May 13, 1969 P. MEAD 3,444,288

METHOD FOR PRODUCTION OF A PROTECTIVE HELMET

Filed Aug. 6, 1965 Sheet 1 of 2

FIG. 1.

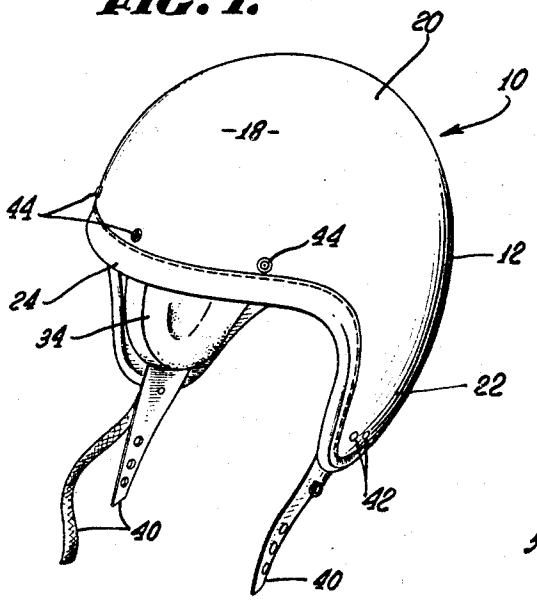
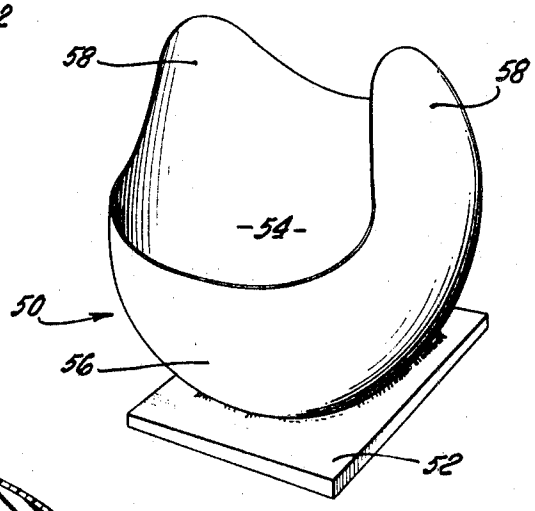


FIG. 3.



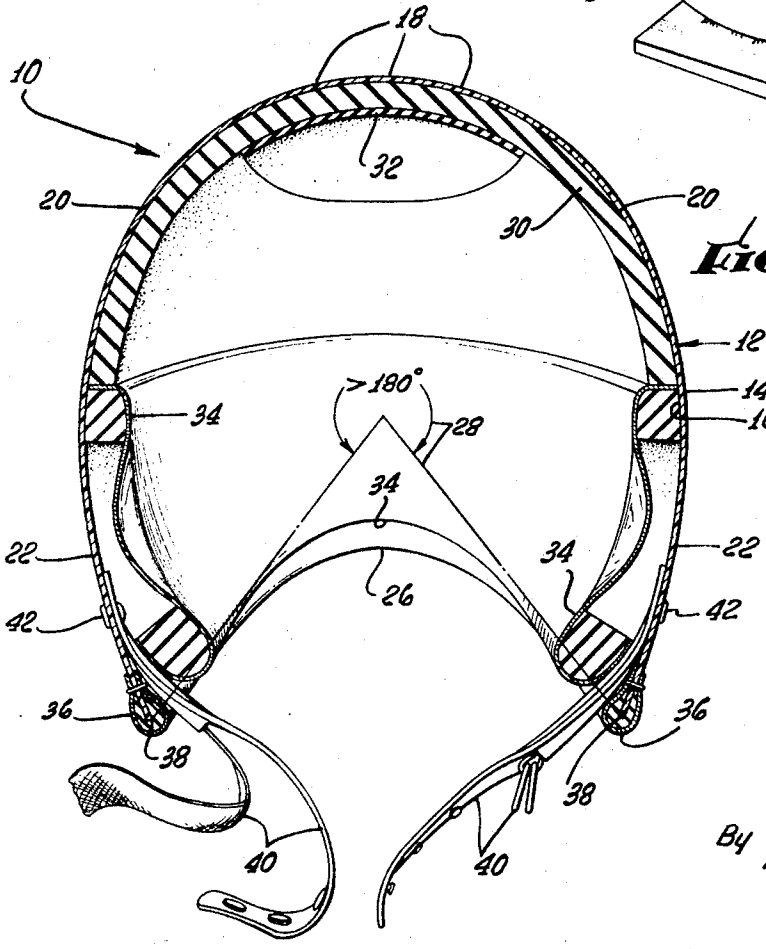


FIG. 2.

