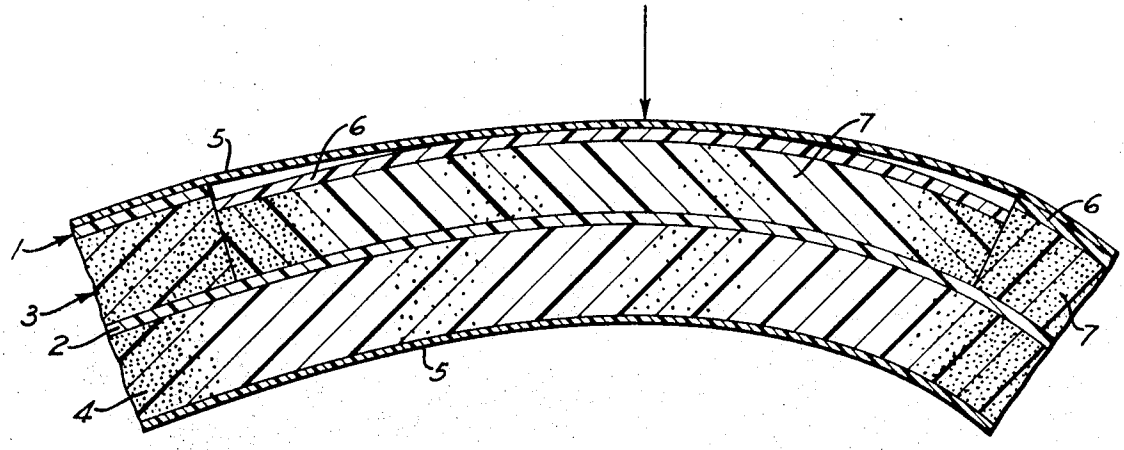


Fig. 4

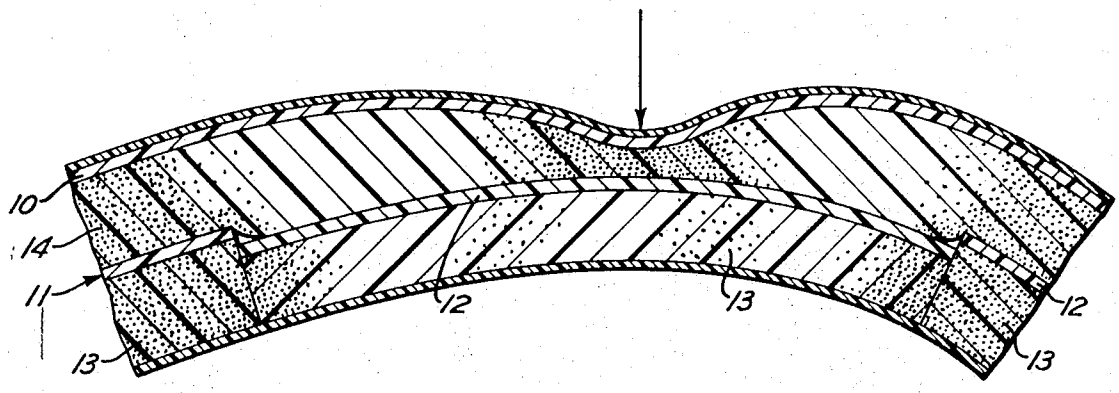


Fig. 5

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SHOCK ABSORBING HELMET

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U.S. Cl. 2—3 R 9 Claims

ABSTRACT OF THE DISCLOSURE

A helmet has spaced inner and outer shells of rigid material for covering the head, an outer layer of energy absorbing material between the two shells, an inner layer of energy absorbing material adjoining the inner surface of the inner shell. One of the shells and the energy absorbing layer adjoining its inner surface are subdivided into a plurality of adjoining segments, whereby an impact against the helmet will be distributed throughout the area of the shell segment and energy absorbing segment receiving the impact.

The failure in practice of high performance helmets provided with shock absorbing material is nearly always due to bottoming of the impactor on the head because of the concentration of the impact load, which exceeds the resistance of the shell and shock absorbing liner in the impact area. Any increase in the rigidity of the shell or in the thickness of the liner to overcome this shortcoming results in a helmet which is heavier and larger than desired.

It is among the objects of this invention to provide a helmet for attenuating the energy applied on impact against it, which resists localized dishing, which distributes the load over a much larger area than heretofore, which reduces the strain on the inner liner and which permits the use of lighter and/or thinner material, thereby reducing the weight and size of the helmet.

The invention is illustrated in the accompanying drawings, in which

FIG. 1 is a side view of our helmet;

FIG. 2 is a plan view thereof;

FIG. 3 is a vertical section;

FIG. 4 is an enlarged fragmentary section through the helmet showing the effect of an impact; and

FIG. 5 is a view, similar to the preceding figure, of a modification.

