Jan. 2, 1962 T. ZBIKOWSKI 3,015,103

SAFETY HELMET

Filed May 21, 1959 2 Sheets-Sheet 1

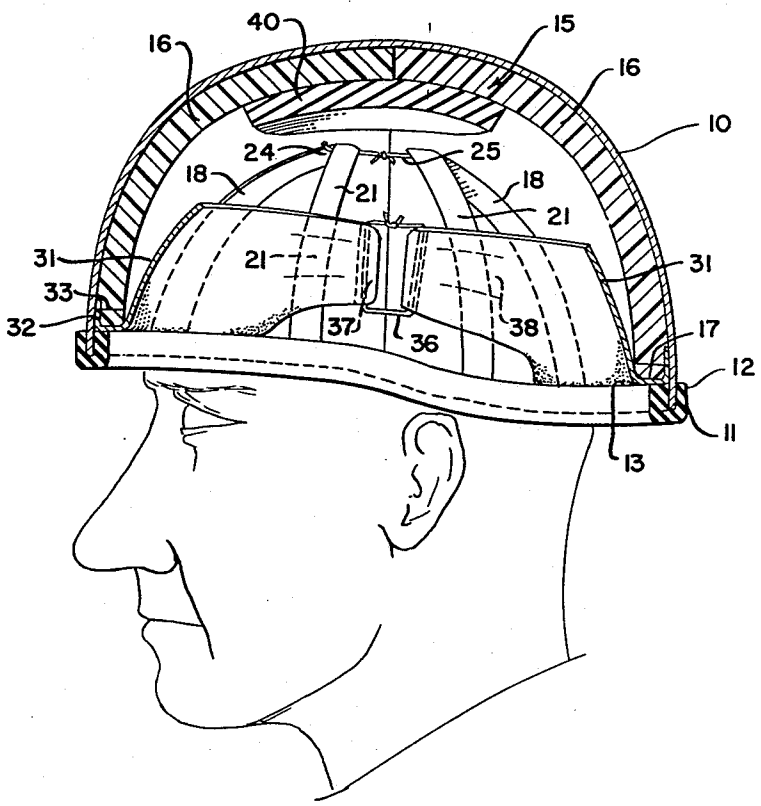


FIG. 1

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SAFETY HELMET

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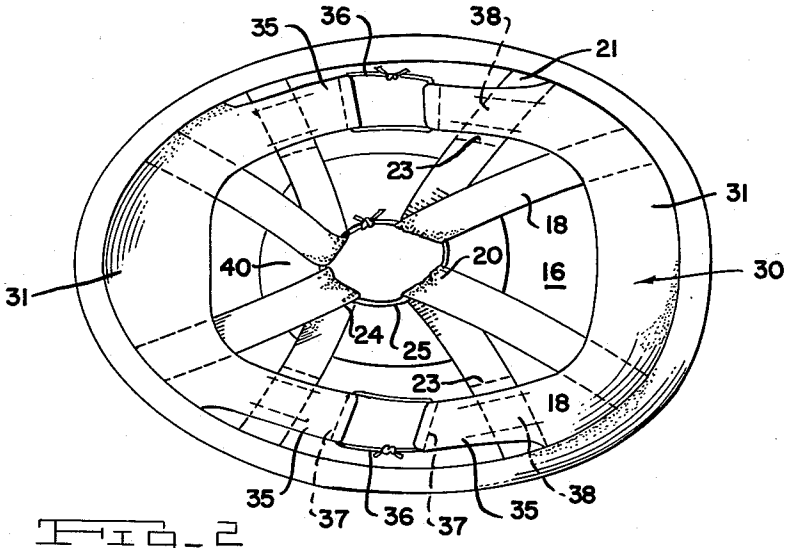


