

[54] **HELMET**

[76] Inventors: **Frank J. Kavanagh**, 406 No. Cayuga Street; **Solomon C. Hollister**, 201 Hallister Building, both of Ithaca, N.Y.

[22] Filed: **Dec. 27, 1971**

[21] Appl. No.: **212,077**

[52] U.S. Cl. **2/3 R**

[51] Int. Cl. **A42b 3/00**

[58] Field of Search..... **2/3, 5, 6, 68, 209**

[56] **References Cited**

UNITED STATES PATENTS

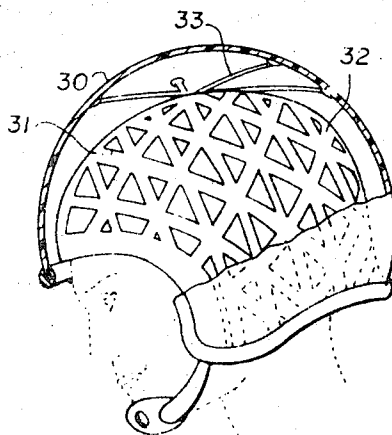
2,866,977	1/1959	Finken.....	2/3 R
2,892,194	6/1959	Lee et al.	2/3 R
2,946,063	7/1960	Boyer	2/3 R
3,156,921	11/1964	Dye	2/3 R

Primary Examiner—James R. Boler
Attorney—Cumpston, Shaw & Stephens

[57] **ABSTRACT**

A rigid shell helmet has an improved way of holding the shell uniformly over the head of the wearer. This includes a cap formed of a network of non-stretchable bands arranged in arcs passing closely over the head and crossing each other at many points to form the legs of triangles arranged in hexagonal groups over the head with the bands in tension between the apexes of the triangles. The cap provides a firm grip on the head at all angles, and is centered within the helmet shell by a plurality of non-stretchable straps extending tangentially in tension from the cap to the shell. Several of these straps are preferably in the zenith region of the cap, and the lower region of the cap is secured to the lower region of the shell.

16 Claims, 10 Drawing Figures



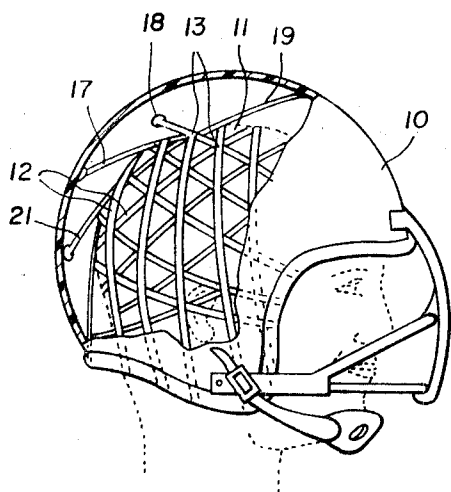


FIG. 1

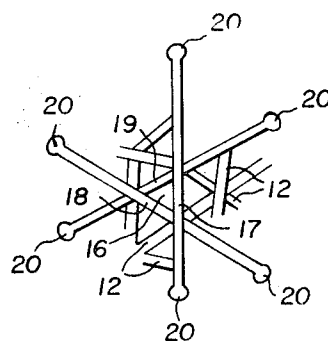


FIG. 2

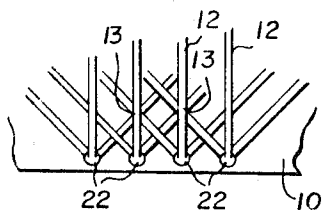


FIG. 3

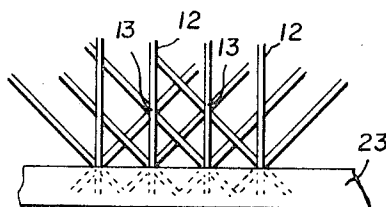


FIG. 4

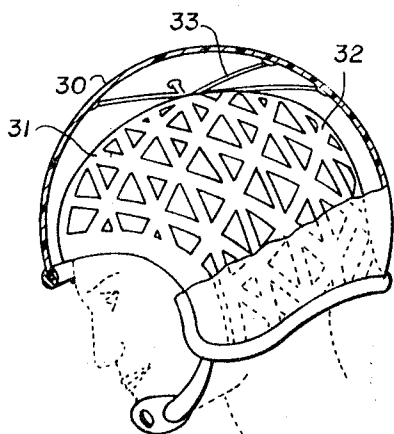


FIG. 6



FIG. 5

INVENTORS
FRANK J. KAVANAGH
SOLOMON C. HOLLISTER
BY *Cumpton, Shaw*
Stephens
ATTORNEYS

