Feb. 28, 1967 G. MARKUS 3,306,328

PLASTIC SEALING METHOD AND APPARATUS

Filed March 25, 1965 2 Sheets-Sheet 1

FIG. 1

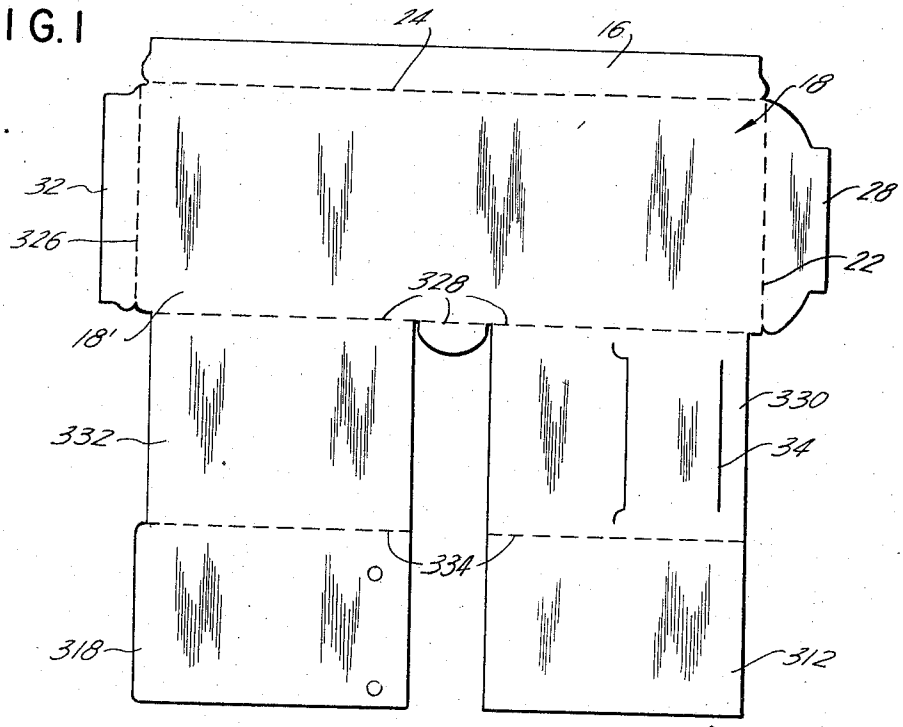
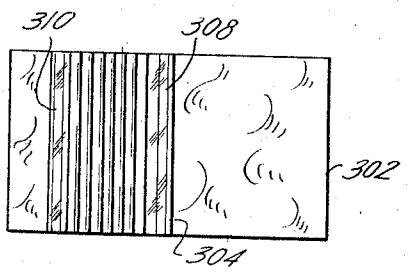
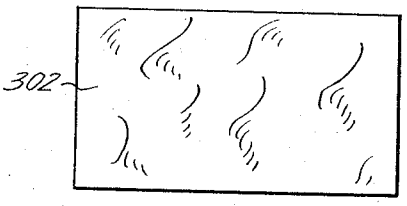


FIG. 3





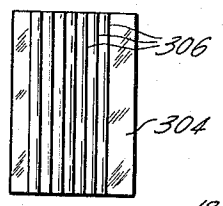


FIG. 2

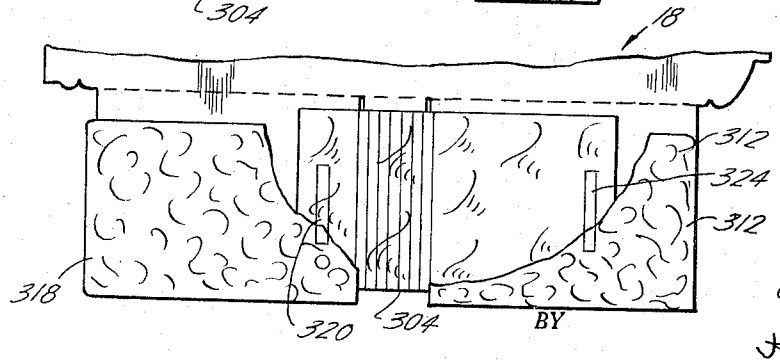


FIG. 5

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Feb. 28, 1967 G. MARKUS 3,306,328

