March 19, 1957 E. STROHM 2,785,404

PROTECTIVE HELMET

Filed March 5, 1954 2 Sheets-Sheet 1

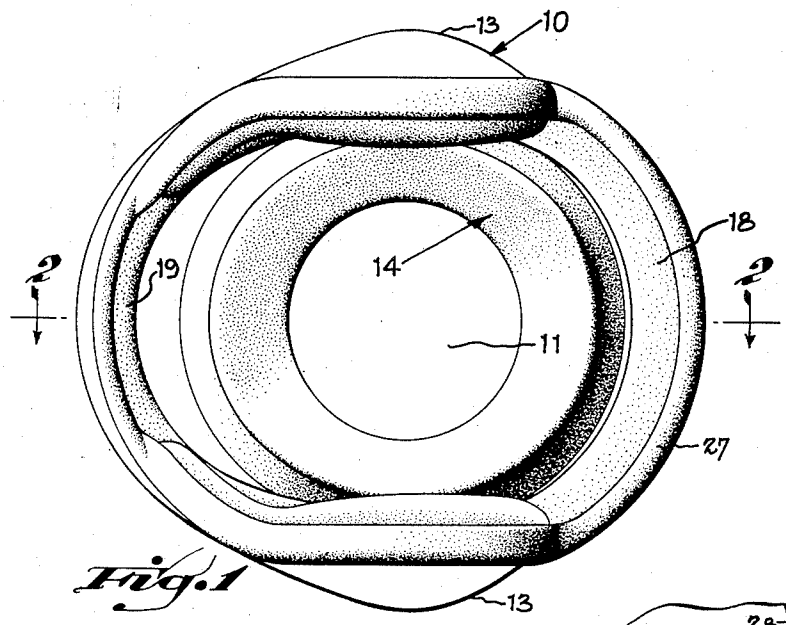


Fig. 1

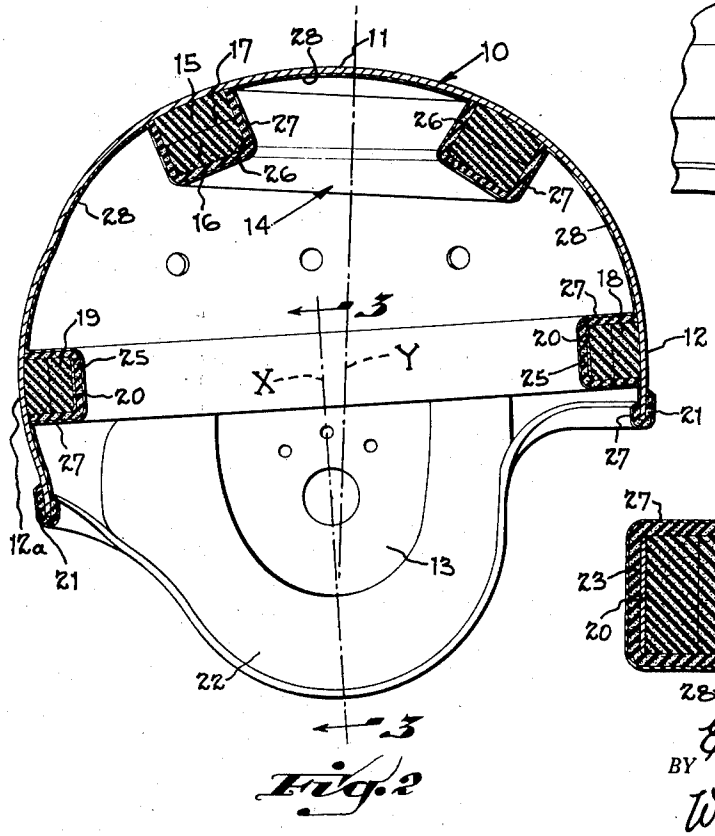


Fig. 2

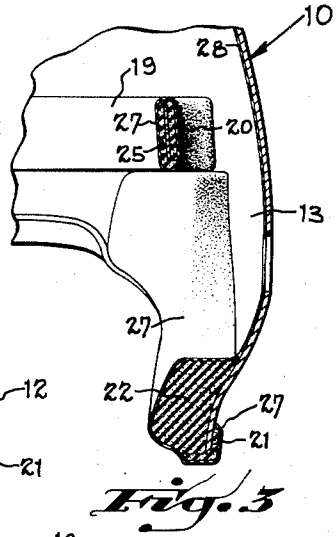


Fig. 3

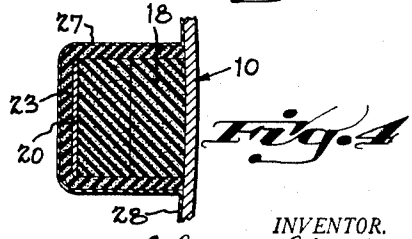


Fig. 4

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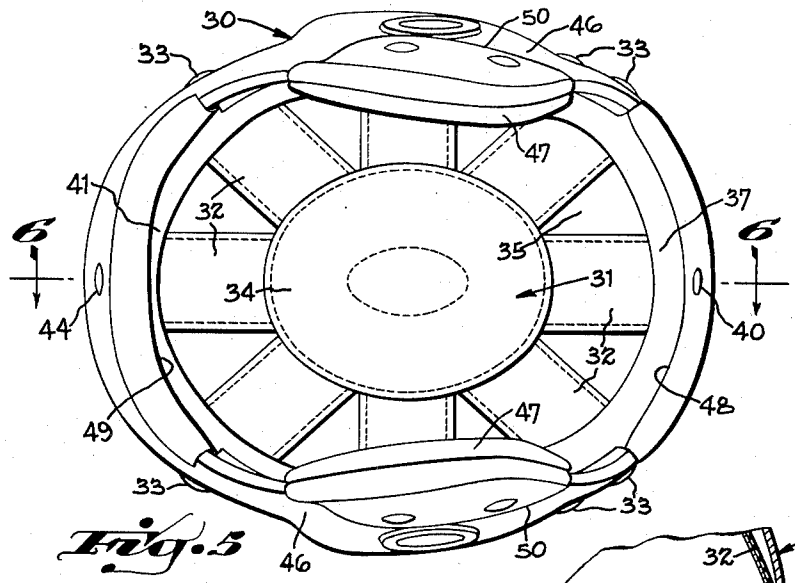