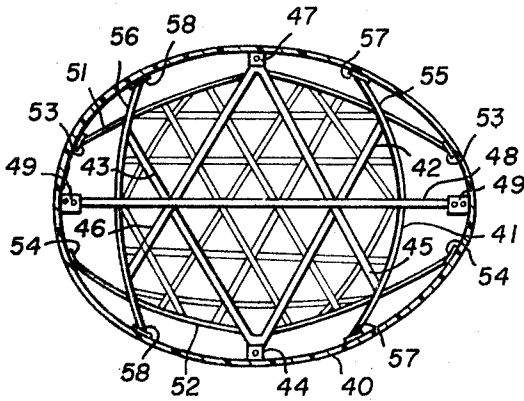


FIG. 7

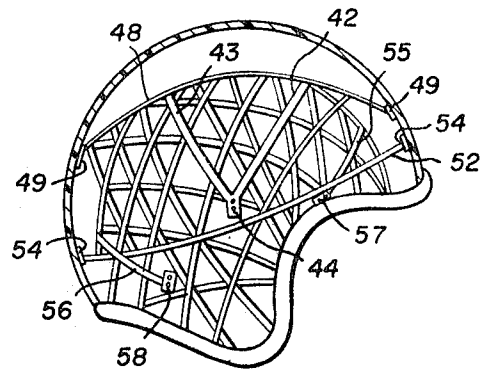


FIG. 8

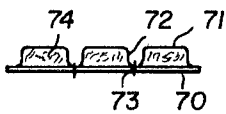


FIG. 10

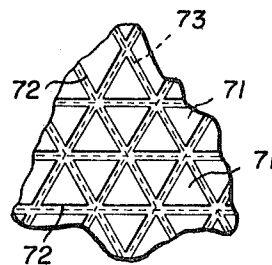


FIG. 9

INVENTORS
FRANK J. HAVANAGH
SOLOMON C. HOLLISTER
BY *Cumpton, Shaw and Stephens*
ATTORNEYS

1 HELMET

THE INVENTIVE IMPROVEMENT

Helmets used in football and other sports, construction work, motorcycle riding, automobile racing, etc., have substantially rigid outer protective shells, and some way of centering and supporting the head within the shell. These have included padding between the head and the shell interior, or an equatorial head band around and spaced from the helmet shell to center the equatorial region of the head within the helmet shell, combined with straps arranged in various ways over the wearer's head to hold the top of the helmet shell above the zenith of the head.

The invention involves analysis of the defects and deficiencies of prior-art ways of supporting and centering the helmet shell over the head, and the invention proposes an improved and different way of centering the helmet shell on the head.

For example, previous helmet support arrangements have allowed the helmet to tilt or twist on the head of the wearer, so that blows at some angles drive the helmet shell against the wearer's head. Also, although previous systems have worked well in supporting the helmet shell against vertical blows down on the zenith or lateral blows in the plane of the equatorial head band, they have allowed oblique blows between the zenith and the horizontal to drive the helmet shell against the wearer's head and cause injuries.

The invention seeks to overcome these defects in an improved means for centering and supporting a helmet shell on the head of the wearer. The invention aims at safety, reliability, efficiency, and economy in an improved helmet.

SUMMARY OF THE INVENTION

The inventive means for maintaining a helmet shell uniformly spaced over the head of the wearer includes a cap formed of a network of substantially non-stretchable, flexible bands arranged in arcs passing closely over the head. The bands cross each other at a plurality of points forming the legs of triangles arranged in hexagonal groups over the head. The bands are fixed relative to each other at the crossing points at the apexes of the triangles, and the bands are in tension between the apexes of the triangles when the cap is on the head. A plurality of substantially non-stretchable straps are secured to the cap and extend substantially tangentially in tension from the cap to the shell to support the cap in spaced relation to the shell, and the lower region of the cap is secured to the lower region of the shell.