PLASTIC SEALING METHOD AND APPARATUS

Filed March 25, 1965 2 Sheets-Sheet 2

FIG. 6

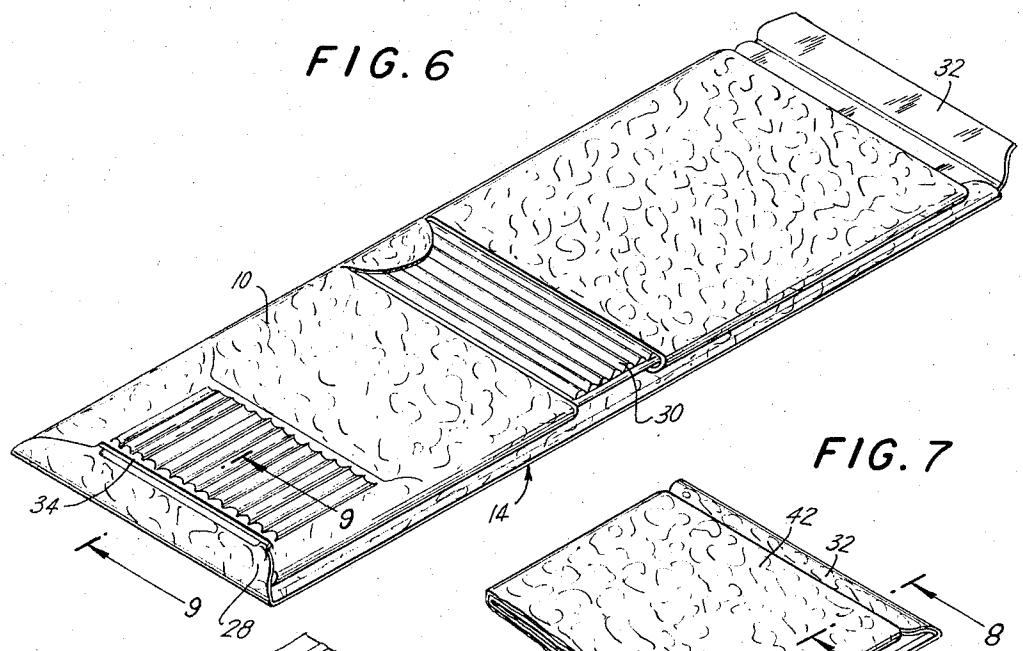
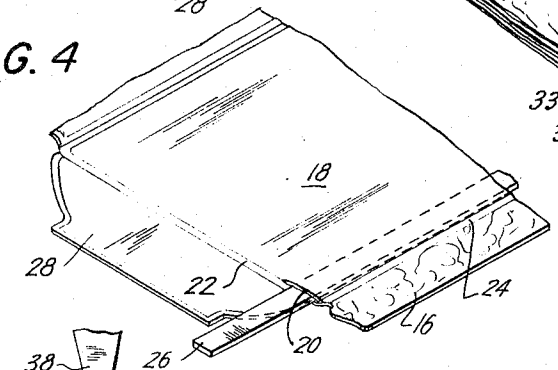


FIG. 7

FIG. 4



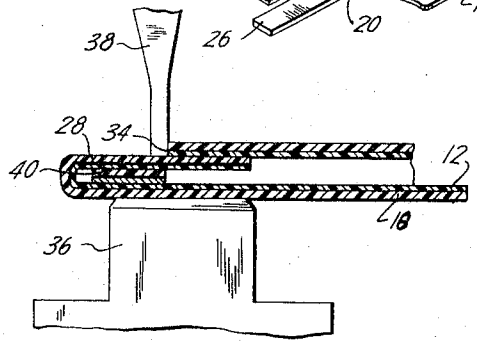


FIG. 9

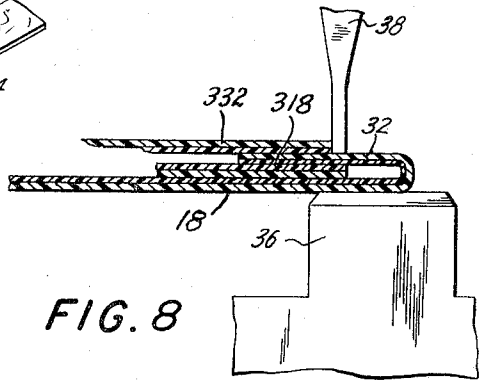


FIG. 8

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United States Patent Office

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PLASTIC SEALING METHOD AND APPARATUS

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Filed Mar. 25, 1965, Ser. No. 442,660
11 Claims. (Cl. 150—38)

This invention relates to a method of manufacturing articles such as wallets, passcases, and billfolds, and to the resultant product, made out of thermoplastic sheet material. More particularly, this invention is concerned with providing folded over edges by heat sealing wherein the obverse, outer surface of the assembly is unmarred and unblemished.

