

June 13, 1944.

G. A. SHROYER ET AL

2,351,235

HELMET

Filed June 18, 1942

2 Sheets-Sheet 1

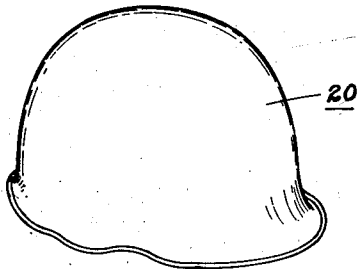


Fig. 1

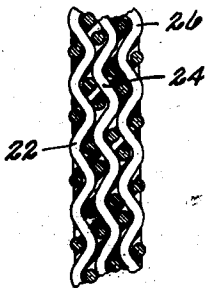


Fig. 5

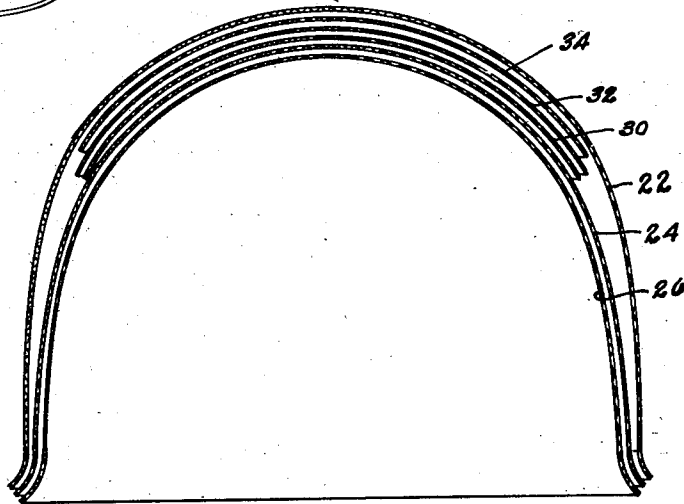


Fig. 2

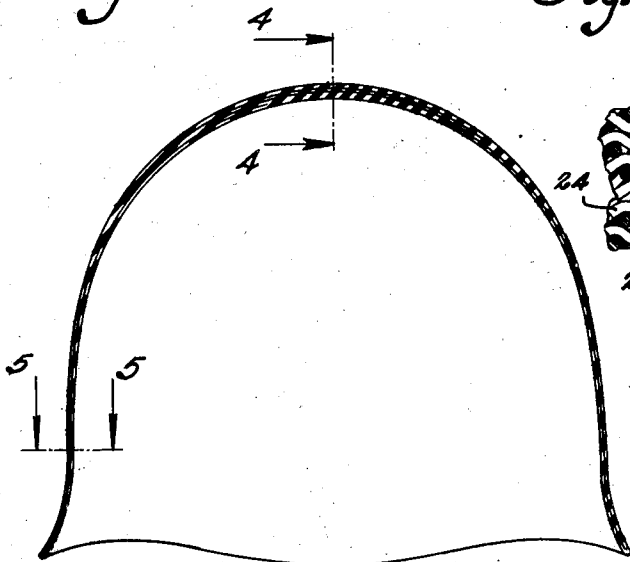


Fig. 3

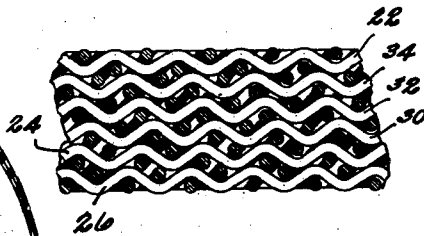


Fig. 4

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2 Sheets-Sheet 2

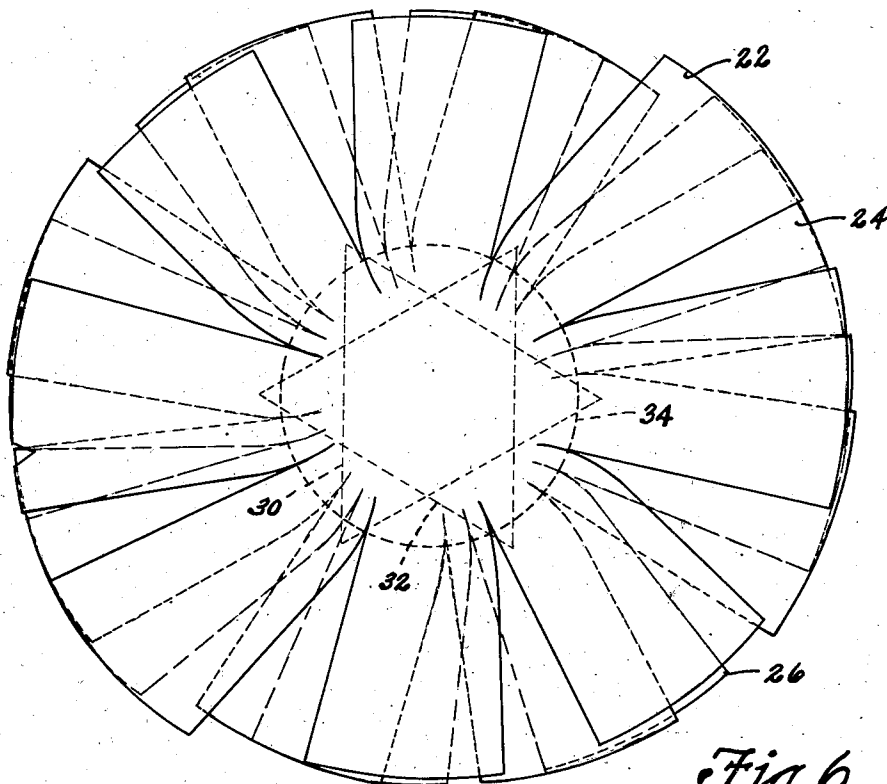


Fig. 6

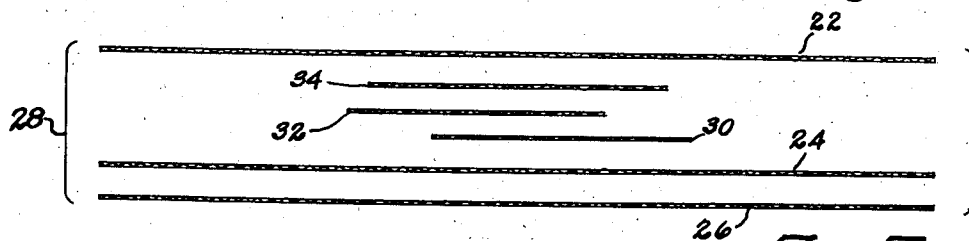


Fig. 7

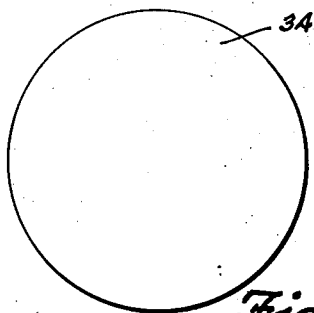


Fig. 8

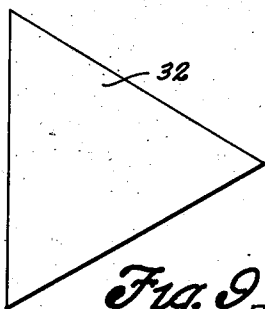


Fig. 9

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2,351,235

HELMET

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Application June 18, 1942, Serial No. 447,492

2 Claims. (Cl. 2—6)

This invention relates to helmets, and more particularly to light, strong, resilient helmets which are adapted to be used per se or as liners for steel helmets.

An object of the invention is to provide a helmet made from non-metallic material which is strong, due to its resiliency and flexibility, and which is light and in the preferred form a non-conductor of electrical currents.

A further object is to form a helmet from superimposed layers of pre-impregnated fabric including a thermosetting resin therein wherein the fabric exceeds the plastic by weight and wherein the entire helmet is integrated by the use of heat and pressure in a mold of the desired shape.