DRAWINGS

FIG. 1 is a partially cut-away elevational view of a preferred embodiment of the inventive helmet positioned on the head of a wearer;

FIG. 2 is fragmentary plan view of a preferred anchoring strap arrangement for the zenith of the cap of the helmet of FIG. 1;

FIG. 3 is a fragmentary elevational view of the fastening of the lower ends of the bands of the cap in the inventive helmet.

FIG. 4 is a fragmentary elevational view of another preferred way of securing the lower ends of the bands of the inventive cap to the bottom of the helmet shell;

2

FIG. 5 is a fragmentary cross-sectional view of a combination pad and band material for forming the inventive helmet cap;

FIG. 6 is a partially cut-away elevational view of another preferred embodiment of the inventive helmet on the head of the wearer;

FIG. 7 is a cut-away, top view of a preferred alternative embodiment of the inventive helmet;

FIG. 8 is a partially cut-away, elevational view of the helmet of FIG. 7;

FIG. 9 is a fragmentary, plan view of a cap construction for the inventive helmet; and

FIG. 10 is a fragmentary, cross-sectional view of the cap construction of FIG. 11.

DETAILED DESCRIPTION

The inventive helmet differs from prior-art helmets in having an internal cap that closely fits the head of the wearer and closely grips the wearer's head in a wide and uniform manner. Rather than letting the helmet turn or twist relative to the internal support, the cap is connected to the helmet by generally tangential tension straps that locate it fairly securely within the central region of the helmet shell. This keeps the head centered within the helmet shell to move with the helmet shell in response to a blow or impact. The force of any such blow or impact is widely distributed over the head by the close-fitting cap, but the shell is not allowed to touch the head of the wearer regardless of the angle of the blow. This has not been true of prior-art helmets, and it will be understood better from the following description.

Cap 11 fits tightly and securely over the head of the wearer inside helmet shell 10. Cap 11 is formed of a network of bands 12 that cross each other at many apexes 13 to form triangles arranged in hexagonal groups over the front and back of the band. Bands 12 are substantially non-stretchable and are flexible to fit closely over the head. As illustrated, bands 12 are generally laid in arcs passing closely over the wearer's head.

When cap 11 is fitted over the wearer's head, bands 12 are in tension between apexes 13. This is accomplished by securing bands 12 together at apexes 13 or by forming bands 12 of an integral, non-stretchable material so that distances between apexes 13 are generally fixed. Bands 12 can be formed as fabric tapes stitched or otherwise secured together at apexes 13, or as best shown in FIG. 5, bands 12 can be formed as embossed lines in a thermoplastic pad material 15 extending between bands 12. Also, bands 12 can be formed as tapes, fabric or other material made integral with a padding material, or padding arranged around or extending between the tapes.

Cap 11 is supported centrally within helmet shell 10 so as to maintain uniform spacing from the inside of helmet shell 10. Such supporting is preferably accomplished at the zenith of cap 11 and also near the bottom of helmet shell 10 either directly or through an equatorial head band inside helmet shell 10.

A preferred arrangement for securing the zenith of cap 11 to helmet shell 10 is best shown in FIG. 2. A triangle 16 is selected in the region of the zenith of cap 11, and support straps 17 - 19 are secured to cap 11 to extend in the direction of the legs of triangle 16. The ends of straps 17 - 19 have terminations 20 fastened to helmet shell 10 by rivets, stitching or other means.

Straps 17 - 19 extend preferably tangentially from the legs of triangle 16 to connect the zenith of cap 11 in tension to helmet shell 10. Straps 17 - 19 can be formed either as separate tapes or strips sewed or otherwise secured to cap 11, or can be as extensions of selected bands 12 reaching to the zenith area of triangle 16. Also, it is not necessary that anchoring straps 17 - 19 all extend from the legs of a single triangle, so long as a number of anchoring straps are provided extending substantially tangentially to tension the zenith of cap 11 in a number of directions to maintain it securely in position relative to the zenith of helmet 10. Support points other than the zenith of cap 11 may similarly be anchored to shell 10 by using anchoring straps 17 - 19 at points around the sides, front, and back of cap 11, or around band 23. Preferably, enough tension straps 17 - 19 are used to extend tangentially in tension between cap 11 and shell 10, to center cap 11 securely within shell 10 to resist blows from any direction on shell 10.