Referring to FIGS. 1 to 3 of the drawings, the overall shape of the helmet is conventional and the helmet is held in place on the head by a chin strap (not shown). The helmet has a smooth outer shell **1** that is made from substantially rigid material, such as a reinforced plastic, which is molded into a shape that will fit over and protect a head. Inside this shell and spaced uniformly from it is a smooth inner shell **2** (FIG. 3) that may be made of the same material. Between the two shells there is a layer **3** of energy absorbing material that preferably is bonded to the outer shell by a suitable adhesive, but not to the inner shell. This material is energy absorbing because it is crushable. Such materials are well known. They include polystyrene and polyurethane foam and other porous or fibrous material that is crushable. A similar layer **4** of energy absorbing material adjoins the inner surface of the inner shell and preferably is bonded to it.

When none, or less than all, of the shells and energy absorbing layers are not bonded together, they are held together and in place by a stiff envelope **5** that fits against the outer surface of the outer shell and the inner surface of the inner energy absorbing layer, as well as around their edges. This envelope is formed from a thin yieldable layer of a suitable plastic.

It is a feature of this invention that if this helmet receives an impact it will resist bending or dishing that would allow the impactor to bottom on the head, but instead will distribute the load more or less evenly over several square inches of the helmet. Accordingly, the outer rigid shell **1** is subdivided into a number of adjoining unconnected segments **6** that are disposed edge to edge substantially in engagement with one another. The exact shape of these segments is not critical. FIGS. 1 and 2 of the drawings illustrate one satisfactory arrangement in which all of the upper group of segments are tapered upwardly and meet at a central point. Segments as large as one quarter of the shell area can be used. If they are too large, the benefits of the segments are lost to a large extent; while if they are too small, there will not be enough distribution of the load created by an impact on a segment.

The energy absorbing layer **3** between the two rigid shells likewise is subdivided into adjoining segments **7** which are substantially coextensive with the segments of the outer shell. All of these segments normally are held in fixed position relative to one another by the surrounding envelope **5**.

If the helmet is struck a heavy blow by an object, such as indicated by the large arrow in FIG. 4, the impact generally will be against only one of the shell segments **6**. Since this segment is not attached to the surrounding portion of the shell, the segment can move bodily inward without deforming appreciably and it will exert more or less uniform pressure over the entire area of the energy absorbing segment **7** engaging it. This will crush the segment **7** more or less, whereby the shock will be absorbed. The load is thus distributed throughout this particular energy absorbing segment and thereby distributed over a larger area of the head through the inner shell and absorption layer. Also, if the crushable segment is not bonded to the inner shell, the segment is free to slide on that shell and absorb energy by friction. Of course, the helmet is designed to attenuate established impact levels. To accommodate the desired design impact level, the density and thickness of the two energy absorbing layers can be varied.

In the modification shown in FIG. 5, the outer rigid shell **10** remains uncut and it is the inner shell **11** that is subdivided into segments **12**. Also, it is the innermost energy absorbing layer **13** that is likewise segmented. With such a helmet, an impact can dent or bend the outer shell, crush the adjoining energy absorbing layer **14** beneath the point of impact and then force the underlying segment **12** of the inner shell toward the head, which will result in the adjoining segment **13** of energy absorbing material being crushed and absorbing the shock. Here again the impact, although concentrated on the outer shell, is distributed over the underlying inner shell segment that in turn spreads it over the entire attached energy absorbing segment. The force of the impact is distributed over a larger area of the head than it would be if the helmet were not made up of the segments described, and therefore is less traumatic.

According to the provisions of the patent statutes, we have explained the principle of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. A helmet comprising an outer shell of substantially rigid material for covering the head, an inner shell of substantially rigid material spaced inwardly from the outer shell, an outer layer of energy absorbing material between the two shells, an inner layer of energy absorbing material

adjoining the inner surface of the inner shell, and means holding said shells and layers together, one of said shells being subdivided into a plurality of adjoining segments disposed edge to edge, the energy absorbing layer adjoining the inner surface of the subdivided shell likewise being subdivided into adjoining segments substantially coextensive with the shell segments, whereby an impact against the helmet will be distributed throughout the area of the shell segment and energy absorbing segment receiving the impact.

2. A helmet according to claim 1, in which the other of said shells is unitary.

3. A helmet according to claim 1, in which said outer layer of energy absorbing material is secured to said outer shell and is slidable on said inner shell.

4. A helmet according to claim 1, in which said outer layer of energy absorbing material is secured to both of said shells.

5. A helmet according to claim 1, in which said subdivided shell and energy absorbing layer are said outer shell and outer layer.

6. A helmet according to claim 5, in which said inner shell is unitary.

7. A helmet according to claim 1, in which it is the inner shell and the inner energy absorbing layer that are subdivided into said segments.

8. A helmet according to claim 7, in which said outer shell is unitary.

9. A helmet according to claim 1, in which said holding means is a stiff envelope conforming to the outer surface of the outer shell and the inner surface of the inner layer of energy absorbing material.

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