Another object of the invention is to provide a helmet having integral crown and brim portions wherein the crown is reenforced for added strength and wherein the rim portion is highly resilient but strong, said helmet being formed from a plurality of superimposed layers of fabric which are impregnated with a thermosetting resin of the phenol-formaldehyde condensation type.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 illustrates a view of the typical helmet or helmet liner;

Fig. 2 is a view of an enlarged scale of the helmet in expanded form, that is to say, showing the helmet in its assembled form wherein the superimposed layers of fabric are separated to show the exact location thereof;

Fig. 3 is a sectional view of a helmet after the layers of material have been integrated by means of pressure and heat;

Fig. 4 is a greatly enlarged fragmentary sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a greatly enlarged fragmentary sectional view of line 5—5 of Fig. 3;

Fig. 6 is a plan view of the assembled layers of fabric used in the manufacture of helmets prior to molding;

Fig. 7 is an expanded view showing disposition of the various layers of fabric prior to molding;

Fig. 8 is a view of one of the crown reenforcing members; and

Fig. 9 is a view of another of the crown reenforcing members.

The helmet described herein is used in its pre-

ferred form as a liner for steel helmets used in war and is sufficiently light and protective to be used as a hat or helmet without the steel covering thereover during times when conditions of warfare permit. In other words, a soldier wearing a helmet of this type may carry the steel portion thereof, which is relatively heavy, separate from the helmet and use the helmet as a protective headcovering during ordinary conditions and during battle may add the steel covering thereto for further protection. Thus, the present helmet construction is relatively light so that the helmet may be worn comfortably by the soldier during the major portion of the time. Further the helmet which is used for the liner of the steel helmet must act as a protective layer to the soldier's head under battle conditions. In this respect it is desirable that the material is highly resilient so that when shrapnel or other metal fragments hits the steel helmet under a glancing blow sufficient to rupture the steel the resilient nature of the non-metallic helmet will keep the sharp edges of the steel from penetrating the head of the wearer by merely bulging inwardly at the point of rupture. The non-metallic helmet is several sizes larger than the head of the wearer and thereby protects the wearer's head against injury in many cases since the non-metallic helmet is set away from the head by means of a harness and hatband therein.

In the past re-enforced plastic helmets have been merchandized for use in mines and the like for head protection. However, these prior art helmets have always been strong, hard and heavy and therefore entirely unsuited for normal use by a soldier due to the great weight. Furthermore, due to the hardness of the helmet it was brittle and thus if used as a helmet liner under conditions noted herein and a shell fragment should pierce the steel portion of the helmet the plastic liner would be fractured and pierce the head of the wearer giving no added protection over the steel. This is due to the fact that in all prior art helmets of which we are aware the plastic was greatly in excess of the fabric or other reenforcement. In fact the helmet itself was a molded plastic element reenforced with the fabric. In the present instance, however, we proposed to make the helmet of fabric and merely impregnate the fabric with plastic to strengthen it and to make it more formable but insufficient plastic is used to cause the helmet to lose its resilient characteristics. Helmets of the type described herein do not weigh in excess of

one-half pound in accordance with Government specifications whereas the prior helmets have weighed well over a pound, the added weight being for the most part due to the excess of plastic material utilized.

Referring particularly to the drawings, the general shape of the helmet 20 of the type described is shown in Fig. 1, and its particular structure is shown in Fig. 2 wherein the various layers are expanded. Fig. 6 shows the various layers of fabric utilized in the manufacture of our helmet wherein three circular portions 22, 24 and 26 are preferably provided which portions have sectors cut therefrom and evenly spaced around the entire circumference thereof as at 28. These sectors provide space for the fabric to come together when the layers are formed into the shape of the helmet without too much overlapping which would create an uneven thickness throughout the helmet. The three portions 22, 24 and 26 when assembled as superimposed so that the solid portions of one layer covers the cut-out segment portions of the next, etc., whereby a substantially uniform thickness is maintained throughout the helmet. These pieces of fabric are preferably preimpregnated with a phenol-formaldehyde resin material such as "Bakelite" or any other thermosetting resin and after assembly, as above noted, the edges of the portions are fixed together around the periphery of the mold portion of annular shape which is next placed on a mold and the impregnated fabric is drawn over the mold by pressure to the desired shape whereupon heat is applied to set the plastic material. The pressure applied is relatively low, generally from 1,000 to 2,000 popnds per square inch, which pressure is sufficient to force the superimposed layers in close contact with one another to facilitate setting of the plastic. When the pressure is removed the helmet may be removed from the mold and the edges trimmed to size since the edges which were affixed to the annular mold portion are obviously of a greater diameter than desired.