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May 13, 1969 P. MEAD 3,444,288

METHOD FOR PRODUCTION OF A PROTECTIVE HELMET

Filed Aug. 6, 1965 Sheet 2 of 2

FIG. 4.

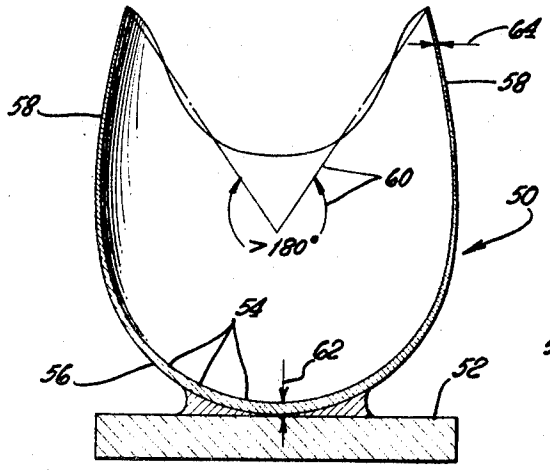


FIG. 5.

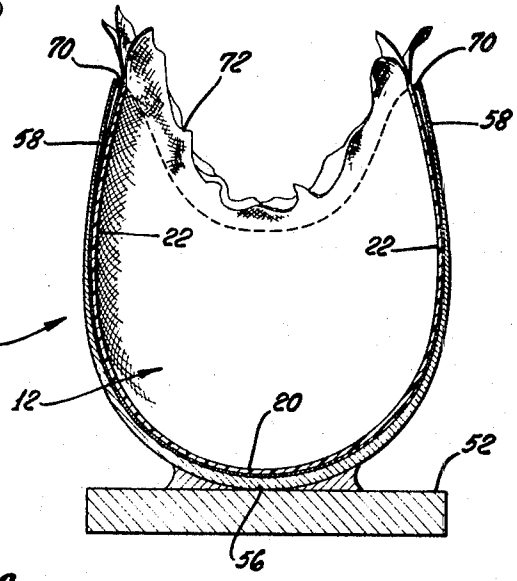


FIG. 7.

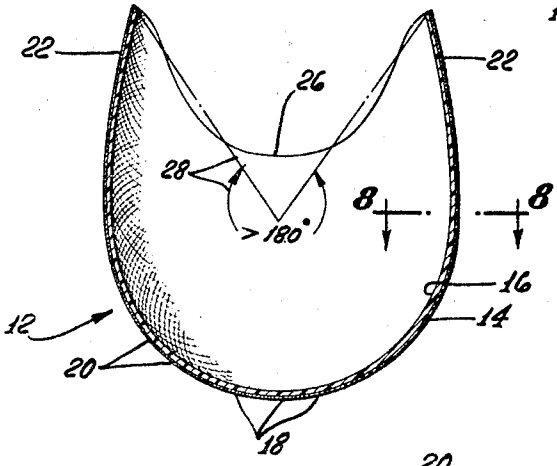


FIG. 8.

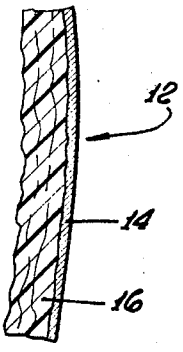
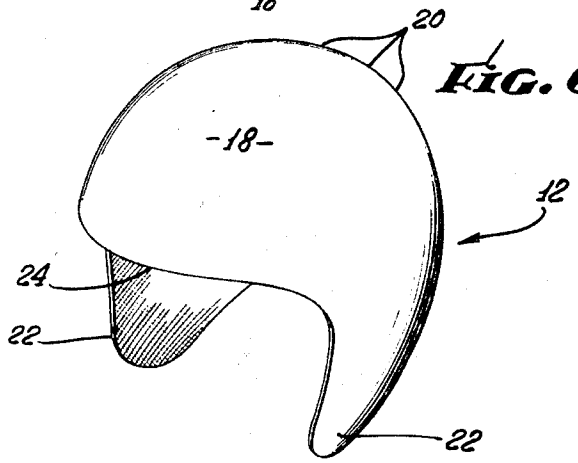


FIG. 6.