Such articles have previously been made of blanks which have been stamped out of plastic sheet material, and then folded up. Such blanks can be scored and sealed by high frequency current and mechanical pressure, as shown in U.S. 2,631,646, granted March 17, 1953, to J. P. Gannon et al. An upper, long hem can be folded over and sewn, as shown in U.S. 2,746,503, granted May 22, 1956, to S. Knee. A side can be folded over other layers and cemented, as shown in U.S. 2,876,819, granted March 10, 1959, to H. Cohen et al.

Sewing is a time consuming process and the needle and thread must pass entirely through the layers being sewn. The stitching is visible from both sides of the sewn-together assembly. Cementing is also time consuming, and since most thick layers of plastic, such as are used in such articles, are non-porous, most cements do not adhere satisfactorily.

It is, therefore, an object of this invention to provide a method of adhering folded-over layers which is both permanent, and not visible on the obverse side of the assembly.

A feature of this invention is the provision of a method of heating several layers of a multilayer assembly of thermoplastic sheet material from one side of the assembly and limiting the depth or the number of layers heated, so that at least the layer on the other side of the assembly is not significantly heated, and its outer surface is unmarred.

These and other objects and features of this invention will be more fully understood from the following description considered in connection with the accompanying drawings which are illustrations of the invention, wherein:

FIG. 1 is a top view of the main blank of the assembly before folding;

FIG. 2 is a top view of two blanks which are to be assembled to form an insert for the assembly;

FIG. 3 is a top view of the two blanks of FIG. 2 assembled to form the insert;

FIG. 4 is a perspective view of a detail of the main blank of FIG. 1 before folding;

FIG. 5 is a top view detail of the partially folded assembly showing the main blank and the insert;

FIG. 6 is a perspective view of the almost completely folded assembly;

FIG. 7 is a perspective view detail of a completely folded assembly;

FIG. 8 is a cross-sectional detail of FIG. 7, taken along the plane 8—8; and

FIG. 9 is a cross-sectional detail of FIG. 6, taken along the plane 9—9.

As shown in the drawing, the illustrative wallet is folded up from a blank. This blank may advantageously comprise a relatively soft, limp outer layer **10** of relatively heavy gauge, e.g. 18 gauge, polyvinylchloride, to simulate leather; and a relatively stiff inner layer **12** of relatively light gauge, e.g. 11 gauge, polyvinylchloride, to

give the assembly stiffness. An additional, innermost layer of a limp, very thin gauge, e.g. 8 gauge, may be added to certain portions of the assembly to serve as a decorative liner.

The assembly blank may be formed with a peripheral tear-seal and scored fold lines, by a suitable die, high frequency current and pressure, as shown in U.S. 2,631,646, supra.

The long, upper edge **14** of the main pocket of the wallet is formed by folding over a marginal portion **16** of the blank onto the main or central portion **18** of the blank to provide a hem. Previously the folded over portion was secured in place by sewing, as shown in U.S. 2,746,503, supra. Such a seam would be visible on both surfaces of the finished wallet. If the hem were secured by the customary dielectric heat sealing technique, a capcitor/pressure plate would be disposed on each outer surface of the hem, marring the outer surface of this assembled wallet. I have discovered that this marring may be avoided in either of two ways.

The first way is illustrated in FIG. 4. An incision **20** is made through the stiff layer **12**, inwardly and parallel to a fold line **22**, and perpendicular and up to the fold line **24** of the marginal portion **16**. An elongated metal plate **26** is inserted through the incision **20**, between the stiff layer **12** and the limp layer **10**, and along the length of the fold line **24**. Subsequently the marginal portion **16** is folded over its fold line **24** and another metal plate, not shown, is placed over and pressed against the hem. A high frequency dielectric heater of conventional construction, as shown in U.S. 2,631,646 is coupled to the two plates to heat the layers of thermoplastic material therebetween, to adhere them together. The layer **10** which is not between the two plates is not heated, and its outer surface is not marred. The inserted plate **26** is now removed. It will be appreciated that when the side marginal portion **28** is subsequently folded over, the incision **20** will be concealed.