Fig. 5

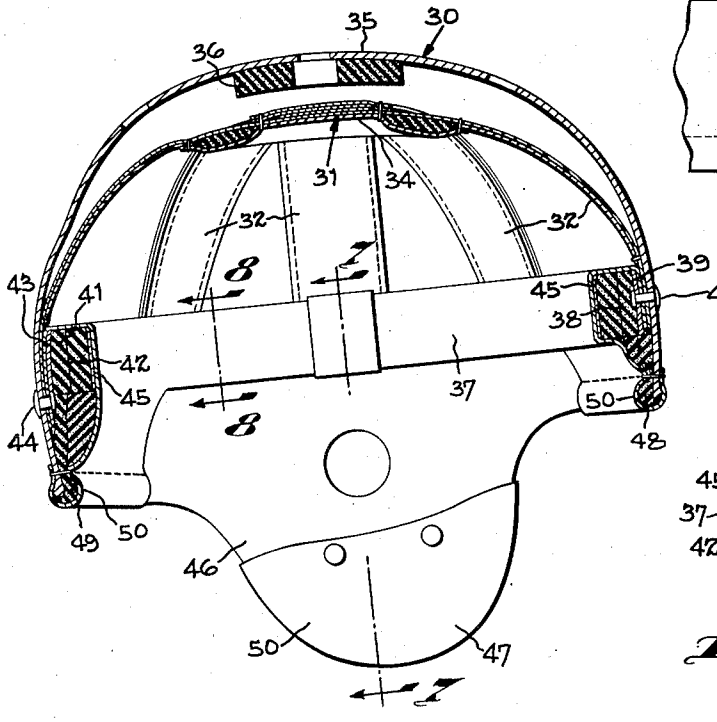


Fig. 6

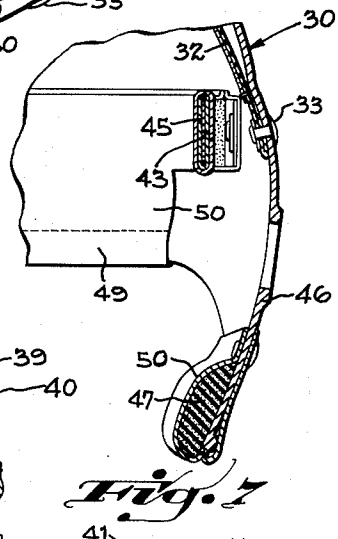


Fig. 7

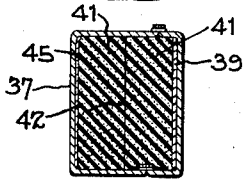


Fig. 8

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PROTECTIVE HELMET

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Application March 5, 1954, Serial No. 414,255

