

article such as a tube or the like where it is necessary or desirable to form several laminates simultaneously.

When our method is used to form an article having a cross sectional shape which is re-entrant, such as the article shown in FIGURE 3, a sectional female mold (not shown) is employed. The mold is first assembled and the laminate 34, the film 38, and the laminate 36 are successively disposed in the mold. A suitable expandible bag (not shown) forms the male mold member. This bag is expanded within the interior of the female mold to press the material against the inner surface of the female mold and the molding operation is completed under the required pressure at an appropriate temperature. In order to remove the article, the bag is collapsed and withdrawn from the interior of the female mold. Since the molding apparatus is known to the art, it is not here shown or described in detail. The female mold is then disassembled and the article removed. It is to be noted that in molding an article such as is shown in FIGURE 3, it is not necessary to employ a film with perforations. The nested laminates 34 and 36 will not separate, since the inner diameter of the mouth of the laminate 34 is less than the longest outer diameter of the laminate 36.

When our laminated plastic article is employed to protect personnel or material, its penetration-resisting quality is provided by the differential deflection between adjacent laminates. That is, when a flying fragment or projectile strikes the surface of the article the respective laminates tend to deflect differentially with respect to one another. This tendency is resisted by the spaced bonds provided between adjacent laminates. The bonding over the surface between the laminates, however, is such that the bonds break to permit differential deflection before an individual laminate shears. This differential deflection to resist penetration is explained more fully in our co-pending application, Serial No. 265,598, identified above.

While we have shown in FIGURES 1 and 3 an article formed of only two laminates separated by a thin film, we preferably form an article with more layers than two. A fragmentary section of an article formed with four layers is shown in FIGURE 2. As has been explained hereinbefore, an article so formed has a wall which forms a labyrinth packing to resist the penetration of moisture into the interior of the article. That is, a vapor barrier provided by the circuitous passage which vapor must travel in passing from laminate to laminate through the wall of the article. This feature is of particular importance when forming containers for protecting materiel.

It will be seen that we have accomplished the objects of our invention. We have provided a laminated plastic article which is light in weight, which is less bulky than similar plastic articles of the prior art, and yet which has superior missile penetration-resisting or ballistic qualities. Our article also resists the passage of moisture through its walls. We have also provided an improved method of forming a laminated plastic article when it is necessary or desirable to form several laminates simultaneously. By use of our method we may form several laminates simultaneously and yet prevent a complete bonding between adjacent laminates over the entire surface between laminates. At the same time, our method permits the formation of spaced bonds over a minor portion of the surface between adjacent laminates. These spaced bonds hold the laminated assembly together during ordinary use while permitting differential deflection between adjacent laminates when a flying fragment or projectile impinges on the surface of the article.

It is to be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of our claims. It is further obvious that various changes may be made in details within the scope of our claims without departing from the spirit of our invention. It is

therefore to be understood that our invention is not to be limited to the specific details shown and described.

Having thus described our invention, what we claim is:

1. A laminated plastic article including in combination a pair of fibrous layers impregnated with a synthetic resin, a thin smooth film of material nonadherent with respect to said layers and impervious to said resin in its uncured state separating said layers, the surfaces of said film being free with respect to said layers to permit relative movement between the layers, said thin film being provided with perforations spaced over its surface and bonds of synthetic resin passing through said perforations for securing said layers to each other to permit them to deflect differentially with respect to each other under the impact of a missile.

2. A laminated plastic article including in combination a plurality of fibrous laminates impregnated with a synthetic resin, a plurality of thin smooth films of material nonadherent with respect to said laminates and impervious to said resin in its uncured state separating adjacent ones of said laminates, the surfaces of said films being free with respect to said laminates to permit relative movement between the laminates, each of said films being provided with spaced perforations and bonds formed of said impregnating synthetic resin passing through said perforations for securing adjacent laminates to one another at separated points, the aggregate area through which the laminates are secured being small with respect to the remainder of the surface area of the laminates, which remainder area is free of securing bonds to permit the laminates to deflect differentially with respect to one another under the impact of a missile.

3. A laminated plastic article including in combination a plurality of fibrous laminates impregnated with a synthetic resin, a plurality of thin smooth films of material nonadherent with respect to said laminates and impervious to said resin in its uncured state, separating adjacent ones of said laminates, the surfaces of said films being free with respect to said laminates to permit relative movement between the laminates, each of said films being provided with spaced perforations and means for securing adjacent laminates to one another through said perforations, the aggregate area through which the laminates are secured being small with respect to the remainder of the surface area of the laminates to permit the laminates to deflect differentially with respect to one another under the impact of a missile.

4. A laminated plastic article as in claim 3 wherein said means for securing adjacent laminates to one another is a plurality of bonds formed of said impregnating synthetic resin.

5. A laminated plastic article as in claim 3 including at least a pair of said thin films each formed with spaced perforations, the perforations of one of said films being staggered with respect to the perforations of the other of said films.

6. A laminated plastic article as in claim 3 wherein fibrous laminates are formed of glass fibers.

7. A laminated plastic article as in claim 3 wherein said synthetic resin is a polyester resin.

8. A laminated plastic article as in claim 3 wherein said thin films are formed of cellophane.

9. A laminated plastic article as in claim 3 wherein said article is formed with a mouth having a diameter which is shorter than the longest inner diameter of the article.

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