FIG-2

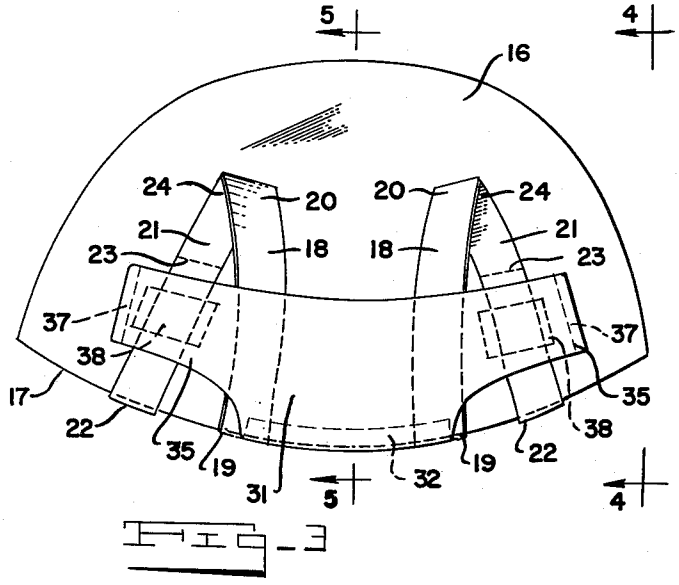


FIG-3

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FIG-4

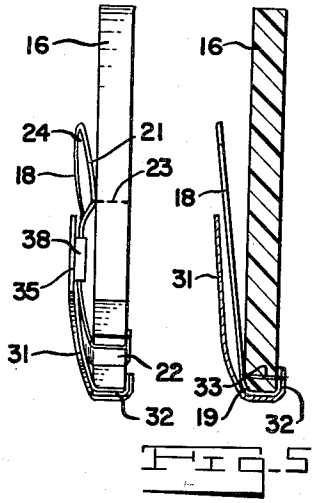


FIG-5

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3,015,103
SAFETY HELMET

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This invention relates to a safety helmet formed to protect the head and skull of a human against injuries due to blows or heavy loads falling thereon.

Safety helmets are widely used by many persons involved in hazardous work where there is a possibility of heavy loads falling on their heads or of the person falling down and striking his head against a hard object such as the ground. For example, safety helmets are commonly used by construction workers, motorcycle riders, etc.

The object of this invention is to form a safety helmet which is provided with an inner lining adapted to tightly wrap around and closely embrace the head of the wearer when the helmet receives a blow.

A further object of this invention is to form a safety helmet having head supporting straps within the helmet, which straps are adapted to translate a load applied to the helmet into a pull on the liner of the helmet to move the liner inwardly of the helmet to closely wrap around the user's head and at the same time to translate part of the load into a force running along the length of the liner, from the bottom of the liner towards the top, wherein the liner functions as a resilient column to absorb the force.

Still a further object of this invention is to provide a helmet liner having head supporting straps and a head band positioned against the head of the wearer, which head band is biased inwardly against the head of the wearer due to a movement of the head supporting straps upon a blow to the helmet, to thus cause the head band to grip or squeeze the entire circumference of the head and to thereby translate the force of the blow more uniformly to the head of the wearer.

It is well recognized, that a sharp blow on one point of the human skull will generally cause far more damage than an equivalent blow evenly applied to the entire skull or to a large section of the skull. Hence, with this head band construction, the entire skull is compressed under a load applied to the helmet. Thus, the skull as a whole reenforces itself against the blow and the force of impact is spread out over a large area of the skull.

These and other objects and advantages of this invention will become apparent upon reading the following description of which the attached drawings form a part.

In these drawings:

FIG. 1 is an elevational cross-sectional view of the helmet worn upon a human head which is drawn schematically.

FIG. 2 is a view looking from the bottom towards the top of the helmet.

FIG. 3 is an elevational view of a section of the helmet liner.

FIGS. 4 and 5 are views taken in the direction of arrows 4—4 and 5—5 of FIG. 3 respectively.

The helmet herein is formed of an outer shell 10 which may be of a rigid, strong, hard material such as a glass fiber reenforced plastic resin. It is formed with a thin wall and is molded to fit the human head with its inner wall spaced a considerable distance from the human head. The particular plastic material used for the shell forms no part of this invention, there being many suitable plastic materials well known in the art and well adapted for this purpose.

The helmet has an open bottom with a continuous bottom edge 11 surrounding the opening. A bead 12 is formed around the bottom edge, the bead being in the

form of a channeled resilient strip which may be formed of rubber or a rubber-like plastic and which fits over the bottom edge of the shell and extends continuously around the entire bottom. The bead extends inwardly of the shell a considerable distance to form a top, continuous ledge 13.

A liner 15 is placed within the shell and completely covers the inside wall of the shell. The liner is formed of two separate sections 16 (see FIG. 3) each having a bottom edge which rests upon the top of the ledge 13.