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United States Patent Office 3,444,288 Patented May 13, 1969

3,444,288

METHOD FOR PRODUCTION OF A PROTECTIVE HELMET

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Int. Cl. B28b 7/12; B29c 7/00
U.S. Cl. 264—161 6 Claims

ABSTRACT OF THE DISCLOSURE

A method for producing a helmet shell within a one piece mold having a pair of opposed side portions encompassing an area of greater than 180° of the mold configuration includes (1) placing shell materials within the mold to form the shell, (2) curing the materials, (3) separating the shell from the mold by flexing the mold portions and the shell portions as a unit to cause slight separation between the side portions of the mold and the ear portions of the shell, and (4) forcing the shell out of the mold by injecting a substance, such as air, under pressure into the slight separation.

The present invention relates to a helmet and a method for producing the helmet including a one piece mold utilized in the method. In particular, the helmet, the mold, and the method relate to the formation of a helmet having a smooth unmachined exterior surface wherein the extending side portions of the helmet encompass a curved section of the surface which exceeds 180°.

Helmets, as a means for protecting the wearer's head from accidents caused in driving motor vehicles, have been known for many years. Early embodiments of such headgear comprise skin-tight coverings of cloth and leather. Thereafter, hard shells with lining materials were developed as speeds and the likelihood of serious injuries increased. Knowledge of the kinds and degree of injuries plus newly developed materials were employed to obtain safer helmets as well as to impart a pleasing and racy appearance thereto. Such new materials included plastics and Fiberglas which were incorporated into the design of the present crash helmet.

The conventional helmet is formed from an outer shell of rigid reinforced plastic having a colored exterior and at least a single layer of resilient or non-resilient foamed plastic or sponge rubber and/or a heavy web to support the helmet on the head. The outer shell is designed to resist abrasion and to dissipate impact blows without shattering or failing. The inner liners are used to absorb and distribute the impact energy which has been transmitted through the outer shell. In such a way, the likelihood of brain concussions and skull fractures are lessened and possibly obviated. The most common materials used for making the outer shell comprise Fiberglas cloth or matted glass fibers impregnated with a resin and molded under contact of pressure. The materials used for the liner vary considerably and take the form of many configurations. In most cases, these designs and configurations are aimed at protecting the wearer's head and for eye-appeal.

With respect to protection, a helmet's design is partly predicated on its shape. Preferably, the outer shell and the liner are configured to conform generally to the skull in order to maximize distribution and dissipation of any blows struck on the helmet. Consequently, no one portion of the skull and the brain will receive the full force of the impact blow so that concentration of the impact at any particular point of the head will be avoided. In addition, the helmet is shaped to afford maximum protection to as large a portion of the head as is possible commensurate with the ability to put on and remove the helmet from the head. Therefore, it is necessary to provide protection not only for the top of the head but also for the forehead, the base of the skull, the temples, and the ears. On the other hand, the helmet cannot extend too close to the neck at the base of the skull in order to prevent the helmet from causing injuries to the neck and the nerves should the head be snapped rearwardly to cause contact between the helmet and the back of the neck. The ear portions further provide a means by which the noise of onrushing air is not transmitted to the ears. The diminishment of this noise has important considerations since such noise otherwise would fatigue the driver and decrease his effective driving time and distance as well as possibly cause injury to his auditory organs.

The consequences of configuring the helmet to the head is to shape the helmet somewhat in the form of an egg or a modified ellipsoid. In so doing, however, those portions of the helmet which cover the ears must have a curvature, when taken in conjunction with the top or crown portion of the helmet, of more than a 180° curved section. Two problems result from this curved section and exist in present helmets and arise from conventional methods of manufacture.