Portions of straps 17 - 19 are illustrated in FIG. 1. Additional anchoring straps can be run preferably tangentially from any selected point on cap 11 to helmet shell 10 to help maintain cap 11 in position within shell 10. One such additional strap 21 is shown in FIG. 1.

The bottom of cap 11 is also anchored securely within helmet shell 10 as shown in either FIG. 3 or FIG. 4. In the arrangement of FIG. 3, the lower ends of bands 12 have terminations 22 secured directly to the inside of helmet shell 10 along the bottom edge thereof by rivets, stitching, or other fastening means. This securely anchors each end of each band 12.

In the alternative arrangement of FIG. 4, the lower ends of bands 12 are stitched or otherwise secured to a strip 23 of fabric or other material that in turn is fastened in place around the lower edge of helmet shell 10. In a similar way, this provides a secure anchorage for each end of each band 12. Alternatively, strip 23 can form an equatorial head band secured within helmet shell 10 in spaced relation therefrom by a generally known construction rather than being secured directly to helmet shell 10. This preferably includes tension straps extending tangentially from head band 23 to the interior of shell 10.

Cap 31 within helmet shell 30 is formed from a padding material 15 to have bands 32 formed of material integral with padding 15 and arranged in intersecting arcs as illustrated. Cap 31 can be formed of a single dome of thermoplastic padding material 15 in which band lines 32 are embossed such as illustrated in cross-section in FIG. 5, or bands 32 can be formed as intersecting tapes on which padding material is arranged to fill the triangles between bands 32 and extend between bands 32 to form an integral, padded cap 31. This preserves the holding network of bands 32 and adds the advantage of a generally padded cap 31.

The zenith of cap 31 is secured within helmet shell 30 by straps 33 a few of which are illustrated. Straps 33 are preferably tapes of material secured to cap 31 in the manner described above to extend tangentially for a tensioned connection to the inside of helmet shell 30. The bottom of cap 31 is preferably stitched or otherwise secured to the inside of helmet shell 30.

Cap 41 is centered within helmet shell 40 as shown in FIGS. 7 and 8 by another preferred spring strap arrangement. Cap 41 is formed of crossed bands intersecting to form the apexes of triangles arranged in hex-

agonal groups over the wearer's head. Some of the straps extend tangentially in tension from cap 41 to the interior of shell 40 to center cap 41 within shell 40. For example, bands 42 and 43 extend tangentially outward in extension straps joining in a connector tab 44 secured to the inside of helmet shell 40. Similarly, bands 45 and 46 extend tangentially outward from cap 41 to form spring straps joining in connector tab 47 secured to the inside of shell 40. Also, a longitudinal, fore and aft band 48 extends tangentially outward in tension at the front and back of cap 41 to terminate in connector tabs 49 secured to the inside of shell 40.

Around the equatorial region of cap 41, fore and aft straps 51 and 52 pass over and are secured to cap 41 along the equatorial head band region to extend tangentially forward and backward to respective terminations 53 and 54 secured to the inside of shell 40. In addition, a pair of lateral spring straps 55 and 56 pass respectively across the front and rear regions of cap 41 and terminate respectively in connector tabs 57 and 58 secured to shell 40.

FIGS. 9 and 10 show another preferred way of making a helmet cap according to the invention. An inner layer of material 70 is formed to fit the head closely, and an outer layer of material 71 has embossed ridges 72 arranged in patterns forming bands that pass over the cap and intersect at many points to form triangles arranged in hexagonal groups. Ridges 72 are secured to inner layer 70 such as by stitching 73 along the band lines. Layers 70 and 71 can be formed of leather, a strong fabric material, or a molded plastic material, and adhesion or some bonding other than stitching can be used to join layers 70 and 71 together along the band lines. The interband spaces between ridges 72 are filled with a padding material 74 in triangular shapes to fill the space between layers 71 and 72 and form a generally padded cap.