As shown in FIG. 3, the two liner sections 16 are formed out of a flat, relatively thick sheet of a resilient material, such as sponge rubber, or a foamed polystyrene type of plastic or any other suitable resilient sheet material, and is cut in such a way that when the section is inserted in the helmet, it covers substantially half of the inside of the helmet shell with the opposite section covering the other half. Preferably the liner is completely free of securement to the shell. But, if desired, it may be secured by means of an adhesive or the like near the top of the shell only, so that its bottom edge 17, which rests upon the ledge 13, and a considerable area from the bottom edge towards the top of the liner, when viewed in FIG. 1, is free of securement to the shell.

A group of head supporting straps 18 is provided, with each strap 18 having an outer end secured at 19 to the liner near its edge 17. The securement may be by means of sewn stitches or a suitable adhesive or the like. As shown in FIG. 2, the inner edges 20 of the straps 18 converge towards each other and towards the center and top of the helmet.

A second group of head supporting straps 21 are arranged with their outer edges 22 wrapped around the bottom edge 17 of the liner and secured to the face of the liner which is in engagement with the shell wall. These straps are also secured to the liner inner face at a point 23 intermediate the ends of these straps by means of sewn stitches or the like. The inner ends of these straps also converge towards the center and the top and connected with the inner ends 20 of the straps of the first group. As shown in FIGS. 2 and 3, the first group of straps and the second group of straps may actually be made out of doubled over pieces of strap material so that one inner strap end 20 is integral with the inner end of a strap 21 to form a loop 24. A suitable cord or string 25 passes through all of the loops 24 to thereby tie the respective groups of straps together. The cord being tied together with a knot, it may be adjusted to bring the strap inner ends closer or further apart to better fit the head of the wearer.

A head band, 30, which is formed of two substantially identical parts 31 is arranged with a bottom end portion 32 wrapped around the liner at the front and rear of the helmet and secured to the outer face of the liner, i.e. the face in contact with the inner wall of the shell, by stitches or the like 33 (see FIG. 5). Each of the two parts of the head band have wing portions 35 extending along the sides of the helmet inside of the shell. The two adjacent side portions on each side of the helmet are secured together by means of a suitable cord 36 passing through loops 37 formed on these wing portions (see FIG. 2). The cord may be connected by a knot so that the adjustment of the head band can be made to comfortably fit the circumference of the head of the user.

The head band overlies all of the straps, is free of securement to the shell, and is secured only to the liner at its bottom end portions 32. However, in order to keep the wing portions of the liner in their proper relationship within the shell, it is preferable to provide sewn loops 38 on the face of the head band which faces towards the shell and to loosely pass the straps 21 through these loops

so that the wing portions are free to move a limited distance relative to these straps.

In addition, a top pad 40 is arranged at the top of the helmet against the top of the liner and above the cord 25 to serve as a bumper if the human head travels that far upwardly into the helmet. The bumper pad 40 may be secured to the liner by a suitable adhesive or in the alternative may be loosely placed against the liner.

In operation, after the helmet is assembled with its liner inserted therein, the wearer of the helmet adjusts the cords 36 on the two parts 31 of the head band 30 to fit around his head and also adjusts the cord 25 which passes through the loops 24 of the head supporting straps to properly position the top of his head relative to the helmet. Then he may wear the helmet as he would any other helmet or hat (see FIG. 1).

When the helmet is struck a blow or receives the impact of a load, the helmet moves towards the head to thus move the inner ends of the head supporting straps towards the top of the helmet as viewed in FIG. 1. When this happens, the head supporting straps 18 pulls the bottom edge 17 of the liner inwardly toward the head, and since the liner is not secured to the shell for at least a considerable distance toward the top, a considerable portion of the liner is pulled inwardly around the head.

The other group of straps 21 because they are connected at their intermediate point 23 to the liner, exert a force upon the liner which runs substantially parallel to the face of the liner so that the liner functions as a resilient column or spring to absorb part of the force. Thus, the liner tends to compress from its bottom edge 17 towards its top under the pull of the straps 21.

Likewise, the inward movement of the bottom edge 17 of the liner and the inward bias of the straps 18 cause the head band parts 31 to pivot inwardly around their connection to the bottom edge 17 of the liner and to tightly embrace the head of the wearer in a band encircling the head to thus translate any impact into a uniform load upon the circumference of the head.

If the load is sufficient, the head may travel upwards into the helmet is sufficient distance to strike the bumper pad 40 which also absorbs part of the load. Thus, as can be seen, an impact or load applied to the helmet causes the liner to collapse inwardly around the head, the head band to tightly embrace the head and translate the load into a uniform circumferential squeeze, and part of the force is absorbed by the resilient collapsing of the liner from its bottom edge 17 toward its top wherein it acts as a spring.