3 Claims. (Cl. 2—3)

This invention relates to protective helmets of the general type which are used as football helmets or crash helmets. The primary objective of the present invention is to provide a protective helmet wherein the protection afforded to the wearer is substantially increased without corresponding increase in the weight or the bulk of the helmet. A secondary objective of the invention is to provide improved cushioning means, and a third objective is to provide a more sanitary helmet.

The drawings disclose the embodiment of the several inventive features in two helmets of slightly different constructions. The helmet disclosed in Figures 1 through 4 inclusive is a sanitary, protective helmet which departs radically from conventional helmet construction. The helmet disclosed in Figures 5 through 8 inclusive is a helmet wherein a number of the features of the first-mentioned sanitary helmet is incorporated in a helmet structure which is otherwise of the more conventional type.

The padding feature of both helmets involves a front rim pad and a back rim pad connected together by a non-elastic strip of glass fibers, such as a strip of woven glass cloth, so that compression on the front pad tends to produce tension on the back pad and vice versa. The connection of woven fiber glass is completely inelastic so that a blow, whether front or back, is absorbed by both pads rather than just one. Thus, extra protection is afforded the wearer without increasing the bulk of the helmet or its stability on the head of the wearer, which merely increasing the thickness of the padding would involve.

More specifically, the helmet of this invention comprises the conventional plastic shell having the conventional ear guards and chin strap, plastic foam padding about the rim of the helmet in front of the ear guards, padding about the rim portion of the helmet behind the ear guards, the padding so attached to the shell that the two tend to move in unison, regardless of whether the shell is pushed or the padding is pulled. The strips of fiber glass which connect the front and back pads are secured to the inside surfaces of the pads so that compression of one plastic foam pad causes stretching of the other plastic foam pad.

In the past it has been conventional to make football helmets in a limited number of sizes and to utilize lacing under the ear guards to adjust the helmet to fit the head of the wearer. The helmets of the present invention, on the contrary, must be made in a substantial number of exact sizes, like men's hats, because the bands of inflexible glass fixed to the inside surfaces of the pads preclude the possibility of any substantial adjustment of the helmet size. While loose supplemental pads may be used to reduce effective size and make minor adjustments which are often necessary to compensate for variations in head shapes, accurate fit is the desideratum.

As disclosed in the helmet of Figures 1 through 4 inclusive, the band of woven glass goes all of the way around the helmet, thereby encompassing the head of

the wearer in an inelastic band. In the helmet of Figures 5 through 8 inclusive, the woven glass bands do not extend around the entire rim of the helmet but merely bridge the gaps between the front and back pads at each side and extend sufficiently beyond the gaps to obtain secure anchorage to the pads.

The padding which is used for the front and back rim pads is novel, at least for helmets of the type under discussion. The padding consists of layers of vinyl resin foam of a composition which provides less resiliency than foam rubber. The air pockets in the vinyl foam are very minute and the pads are rather stiff and slow on the rebound. The virtue of pads of this type is that they tend to act somewhat as beams and to distribute the impact of a blow from the local area of impact over a greater area. In other words, the blow is not only cushioned, but its force is dissipated by the distribution effected by the beam like pads.

The theory behind the present invention is that it is better practice to construct safety helmets to protect the life of the wearer from the effects of blows which might be of fatal magnitude than to construct the helmet to provide minimum discomfort from the impact of minor blows. In other words, a helmet provided with soft flexible padding may be more comfortable to the wearer when subjected to blows which might be painful but not dangerous. The same helmet, however, might fail its primary purpose if subjected to a blow of skull-fracturing magnitude. The helmet of the present invention is constructed on the theory that the wearer should be provided with maximum protection against the incipiently dangerous blows, even at the expense of lesser comfort in respect to the minor blows.