Since the inventive cap fits closely and firmly over the head of the wearer and since it is securely anchored within a helmet shell around the bottom of the cap and at the zenith of the cap, it prevents sideways twisting, or other movement of the head relative to the helmet shell. This means that if the helmet shell is jarred or moved by a blow, the head within the shell will move substantially in the same path. Most blows directed against helmets are of short stroke so that such motion of the head does no damage. Furthermore, even if the cap is turned on the wearer's head, it still prevents any blow from moving the helmet relative to the cap to a position so that the shell itself can touch the head of the wearer and transmit the blow to a single localized spot on the head. This eliminates any focusing of blows to damage the wearer's head.

Any blow to the inventive helmet is transmitted to the cap by tension in anchoring straps 17 - 19 at the zenith of the cap or in the anchored ends of the cap bands, and such tension is transmitted through connecting bands throughout a wide area of the cap. This means that the force of any blow is diffused widely over the head for maximum comfort and minimum damage.

It will thus be seen that the inventive helmet accomplishes its above stated objects in both securely fixing the wearer's head within the helmet shell and distributing any blow on the shell widely over the head of the wearer for maximum protection.

Persons wishing to practice the invention should remember that other embodiments and variations can be

adapted to particular circumstances. Even though one point of view is necessarily chosen in describing and defining the invention, this should not inhibit broader or related embodiments going beyond the semantic orientation of this application but falling within the spirit of the invention. For example, those skilled in the art will appreciate the different materials, shapes, and constructions that can be used for making helmets according to the invention for various purposes.

We claim:

1. In a helmet having a protective outer shell, improved means for maintaining said shell in a substantially uniformly spaced relation over the head of the wearer, said means comprising:

- a. a cap formed of a network of substantially non-stretchable, flexible bands arranged in arcs passing closely over said head;
 - b. said bands crossing each other at a plurality of points to form the legs of triangles arranged in hexagonal groups over said head;
 - c. said bands being fixed relative to each other at said crossing points at the apexes of said triangles;
 - d. said bands being in tension between said apexes of said triangles when said cap is on said head;
 - e. a plurality of substantially non-stretchable straps secured to said cap and extending substantially tangentially in tension from said cap to said shell to support said cap in spaced relation to said shell; and
 - f. means for securing the lower region of said cap to the lower region of said shell.
2. The helmet of claim 1 wherein said bands are tapes fastened together at said apexes of said triangles.
3. The helmet of claim 2 wherein said straps comprise extensions of selected ones of said tapes beyond said apexes to said shell.
4. The helmet of claim 1 wherein a plurality of said straps extend from the zenith region of said cap to said shell.

5. The helmet of claim 1 wherein said bands are formed as embossed lines in a pad of thermoplastic cushioning material extending between said bands.

6. The helmet of claim 1 wherein said bands are formed as a network of tapes, and a padding material is made integral with said tapes and extends between said tapes.

7. The helmet of claim 1 wherein the lower ends of said bands are secured to an anchoring strip fastened to said lower region of said shell.

8. The helmet of claim 1 wherein the lower ends of said bands are secured to an equatorial head band arranged in spaced relation from said shell.

9. The helmet of claim 1 wherein said cap is formed of inner and outer layers secured together to form said bands, and a padding material fills the space between the inter-band regions of said layers.

10. The helmet of claim 1 wherein said straps include a pair of straps passing over said cap and secured to front and back regions of said shell.

11. The helmet of claim 10 wherein said straps include a pair of said straps passing over said cap and secured to opposite side regions of said shell.

12. The helmet of claim 1 wherein said straps comprise extensions of selected ones of said bands beyond said apexes to said shell.

13. The helmet of claim 12 wherein a plurality of said straps extend from the zenith region of said cap to said shell.

14. The helmet of claim 13 wherein said bands are tapes fastened together at said apexes of said triangles.

15. The helmet of claim 13 wherein said bands are formed as embossed lines in a pad of thermoplastic cushioning material extending between said bands.

16. The helmet of claim 13 wherein said cap is formed of inner and outer layers secured together to form said bands and a padding material fills the space between the inter-band regions of said layers.

* * * * *

40

45

50

55

60

65