With this construction, the helmet is capable of absorbing tremendous loads without injuring the head and will protect the head against blows which would normally crush it.

This invention may be further developed within the scope of the following attached claims. Accordingly, it is desired that the foregoing description be read as being merely illustrative of an operative embodiment of this invention and not in a strictly limiting sense.

I now claim:

1. A safety helmet comprising a thin wall outer shell formed of a hard, rigid material and being shaped to fit over the human head with its wall a distance from the head, and being open at its bottom; a liner, formed of a relatively thick sheet of resilient material, covering and being in face to face contact with the inside wall of the shell and having a continuous bottom edge; the area of the liner which extends from its bottom edge for a substantial distance towards the top of the shell being substantially free of securement to the shell so that it is inwardly moveable, under an applied force, away from contact with the inside wall of the shell and towards the center of the shell; a plurality of head supporting straps, each strap having an outer end secured to the liner at the bottom edge of the liner, with the outer ends of the straps being spaced from one another about the liner bottom edge, and each strap having an inner end, with all of the inner ends converging together and means securing said inner ends together at a location which is near the top of the helmet, but spaced below the liner at the top of the helmet; selected straps being secured to the liner at a point intermediate to their ends, the remainder of the straps being free of securement to the liner, except at their outer ends; a head band formed in two parts, namely, a front part and a rear part, each of the parts having a bottom edge wrapped around and secured to the bottom edge of the liner at the front and rear of the helmet respectively; each part having end portions extending around the sides of the helmet, with the two end portions on each side being adjustably secured to each other, said headband parts loosely overlying the liner and all of the straps, whereby when the inner ends of the straps move towards the top of the helmet under load, they bias the headband to pivot inwardly about its bottom edge to closely and tightly embrace the head of the wearer of the helmet.

2. A safety helmet comprising a thin wall, outer shell formed of a hard, rigid material, and being shaped to fit over the human head with its wall a considerable distance from the head, and being open at its bottom and having a continuous bottom edge, a bottom edge bead extending inwardly of the helmet and secured to the shell, to form a continuous ledge adjacent to said bottom edge inwardly of the shell, a liner formed of a relatively thick sheet of resilient material, said liner covering and being in face to face contact with the inside wall of the shell and having a bottom edge rested upon said ledge; a plurality of head supporting straps, each strap having an outer end secured to the liner at the bottom edge of the liner with said outer ends being spaced from one another about the liner bottom edge and each strap having an inner end, with all of the inner ends converging together and means securing the inner ends together at a location spaced below the liner at the top of the helmet; selected straps each being secured to the liner at a point intermediate to its ends, the remaining straps being free of securement to the liner, except at their outer ends; whereby a load applied to the helmet urges the inner ends of all of the straps towards the top of the helmet to thereby urge said selected straps to apply a force to the liner in a direction from its bottom edge towards its top whereby the liner forms a long narrow, resilient column to resist said force and to urge the remaining straps to pull the liner bottom edge inwardly away from the shell and towards the head wearing the helmet, to thereby closely envelop the sides of the head; and a headband formed in two parts, namely, a front part and a rear part, with each of the parts having a bottom edge secured to the bottom edge of the liner at the front and at the rear of the helmet respectively, each part having end portions which extend around the sides of the helmet with the two end portions on each side of the helmet being adjustably secured to each other, said headband parts loosely overlapping the liner and all of the straps, whereby when the inner ends of the straps move towards the top of the helmet, they bias the headband parts to pivot inwardly above their connections to the liner to closely and tightly embrace the head of the wearer of the helmet.

3. A safety helmet comprising a thin wall, outer shell formed of a hard, rigid material and being shaped to fit over the human head with its wall a distance from the head, and being open at its bottom and having a continuous bottom edge to surround the head; a liner, formed of a relatively thick sheet of resilient material, covering and normally being in face to face contact with the entire inside wall of the shell from the top thereof to its bottom edge, with the liner having a bottom edge adjacent to said shell bottom edge, the bottom edge of the liner and the area of the liner which extends from the bottom edge for a substantial distance towards the top of the shell being substantially free of connection to the shell so that it is inwardly moveable, under an applied force, away

from contact with the inside wall of the shell and towards the center of the shell; a plurality of narrow, head supporting straps arranged inwardly of the liner, each strap having one of its ends secured to the liner at the bottom edge of the liner and spaced from the other straps about the liner bottom edge; means securing opposite ends of all of the straps together below the liner at the top of the helmet, and selected straps being also fastened to the liner at a point intermediate their respective ends, whereby movement of said opposite ends of these selected straps towards the top of the helmet applies a force to the liner in a direction from its bottom edge towards its top whereby the liner forms a long, resiliently compressible column to resist such force, the remaining straps being free of securement to the liner except at their said one ends, wherein movement of said opposite ends of the remaining straps towards the top of the helmet, applies a force to the liner bottom edge tending to pull it inwardly towards a head wearing the helmet for closely enveloping the head.