Current manufacturing methods utilize a two piece mold in order that removal of the helmet shell therefrom may be effected due to the greater than 180° curvature or curved section of the helmet and the mold in which the shell is cast and hardened. The mold comprises two halves having a junction line which extends from the center of the brow to the base of the skull. Clamps, nuts and bolts, or similar securing means are used to hold the halves together during the casting of the shell therein. This mold line is reproduced on the shell as a center line or ridge which must be removed by grinding of buffing. If the shell incorporates Fiberglas cloth, the center ridge may not produce any weaknesses in the shell along the line. However, when Fiberglas mat, i.e., short segments of fibers is used, the ridge may result in a line of weakness in the shell whereby any blow imparted thereto may cause the shell to fail along the line.

In addition, a finished helmet must have a pleasing appearance, which is achieved by coloring and a finished surface. This ridge creates problems with respect to the coloring and the surface. One may buff down the ridge and place a strip of tape or a stripe of paint along the buffed ridge to hide the results of the machining. Instead of using a strip or stripe, the entire shell may be lacquered with a colored paint not only to hide the buff marks but also to impart a color to the helmet. Regardless of whether tape or lacquer is used, both have serious disadvantages. They increase the cost of the helmet to as much as three or four times its sales cost because great care, attention and proper materials are required in order to obtain the proper colored and smooth surfaced result. Also, during normal use the helmet may be struck or scraped to chip or scratch the painted surface whereby the lacquered appearance is ruined, necessitating another expensive reapplication of the lacquer.

Another method utilized to color the shell comprises the application of a pigmented resin to the interior of the two piece mold and then to apply layers of Fiberglas cloth or mat impregnated with the resin thereupon. However, a ridge still results since a two piece mold is still employed. Upon grinding of this ridge, the color in the area of the center line may be completely removed to expose the Fiberglas resin laminate thereunder. Consequently, a lacquering, painting or taping step is still involved.

The present invention overcomes the structural weakness, buffing and color problems while still maintaining the greater than 180° contour required for crash helmets.

As a result, to produce the new helmet, a new method for producing the helmet is utilized which includes the use of a new mold. The essential feature, with respect to the helmet, resides in the obtaining of a smooth unmachined shell surface having a desired color wherein the curvature of the helmet through its crown portion and side or ear portions comprises a curved section greater than 180°.

Preferably, the helmet includes a shell having a smooth unmachined hard exterior surface layer of clear solidified thermosetting resin or gel coat pigmented with a solid or flaked and sparkling color and an inner supporting layer of laminated Fiberglas cloth and thermosetting resin. Any plastic or other suitable substance, however, may be employed in place of the thermosetting resins. A soft foamed plastic, having a slow recovery rate to deformation forces, is disposed on the inner surface of the crown portion, soft beading is secured to the edges of the shell, and straps and soft liner materials for the ear, base of the skull, and brow portions are affixed to the remaining inner portions of the shell. A soft bumper top piece is secured to the foamed plastic.

The new mold comprises a single unit having a smooth inner surface upon which the shell is cast. Consequently, the mold surface incorporates a substantially ellipsoidally configured area having a smooth uninterrupted curvature which encloses a greater than 180° curved segment of the ellipsoid. The side portions of the mold are of sufficient thinness to be flexible. In the preferred embodiment, the mold is formed from nickel having a chromium plated inner surface such that the thickness of the side portions is one half that of the crown portion. If desired, however, other suitable materials may be used. The preference for chromium is derived from its hard durable characteristics and its ability to be polished to a high gloss while permitting removal of the shell from the mold.

To produce the helmet, which is the subject matter of the present invention, the one piece mold is sprayed on its interior with a mixture of clear gel coat and coloring matter comprising a pigment or colored flakes. The gel coat is allowed to harden at room temperature. A mixture of resin and catalyst then is brushed on the gel coat layer, Fiberglas cloth is disposed on the resin-catalyst mixture, more of the mixture is applied, and the process is repeated until the desired thickness of laminate has been attained. Although the resin will produce heat and be self-hardening under the influence of the catalyst under normal room temperatures, heat from an external source is applied to aid the curing of the resin. At this point the shell is formed.

It is removed from the mold first by flexing the side or ear portions of both the mold and the shell in order to procure a slight separation therebetween. Pressurized air is then forced into this separation to separate completely the shell from the mold. Because the curvature of the mold exceeds a 180° curved section, it would be impossible to release the shell therefrom if compressed air or gas were not applied. Excess Fiberglas and catalyzed resin are trimmed from the peripheral edge of the shell and holes are drilled about the edge and through selected points. A soft beading is sewn about the peripheral holes. Snaps are secured in other holes and chin straps are riveted to the appropriate ear portion holes provided therefor. A foamed plastic is secured to the inner surface of the crown portion of the shell, cushioning material is secured to the ear, brow, and base of the skull portions of the shell and a top bumper piece is cemented to the foamed plastic. The result of this process is to form a helmet having an exterior with a smooth unmachined surface devoid of ridges and possible structural weaknesses and imparted with a color and an appearance resistant to chipping and scratching.