In many instances it is highly desirable to reinforce the crown portion of the helmet to strengthen the same. In this instance we prefer to utilize one or more reenforcing portions and in the preferred form three of such portions are used. These portions are preferably in the shape of two triangular pieces 30 and 32 and a circular piece 34. The particular shape of these reenforcing portions is not of great importance although the particular shape described is desirable since it provides the greatest reinforcement at the top of the crown which reinforcement tapers off substantially uniformly down the sides of the crown due to the pointed portions of the triangular reenforcements which are so spaced as to form a star, as shown.

The fabric material used is preferably a duck of good strength and light weight and fine weave, for example 8.6 ounce cotton duck. The resin which is preimpregnated into the duck is preferably cured at a temperature around 325° F. for about five minutes.

This resin content generally is between 40 and 48% of the duck material although in some cases we have found that it is desirable to form high resin layers on the outer surfaces of the helmet with the low resin layer on the inner surface. In this instance a high percentage of resin may be present at the external surface of the helmet while the internal layers may include resin as low as 30%, such variations coming within the

scope of the invention providing a resin wherein the total content is less than 50% by weight of the entire helmet. In all cases the resin impregnated is desirable since it waterproofs the helmet and makes it electrically non-conductive as well as strengthening and stiffening the duck material to the desired degree. On the other hand if the resin content is below 50%, as herein explained, the finished helmet maintains its resiliency and is not easily cracked or fractured which is highly desirable.

Figures 4 and 5 are greatly enlarged, sectional views of the helmet taken in the crown portion shown in Fig. 4 and in the brim portion shown in Fig. 5. In these views it will be noted that the fabric definitely forms the major portion of the helmet whereas the resin impregnant acts as a binder and filler only. This is extremely important since, as previously explained, if more resin is present there is little or no resiliency in the helmet and in fact the helmet is brittle which condition is highly undesirable and to be avoided.

After the helmets are completed and the harness and hat-band are put in place by rivets or other suitable means, we prefer to spray the helmet with a covering of paint or lacquer to give it a more finished appearance and uniform color.

It is understood that other material may be used as a base for helmets of the type described, which material may be impregnated with plastic which acts as a binder and filler only. In this instance paper, wood product and other types of cloth other than duck or canvas, either alone or in combination with other suitable materials, may be used, the only important limitation being that the flexible material (that is to say the duck, paper, canvas, cloth, etc.) forms the major portion of the helmet so that the helmet has good resiliency and wherein the resin does no more than strengthen the material without making it brittle. Thus, in instances where impacts are taken up by the helmet, even if the impact is great, parts of the helmet do not break due to the resiliency of the material. This is in direct contrast with helmets manufactured heretofore wherein, due to high resin content, the helmet is brittle and on impact shock portions of the helmet may be broken away.

It should be further understood that when desired other reenforcing means should be utilized within the helmet construction. For example, burlap, or heavier cloth, or other suitable materials may be included as the internal surface of the helmet to add strength, if desired. However, we have found that under normal conditions of usage that a helmet constructed as described herein, with its highly resilient walls and reenforced crown together with its strength, is completely satisfactory.

It is to be understood that the helmet herein described may also be used by polo players, miners, firemen and the like, as it presents an excellent headguard without the use of the steel covering thereover and its high resiliency and good strength provides adequate protection for persons in civilian life under conditions where head protection is required.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A non-metallic helmet for use as a liner in

metal helmets comprising a substantially integral unit including a reenforced crown portion and a brim portion, said unit consisting of a plurality of layers of superimposed fabric material wherein the number of layers in the crown portion exceed the number of layers in the brim portion, said layers being held together by means of a thermosetting resin impregnated within the fabric and being present in quantities above 30% and below 50% of the total weight of the helmet, said element being light, relatively resilient and strong.

2. A non-metallic light weight helmet comprising an integral unit including crown and brim portions formed from superimposed layers of fabric material impregnated with a thermo-

setting resin, wherein the various layers of fabric are integrated by means of heat and pressure in a mold, the crown portion only of said helmet having reinforcing means consisting of an additional layer or layers of fabric, said helmet including thermosetting resin as a binding medium therein in quantities of from 40% to 48% of the total weight of the helmet whereby the major portion of the helmet is fabric and the minor portion thereof is resin for forming a strong helmet which has considerable resiliency by reason of the controlled ratio of fabric to resin.

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