4. A safety helmet comprising a thin wall, outer shell formed of a hard, rigid material and being shaped to fit over the human head with its wall a distance from the head, and being open at its bottom; a liner, formed of a relatively thick sheet of resilient material, covering and normally being in full face to face contact with the inside wall of the shell, with the liner having a bottom edge; a plurality of narrow, head supporting straps arranged inwardly of the liner, each strap having an outer end secured to the liner at the bottom edge of the liner, said outer ends being spaced from one another about the liner bottom edge, and each strap having an inner end, and means securing all of the inner ends together below the liner at the top of the helmet; each alternate strap being secured to the liner at a point intermediate its opposite ends, the remaining straps being otherwise free of securement to the liner, whereby when the inner ends of the straps are biased towards the top of the helmet under an applied load, each alternate strap applies a force to the liner in a direction from its bottom edge towards its top so that the liner forms a long, resiliently compressible column to resist such force, and each other strap urges the liner bottom edge inwardly for closely enveloping the head.

5. A safety helmet comprising a thin wall, outer shell formed of a hard, rigid material and being shaped to fit over the human head with each wall a distance from the head, and being open at its bottom; a liner, formed of a relatively thick sheet of resilient material, covering and normally being in face to face contact with the inside wall of the shell, with the liner having a bottom edge, the bottom edge and the area of the liner which extends from the bottom edge for a substantial distance towards the top of the shell being substantially free of securement to the shell so that it is inwardly moveable, under an applied force, away from contact with the inside wall of the shell and towards the center of the shell; a plurality of head supporting straps arranged inwardly of the liner, each strap having an outer end secured to the liner at the bottom edge of the liner and spaced apart from the other outer ends, the straps being otherwise free of securement to the liner; each strap having an inner end, with all of the inner ends converging and means for securing the inner ends together; and a frusto-conical shaped, flexible headband loosely overlying all of said straps and formed of a height corresponding to the height of a forehead for completely surrounding and engaging the head in a circumferential band of a vertical height approximately equal to the height of the forehead and having a bottom edge secured to the liner bottom edge at the front and at the rear of the helmet to form a horizontal hinge connection to the liner, the headband thus being pivotal inwardly about its bottom edge hinge connection relative to the liner, whereby, when the inner ends of the straps move towards the top of the helmet under load, they bias the headband to pivot inwardly about its bottom edge to closely and tightly embrace the head of the wearer of the helmet.

6. A safety helmet comprising a thin wall, outer shell formed of a hard, rigid material and being shaped to fit over the human head with its wall a distance from the head, and being open at its bottom; a liner formed of a relatively thick sheet of resilient material, covering and normally being in face to face contact with the inside wall of the shell, with the liner having a bottom edge, the bottom edge and the area of the liner which extends from the bottom edge for a substantial distance towards the top of the shell being substantially free of securement to the shell so that it is inwardly moveable, under an applied force, away from contact with the inside wall of the shell and towards the center of the shell; a plurality of head supporting straps arranged inwardly of the liner, each strap having an outer end secured to the liner at the bottom edge of the liner and spaced apart from the other outer ends, each strap having an inner end, with all of the inner ends converging and means for securing all the inner ends together; and a flexible headband loosely overlying all of said straps and formed for surrounding and engaging the head in a circumferential band of considerable vertical height and having a bottom edge secured to the liner bottom edge at the front and at the rear of the helmet to form a horizontally arranged hinge connection to the liner, the headband thus being free to pivot inwardly about its bottom edge hinge connections relative to the liner; and selected straps being secured to the liner at a point intermediate their opposite ends, the remaining straps being free of securement to the liner except at their outer ends, whereby, when the inner ends of the straps move towards the top of the helmet under load, they bias the headband to pivot inwardly about its bottom edge to closely and tightly embrace the head of the wearer of the helmet.

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