It is, therefore, an object of the present invention to provide a helmet having a smooth unmachined shell surface.

Another object of the invention is the provision of such a helmet shell having ear portions which extend greater than 180° about the curved contour of the helmet.

A further object of the invention is to provide a helmet having a colored shell wherein the color thereof is resistant to removal.

Another object of the invention is the provision of a mold for the production of such a helmet shell.

Still a further object of the invention is to provide a single unitary one piece mold having side portions which extend greater than 180° about the inner curvature thereof.

Still another object of the invention is the provision of such a mold wherein the side portions are flexible.

Another object of the invention is the provision of a method for producing such a helmet shell.

Another object of the invention is to provide a method for producing such a helment shell utilizing a one-piece mold.

Another object of the invention is the provision of a method for removing such a helmet shell from such a mold.

Other aims and objects and a more complete understanding of the present invention will appear from the following explanation and the accompanying drawings, in which:

FIG. 1 is a perspective view of the helmet having a smooth unmachined shell surface;

FIG. 2 is a cross sectional view of the helmet taken through the ear or side portions and also illustrating the smooth unmachined shell surface and the greater than 180° curvature thereof;

FIG. 3 is a perspective view of the one-piece mold used in the method for producing the helmet;

FIG. 4 is a cross sectional view of the one-piece mold depicting the greater than 180° curvature and means by which the side portions are made flexible;

FIG. 5 is a cross sectional view of the mold shown in FIG. 4 depicting a shell disposed therein after having been fabricated and a partial separation between the mold and the shell at the ear portions preparatory to removal;

FIG. 6 is a perspective view of the shell after having been removed from the mold and trimmed at the peripheral edge wherein the smooth unmachined exterior surface is shown;

FIG. 7 is a cross-sectional view of the shell taken through the side portions again illustrating the smooth unmachined surface and the greater than 180° curved section; and

FIG. 8 is a partial section of the shell taken along lines 8–8 of FIG. 7.

With reference to FIGS. 1 and 2, a helmet **10** is disclosed as made in accordance with the present invention. It includes a shell 12 having an outer gel coat layer **14** and an inner reinforced layer **16** (see also FIG. 8). As presently conceived, the gel coat layer is formed from a hardened thermosetting plastic such as a styrene unsaturated polyester resin made thixotropic and colored by pigments or colored flakes. It is understood, however, that other materials, such as epoxy resins and nonplastic substances may be utilized so long as the outer layer is hard, smooth and abrasion resistant. If a solid color is desired, an inorganic or organic pigment may be added to the gel coat as is well known in the art. On the other hand, a fully colored flaked or sparkled effect may be obtained by adding a small percentage of precision cut colored and epoxy coated aluminum foil to the resin before the hardening thereof. The latter is preferred since it not only adds to the attractiveness of the helmet, but also provides a safety feature whereby the wearer of the helmet may be easily seen by other drivers. The outer layer comprises a thickness of approximately $^{30}/_{1000}$ inch.

The inner reinforced layer is bonded to the gel coat layer during the manufacturing operation and comprises a laminate of fiberglas cloth and thermosetting plastic. Although other reinforcing materials such as animal, vege-

table, mineral, and synthetic fibers may be used, a fiberglas cloth is preferred since it incorporates the several advantageous features as great strength per unit weight and compatibility with resins. For the same reason, Fiberglas cloth is better suited for the production of helmets over Fiberglas mat which comprises short cut threads of glass fiber. The thermosetting plastic used is a styrene unsaturated polyester resin although it is obvious that other plastics or materials may be used. A peroxide composition is added to the resin as a catalyst.