The sanitary helmet of Figures 1 through 4, inclusive, is devoid of metallic fastening or attaching elements, except for the chin strap clip and is also devoid of cloth, leather and other fabric material conventional to helmet construction. The vinyl foam padding is cemented directly to the shell and is coated with a vinyl finish which is impervious to moisture and perspiration. In the helmet disclosed in Figures 5 through 8 inclusive, the customary metal fasteners, cloth and leather strap suspension and leather pad coverings are utilized. The advantages of the structure of Figures 1 through 4 inclusive are that the helmet is more durable and also more sanitary. This helmet does not become perspiration soaked and may be cleaned by washing with soap and and water without shrinkage, embrittlement or other adverse effects.

In the drawing, Figure 1 is a plan view looking down on the inside of the sanitary protective helmet. Figure 2 is a sectional view taken on line 2—2 of Figure 1. Figure 3 is a sectional view taken on line 3—3 of Figure 2. Figure 4 is an enlarged sectional view of the rim pad and helmet shell. Figure 5 is a plan view looking down on the inside of the protective helmet with the conventional strap suspension. Figure 6 is a sectional view taken on line 6—6 of Figure 5. Figure 7 is a sectional view taken on line 7—7 of Figure 6. Figure 8 is a sectional view taken on line 8—8 of Figure 6.

In Figures 1 through 4 inclusive, a flexible plastic shell 10 is disclosed. While the shell is integral it may be more conveniently described by designating the top as a dome portion 11, portions extending somewhat above the rim, front and back, as rim portions 12 and 12a and depending outwardly flaring ear guards 13. Mounted within the dome portion of the helmet and adapted to rest upon the top of the head of the wearer is a circular or annular or doughnut-shaped pad 14. This dome pad is constituted by two circular, originally flat pieces of vinyl foam 15 and 16, cemented together as at 17. A downward blow on the top of the helmet is distributed by the dome pad over a substantial area of the top of the head

of the wearer and greater cushioning effect is provided than by the strap insert of the helmet disclosed in Figures 5 through 8 inclusive. Further, the dome padding cooperates with the rim padding in absorbing blows which are intermediate horizontal and vertical.

The rim padding includes a front pad **18** and a rear pad **19**, each of which is disposed somewhat above the actual rim of the helmet and extends arcuately about the helmet. The pads themselves are not joined together directly but each extends to the vicinity of the ear guards. Each pad is cemented directly to the helmet shell over its entire extent, as distinguished from merely being attached in spots. A band **20** of woven fiber glass is cemented to the inner faces of these pads and extend over the gaps between the pads which are occasioned by the flaring ear guards. In the helmet being described, a single band extends all the way around the inside of the rim padding with the ends joined at the center of the back pad, but two bands, one over each ear guard area, may be used if desired. The woven glass cloth may be, and preferably is, coated on each side with a plastic, such as natural or synthetic rubber, for instance, neoprene.

The one or more inelastic fiber glass bands, in combination with the front and rear pads to which they are cemented, constitute an inelastic annulus about the head of the wearer, the shock absorbing pads being disposed between the inelastic band and the helmet shell and being cemented to each whereby the shock of a blow at any point is dissipated over a substantial area of the wearer's head and is virtually absorbed by the helmet padding and shell as a whole, rather than by a local area thereof.

It is to be observed in Figure 3 that the upper and lower edges of the rim pads and glass bands are bounded by the same planes and that the axis, an extension of section line 3—3, marked X, of the rim padding, considered as an annulus, is angulated in respect to the axis marked Y, of the dome pad, considered as an annulus. The said axes meet to form an acute angle which faces forwardly. While the dome pad may be ineffective to cushion an absolutely horizontal blow and the rim pads to cushion an absolutely vertical blow, the two annular pads cooperate to cushion blows of intermediate angularity and also to position or moor the helmet firmly on the head of the wearer.

The dome pad and the rim pads are relatively stiff. Together, and with the glass cloth connecting the individual rim pads, they tend to reinforce the helmet shell in addition to absorbing the shock of impacts. These pads are fabricated from vinyl sponge or foam, which is sometimes called plastisol foam. They are preferably fabricated from polyvinyl chloride foam having a closed or unicellular structure and a density of 5 to 7 pounds per cubic foot. The cellular structure is very fine to provide optimum impact absorption and slow recovery or rebound after deformation.

A helmet provided only with the dome pad and connected rim pads, which have been described, would be relatively uncomfortable upon the head of the wearer because the shock absorbing pads themselves and particularly the glass cloth lined rim pads are relatively harsh to the touch. On this account the helmet is provided with supplemental padding or cushioning to make it more comfortable to the wearer. The entire rim proper of the helmet is covered with a thin protective layer of vinyl foam **21** and the ear guards are padded with vinyl foam cushioning **22**. These two elements **21** and **22** are preferably considerably softer than the main protective pads.