The shell and helmet are provided with a crown portion **20**, side or ear portions **22**, a brow portion **24**, and a base of the skull portion **26** (see also FIGS. 6 and 7). The helmet and the shell, as best shown in FIGS. 2 and 7, is substantially ellipsoidal in shape wherein the curvature thereof provides a curved section of greater than 180° from ear portion to ear portion as indicated by indicium **28**. Coupled with the fact that the curved section exceeds 180° is the fact that surface **18** is smooth and unmachined, having a pleasing and colored appearance.

The interior of the crown portion is covered by a liner **30** of a soft closed cell sponge of, for example, vinyl, having a slow recovery rate after application of pressure, such as Ensolite (trademark, U.S. Rubber Company). A rubber base cement or other adhesive compatible with the liner and shell materials is employed to secure the two together. A bumper segment **32** of a foamed plastic is cemented to liner **30** by appropriate means. A liner **34** formed from a cloth or leather enclosed plastic is secured by appropriate means to the interior of the shell at the side, brow and base of the skull portions. Both plastics used in segment **32** and liner **34** may comprise a polyester foam. A beading **36** is secured about the peripheral edge **38** by adhesives or stitching to provide a soft terminus for the shell. Chin straps **40** with associated fasteners are securely attached to the ear portions by rivets **42**. Snap fasteners **44** are attached to the shell for securement thereto of a visor or a protective face shield.

The purpose of the hard shell, besides effecting an attractive and uninterrupted curved appearance for the helmet, is to provide a means by which impact blows may be resisted. The liners, in particular liner **30**, function to absorb, dissipate and distribute the force of the impact blows upon the shell. Bumper segment **32** is a further safety feature to provide additional protection to the top of the skull. It is obvious, therefore, that the helmet which forms a part of the present invention incorporates several novel aspects.

FIGS. 3–5 illustrate a mold **50** used for the preparation of shell **12**. A base **52** supports the mold. The mold is provided with a substantially ellipsoidal inner surface **54** having a smooth uninterrupted area. It comprises a crown portion **56** and side portions **58** to produce a curved section of greater than 180° as designated by indicia **60**. The crown portion is generally rigid while the side portions are made flexible as suggested by the respective dimensional thickness arrows **62** and **64**. Although the mold may be prepared from several materials, it is preferred to use a chromium plated nickel mold, the chromium plate forming surface **54**. The use of such metals imparts the desired flexibility and durability to the mold. It is contemplated that the crown portion dimensions at indicia **62** is $\frac{1}{10}$ of an inch while the side portion thickness at indicia **64** is $\frac{1}{20}$ of an inch. These dimensions are set forth only for the purpose of illustration since it is obvious that other thicknesses and other materials will provide flexibility, strength and durability. A chromium plate has been found to be preferred in those cases where it is desired to impart a high gloss to the helmet shell. Such a gloss may be obtained by buffing surface **54** to a high shine which will be transferred to the gel coat layer during the casting operation. It has been found that a nickel surface, although able to be buffed to a high shine, will not allow the shell to be removed from the mold. It has been theorized that the buffing operation closes the nickel pores while a similar buffing operation does not have this effect on chromium. Consequently, it is envisioned that any surface material which is porous would be suitable for the mold.

The first step in making the helmet requires the production of a shell which comprises an outer or surface layer of colored gel coat and an inner laminated layer. The purpose of the gel coat layer is to impart the helmet shell with a smooth unmachined and wear-resistant surface having a desired color. The basic component of the gel coat is a styrene unsaturated polyester resin provided with a thixotroping agent. If desired, however, an epoxy resin or similar thermosetting plastics or other substances may be employed. Such resins used are generally clear or amber colored and a colorant is added in order to impart a pleasing appearance to the finished product. Various organic or inorganic pigments may be used if a solid color is desired. Such pigments are well known in the art and include, among others, organic dyestuffs and inorganic materials such as titanium dioxide for white, carbon black, cadmium yellows, oranges and reds, the iron earths, chrome green, phthalocyanine blue and green, etc.

On the other hand, a flaked or sparkled effect may be desired in which case colored flakes of material are added to the clear gel coat. The present invention uses an aluminum foil which is precision cut to size. Each flake comprises a $\frac{1}{60}$ inch square provided with a blue, green, red, gold, silver, etc., color and coated with an epoxy resin. Approximately 15% flake is mixed with the clear resin to obtain the proper, fully colored, flaked effect.

Since the gel coat resin is relatively thin and smooth flowing before being cured, it will tend to run after being applied to the interior of the mold. Consequently, a thickening or thixotropic agent, which is finely divided particles, is added to clot the resin so that it will not drain from an inclined or even a vertical surface. Known agents include porous granules such as special silicas and bentonite, platelets such as mica, or short fibers as asbestos or chopped glas fiber. The resin composition, as pigmented or flaked and made thixotropic, is so formulated that it may be sprayed against the mold surface and allowed to gel in place. Sufficient material is sprayed into the mold to form an external layer having a thickness of approximately 0.0030 inch. The gel coat is allowed to cure at room temperature, although the curing itself produces temperatures as high as 310° F.

After the outer layer has hardened, a laminate of Fiberglas cloth and resin is applied thereto. The present invention utilizes a styrene unsaturated polyester resin mixed with a peroxide type catalyst to initiate the polymerization through a free radical mechanism. It is contemplated, however, that the other resins, such as the epoxy group and their associated catalysts, or other substances may be used. The Fiberglas cloth is ten ounces per square yard in weight; however, it is obvious that other weights are as effective and may be used as understood by those skilled in the art. It is also possible to use materials other than Fiberglas cloth, such as mat, or chopped strands or staple of animal, vegetable, mineral, and synthetic fibers. Glass fiber, however, is preferred since it confers high tensile, compressive, flexural and impact strength, improves heat resistance, and reduces shrinkage and thermal expansion. Since strength and weight are very important factors in helmets, Fiberglas cloth is highly recommended over Fiberglas mat, which is chopped strands of thread.

The cloth is specially cut into segments so that they may be disposed within the curved mold with a minimum of wrinkling and bunching and a maximum of smoothness. A first brushing of resin-catalyst mixture is applied to the hardened gel coat. A segment of Fiberglas cloth is then disposed on the mixture and more mixture is applied. The glass and mixture are alternately applied until a laminate is produced having five layers of Fiberglass cloth and six layers of mixture. Although the mixture generates its own heat and is self-curing, an external source of heat at

120° F. is applied by means of heat lamps or in an oven. It is obvious, of course, that other sources of external heat may be utilized or, if desired, no heat may be applied at all. However, this curing stage is speeded by the use of heat and is consequently shortened to approximately twenty minutes. After cooling, the shell is then ready for removal from the mold.

At this point the shell is held securely within the mold (see FIG. 5), partly because of the casting process and to a greater extent by the fact that the ear to ear configuration of the mold extends more than 180° over the substantially ellipsoidal surface. The side portions of the mold and shell are first flexed to form partial separations **70** therebetween, as depicted in FIG. 5. Air under pressure is then supplied from a compressor through a nozzle into the partial separations. The air progresses between the mold and the shell to cause a force to be directed progressively against both the mold and the shell and to separate fully one from the other.

Preferably, the air supplied is under a pressure of 150 p.s.i. This pressure has been found to be most effective since it causes the shell to pop out of the mold. A smaller pressure would work to separate the shell from the mold but with some difficulty while air at too great a pressure would cause too rapid a separation and possible damage to the shell.

After removal, excess Fiberglas cloth and catalyzed resin **72** is trimmed and removed. Beading holes are drilled about the peripheral edge, a pair of strap holes are drilled through each ear portion, and fastener holes are drilled at least in the brow portion. A beading of soft material is sewn about the edge of the shell through the beading holes to eliminate direct contact with the hard exposed edges and glass threads of the shell. Snap fasteners are then secured in the snap holes and prepared neck straps are secured to the side portions through the strap holes. A liner material formed from a foamed plastic, having a slow recovery rate after application of pressure, e.g., a closed cell vinyl sponge such as Ensolite (trademark, U.S. Rubber Company), is cemented or otherwise secured to the inner crown portion of the shell. A foamed plastic top piece is secured to the foam liner. Brow and base of the skull padding is finally attached to the shell in contact with the crown liner. Appropriate compatible adhesive materials are used for this purpose.

A specific example of the process or method is now set forth. The data illustrated pertains solely to the preparation of a shell since the method of applying the beading, lining, straps, and padding is conventional.

Example

A gel coat comprising styrene unsaturate polyester resin composition made thixotropic and pigmented with 1/60 inch square aluminum foil colored and epoxy coated is sprayed within the mold to a 0.0030 inch thickness. The coat is allowed to gel in place for twenty minutes without running or sagging because of the thixotropic agent.