Inasmuch as the inwardly facing surface of the rim pads are connected by and covered by strips of glass cloth which are substantially as wide as the pads, appropriate cushioning is provided between the glass cloth and the wearer's head. The rim pads are therefore preferably covered with relatively soft vinyl foam cushioning **23**. As disclosed, this cushioning is disposed not only on the inner faces but on the top and bottom sides of the pads so

that the edges of the glass cloth are covered and the rim pads have a soft smooth exterior.

These rim pads are further strengthened and integrated by the perspiration resistant vinyl coating which is applied to their exterior surfaces. This construction is particularly illustrated in Figure 4. Preferably this vinyl covering is also wrapped around the strips of glass cloth which connect the front and rear rim pads as at **25** in order to provide some cushioning between the wearer's head and the surrounding band of glass cloth over its entire extent. Similar cushioning **26** may also be applied to the dome pad **14**, but the added comfort is of less importance in respect to the dome pad, so this cushioning may be omitted if desired.

From the point of view of the wearer of the helmet, the sanitary feature of the helmet of Figures 1 through 4 inclusive is of primary importance. If a helmet is fabricated in part from leather, cloth and other conventional fabrics which are moisture and perspiration absorbent, a certain amount of odor is bound to develop. Also, perspiration tends to rot, deteriorate or stiffen most fabric materials such as cloth or leather. The helmet of Figures 1 through 4 inclusive, is rendered moisture and perspiration resistant or proof by utilizing no padding or cushioning in the helmet, other than the vinyl foam cushioning or padding described, and coating all exposed surfaces of the vinyl foam with a finish or a lacquer or varnish constituted by a vinyl resin dissolved in volatile solvent whereby the coating or finish **27** becomes the permanent continuous outer surface of the padding and cushions.

The coating composition may be constituted by a 25–40% vinyl resin, such as a vinyl chloride, vinyl acetate copolymer, which may be plasticized with dioctyl phthalate and dissolved in one or more solvents such as methyl ethyl ketone, methyl isobutyl ketone and toluene.

An additional improvement which characterizes the helmet of Figures 1 through 4 inclusive, is that the inside of the shell of the helmet is treated to alter its acoustic properties. This is accomplished by coating the exposed portions of the inside of the helmet shell as at **28** with a vinyl lacquer or varnish in which cotton fibers or other noise deadening fibers are incorporated.

The helmet of Figures 1 through 4 inclusive, as illustrated in the drawing and as described above, constitutes the preferred embodiment of this invention. While the preferred padding is the vinyl polymer foam disclosed, it is to be understood that plastic foams generally, including other resin foams, foam rubber and mixtures of rubber and vinyl resin or other resins in the form of a foam or sponge may be used in place of the preferred padding herein disclosed. In fact, any type of foam or sponge padding may be used if it has the capacity to absorb the shock of blows and the capacity to withstand tension. If hair padding or the like were used in a helmet of this construction, then a blow on the front of the helmet would tend to pull the rear rim pad apart and the hair padding would offer little resistance and therefore be of little value in absorbing the shock of the blow. Further, such padding would soon disintegrate in use. The plastic foam or sponge type padding, on the other hand, tends both to absorb blows and to resist stretching. It is this type of padding which is adapted to be used in the helmets of this invention.

The novel rim padding of this invention may also be used in helmets which are otherwise of construction more conventional than that of the helmet disclosed in Figures 1 through 4 inclusive. In the helmet disclosed in Figures 5 through 8 inclusive, a plastic shell **30** is provided with the conventional strap suspension **31** for holding the helmet on the head of the wearer. The lower ends of the individual straps **32** are secured to the helmet shell by rivets 33. The upper ends of the straps are attached to a central crownpiece **34**. Between the crownpiece and the dome **35** of the helmet, a plastic cushion **36** is cemented. This cushion may be vinyl foam and serves

the purpose of providing protection for the head of the wearer in case the dome of the helmet is flexed too violently.