A mixture of styrene unsaturated polyester resin, mixed with a peroxide composition catalyst, is brushed on the hardened gel coat. A pre-cut segment of Fiberglas cloth is then placed on the resin-catalyst mixture and smoothed into position. Another coat of the mixture is applied and a second segment of Fiberglas cloth is smoothed thereover. This process is repeated until a laminate is built up of five layers of Fiberglas cloth interspersed with six applications of the mixture. The sixth or final coat of the mixture is placed over the final segment. One segment is disposed to fit on one ear portion, another segment is disposed to fit over the other ear portion, and a third segment is disposed to be placed partially over the ear segments at the center of the in process shell.

The mold and its contents are then placed beneath a bank of heat lamps for exposure to heat at a temperature of 120° F. for a period of twenty minutes. After the resin has catalyzed, the mold is removed from the heat and allowed to cool.

The sides of the mold and shell are flexed to cause partial separation therebetween. Air under a pressure of 150 p.s.i. from a compressor is directed through a nozzle and into the partial separations. The shell pops away from, and is worked out of. the mold.

The shell is then ready for trimming and for completion into a finished helmet.

In the above example, the untrimmed shell came out of the mold with great ease and with a smooth, unmachined and finished surface. It was not necessary to perform any further operations, machined or otherwise, on the outer surface with respect to smoothing or coloring. Thus, it is obvious that the method and the mold used therein is provided with many novel and useful aspects with reference to both the economy of the method and to the quality of the finished shell and helmet.

I claim:

1. A method for producing a helmet shell of substantially ellipsoidal configuration provided with a smooth unmachined exterior surface and with a pair of ear portions extending beyond 180° of the configuration including the steps of utilizing a substantially rigid one piece mold provided with a smooth interior surface of substantially ellipsoidal configuration having a pair of opposed side portions encompassing an area of greater than 180° of the mold configuration, said side portions having a thickness sufficient to impart rigidity and to afford flexibility to said side portions; disposing shell materials within said mold and onto said mold surface to form the shell; and separating and removing the shell from said mold first by flexing said mold portions and the shell portions as a unit to cause slight separations between the ear portions and said mold portions and second by forcing the shell out of said mold and by moving said shell past said opposed side portions.

2. A method as in claim **1** wherein said separating and removing step further includes the step of injecting a substance under pressure into the slight separations.

3. A method as in claim **1** wherein said separating and removing step includes the step of applying a separating force between the shell and said mold.

4. In a method for fabricating a unitary helmet shell in a one piece mold to provide a hard, smooth, unmachined exterior for the shell wherein the mold comprises a curved crown portion of a selected thickness and a pair of curved ear portions integrally formed on opposed sides of the crown portion to provide an internal mold curvature exceeding 180° from one of the ear portions to the other of the ear portions, each of the ear portions having a thickness less than the crown portion thickness to impart flexibility to the ear portions, the mold having a smooth unbroken interior: said method including the steps of spraying a colored resin onto the mold interior and curing the resin to provide the smooth unmachined shell exterior, applying a laminate of Fiberglas cloth and resin mixed with a catalyst alternately on the cured colored resin and heating the catalyst and resin for aiding the hardening thereof, flexing the ear portions and the adjacent hardened shell ear portions as a unit for partial separation of the shell and the mold, injecting compressed air between the mold and the shell for complete removal thereof from the mold, and trimming the edges of the shell.

5. A method as in claim **4** wherein the exterior resin is selected from the group of styrene unsaturated polyester resins mixed with a thixotroping agent.

6. A method as in claim **4** wherein the exterior resin is colored by the addition thereto of precision cut colored flakes before the curing of the exterior resin.

References Cited

UNITED STATES PATENTS

2,196,258	4/1940	Erdle	264—313 X
2,614,309	10/1952	Price	25—120 X

(Other references on following page)

9

UNITED STATES PATENTS

2,614,955	10/1952	Halsall	156—232 X
2,744,286	5/1956	Carpenter et al.	264—335
2,747,180	5/1956	Brucker	156—242 X
3,001,900	9/1961	Frieder et al.	2—3 X
3,061,904	11/1962	Wise	25—120

10

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U.S. Cl. X.R.

2—3; 156—242; 249—66; 264—255, 257, 313, 335