The helmet is provided with a front rim pad **37** constituted by two layers of plastic foam (preferably vinyl resin foam) cemented together as at **38**. The pad is cemented to a fiber strip **39** which is secured to the helmet in the front center by rivet **40** which attaches one of the suspension strips and by at least two supplemental rivets, one on each side (not shown in the drawing). A rear rim pad if like structure is provided and is constituted by two layers of vinyl resin foam **41** cemented together as at **42**. The pad is cemented to a fiber strip backing **43** which is attached to the shell by back center rivet **44** and supplemental side rivets (not shown) to the rear portion of the helmet shell.

In this construction, the front rim pad and the back rim pad are secured together by means of strips or bands of glass cloth **45** which extend over the gaps between the front rim pad and the rear rim pad in the region of the ear guards **46**. These strips of glass cloth are cemented to the inner faces of the front and rear rim pads but need not necessarily encircle the entire head of the wearer, i. e. the glass cloth need be cemented to the rim pads only for a sufficient distance to provide a good grip.

In contrast to the helmet of Figures 1 through 4 inclusive, the helmet of Figures 5 through 8 inclusive does not have the rim pads cemented directly to the helmet shell but to reinforcing fiber strips which are riveted to the helmet shell at a plurality of points. This construction is less effective than the preferred construction but still accomplishes the result of imparting some of the force of a blow on the front of the helmet to the rear rim pad and the rear portion of the helmet shell.

This second type of helmet is also provided with ear guard pads **47**, supplemental front edge padding **48** and supplemental rear edge padding **49**. All of the padding is covered with leather **50**, including the glass cloth bands which connect the front and rear rim pads. In fact, the helmet of Figures 5 through 8 inclusive, is conventional in construction except for the front and rear rim pads and their connection by bands of inelastic woven glass cloth and the utilization of the slow rebound vinyl foam as the preferred material for the front and rear rim pads.

Both helmets utilize the conventional chin strap (not shown) and the conventional clips for attaching it (not shown). The helmet of Figures 5 through 8 inclusive, has the characteristics of the conventional protective helmets which have been used in the past except that the helmet provides the wearer with better protection against forcible horizontal blows due to the improved rim padding. This improvement is provided by the front and rear pads of plastic foam secured together by means of inelastic bands of woven glass, whereby a blow on any portion of the rim of the helmet is absorbed by the helmet as a whole and dissipated over a larger area of the wearer's head. The protective helmet of Figures 1 through 4 inclusive, on the other hand, not only has the improved rim padding of the helmet of Figures 5 through 8 inclusive, but also has greater stability on the

head of the wearer due to the cooperation of the rim padding and the dome pad, and further, of being impervious to moisture and perspiration, and the capacity to be washed with soap and water.

Having described my invention I claim:

1. A protective helmet comprising a dome-shaped plastic shell with ear guards depending at each side thereof, a resilient plastic foam front rim pad mounted in the shell in front of the ear guards, a resilient plastic foam rear rim pad mounted in the shell in back of the ear guards, the front and rear rim pads being spaced from one another, each of said pads having an inner surface facing the interior of the helmet, and bands of inelastic woven glass cloth connecting the inner surfaces of the front and rear pads and extending over the gaps between them, each of said bands of woven glass cloth extending a substantial distance along the front and rear rim pads, whereby compression on the front rim pad produces tension on the rear rim pad and vice versa.

2. A protective helmet comprising a dome-shaped plastic shell with ear guards depending at each side thereof, a resilient plastic foam front rim pad mounted in the shell in front of the ear guards, a resilient plastic foam rear rim pad mounted in the shell in back of the ear guards, each of said pads having an inner surface facing the interior of the helmet, the front and rear rim pads being separated from one another, and a band of inelastic woven glass cloth connecting the inner surfaces of said rim pads and extending over the gaps between them, said band of woven glass cloth extending along the entire inner surface of the front and rear rim pads, whereby compression of the front rim pad produces tension on the rear rim pad and vice versa.

3. A protective helmet comprising a dome-shaped plastic shell with ear guards, depending at each side thereof, a resilient plastic foam front rim pad mounted in the shell in front of the ear guards, a resilient plastic foam rear rim pad mounted in the shell in back of the ear guards, each of said pads having an inner surface facing the interior of the helmet, the front and rear rim pads being separated from one another, and a band of inelastic woven glass cloth connecting the inner surfaces of said rim pads and extending over the gaps between them, said band woven glass cloth extending along the entire inner surface of the front and rear rim pads, whereby compression of the front rim pad produces tension on the rear rim pad and vice versa and an annular pad mounted in the dome of the shell, said pad being adapted to engage the top of the head of the wearer of the helmet.

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