The second way is by means of an ultrasonically operated tool; such as a tool which is vibrated by a magnetostrictive driver. A tool which may be advantageously used for this purpose is described in the periodical, "Plastic Design & Processing," August 1962 under the title, "New Development Advances Use of Ultrasonics for Automated Plastic Film Sealing," by H. Deans. The folded over hem is placed on an anvil and the tool is reciprocated against the hem. The vibration fuses the layers by producing a natural molecular bond. The depth of penetration of the weld is limited by means of a stop which permits the tool to penetrate into the plastic to a predetermined depth while fusion is taking place beneath the tool tip. This depth is set so that the lowermost layer is not penetrated by the tool and thus its lower-outer surface is not marred. The amount of energy necessary to raise the mass of the volume to the fusion point is a function of the specific heat of the plastic involved. A large quantity of the ultrasonic energy is applied to the plastic in the form of heat, if the appropriate bonding conditions are satisfied. This depends on the resiliency constant of the film itself, the coupling coefficient of the tool to the plastic, speed of the tool with respect to plastic advance, if any, gauge of the film, and the rate at which the surface heat is carried away through the tool tip and the anvil.

An insert, such as a gusset **30** is assembled from a thin gauge blank **302** of limp plastic and a heavy gauge blank **304**. The heavy blank **304** may have transverse, parallel embossed indentations **306** therein to aid in the ready bending of the blank when in use. The heavy blank **304** is disposed on the light blank **306** as shown in FIG. 3, and fused thereto, as along two fusion lines or areas **308** and **310**.

The insert **30** is then fused to and between two tail portions **312** and **318** of the main blank, as along two fusion lines or areas **320** and **324**.

It will be appreciated that the main blank may be considered to comprise a central portion **18** and three marginal portions **16**, **28** and **32**. The central portion **18** may be considered to comprise three subportions, which are the major distal portion **18'** defined by the fold lines **22**, **24**, **326** and **328**, the two part major medial portion **330** plus **332** defined by the fold lines **328** and **334**, and the two part major distal portion provided by the tail portions **312** and **318**.

Subsequently, the blank is completely folded up, with any inserts, such as the gusset **30** included, and the side marginal portion **28** and **32** are folded over. The side marginal portion **28** is inserted through an incision **34**. The assembly is placed over an anvil **36** and the tool **38** is driven against the upper surface of the folded over marginal portion **28**, as shown in FIG. 9, to fuse the portion **28** to the underlying layer **40**, but not to fuse the lowermost layer, as previously discussed. The side marginal portion **32** is tucked between the upper two layers **332** and **318** of the folded over blank. The assembly is placed over the anvil **36** and the tool **38** is driven against the upper surface of the folded over marginal portion **32**, as shown in FIG. 8, to fuse the portion **32** to the underlying layer **318**, but not to fuse the lowermost layer, as previously discussed.

The fused bonds thus provided form a permanent assembly which has an outer surface which is not marred.

It will be appreciated that the entire blank need not be comprised of the two layers **10** and **12**. The central or main portions, such as **18**, are advantageously comprised of both layers, wherein the layer **12** provides the necessary stiffness. However, the marginal portions, such as **16**, which are folded over need only be comprised of the layer **10**, since stiffness will be provided by the underlying main portion.

The wallet illustrated as embodying this inevntion is folded up from a blank having three major portions. The portion **18'**, together with the portion **40**, the gusset **30**, and the portion **332** form a full length, longitudinally open pocket or compartment which may be used to receive paper currency. The portion **318** together with the portion **332**, form a half length, laterally open sleeve or compartment which may be used to receive an auxiliary passcase. This sleeve is open at both of its laterals. It will be noted that the marginal portion is fused to the underlying portion **318** and not to the overlying portion **332**. The gusset **30** is attached to the portion **318**.

While there has been shown and described a presently preferred embodiment of the invention, it will be understood that various changes in the details of construction and in the form and arrangements of parts may be made without departing from the underlying idea or principles of this invention within the scope of the appended claims.

What is claimed is:

1. A method of manufacturing an article of layers of thermoplastic material comprising: forming a blank of two layers of said thermoplastic material joined together; folding up said blank to at least in part form said article thereby having portions having a thickness of a number of layers; heat fusing portions of a plurality of said number of layers together, said plurality being at least one fewer than said number.

2. A method of manufacturing an article of layers of thermoplastic material comprising: forming a blank of two layers of said thermoplastic material by heat fusing at least a portion of the peripheries of said two layers together; folding up said blank to at least in part form said article, said article thereby having portions having a thickness of a number of layers; heat fusing portions of a plurality of said number of layers together, said plurality being at least one fewer than said number.

3. A method of manufacturing an article of layers of thermoplastic material comprising: forming a blank of at least two layers of said thermoplastic material by heat fusing a peripheral tear-seal; folding over a marginal portion of said blank onto a central portion of said blank, said article thereby having a resultant portion having a thickness of a number of layers; disposing said resultant portion between an ultrasonically driven tool and an anvil, and limiting the travel of said tool into said resultant portion to a distance equal to a plurality of layers, said plurality being at least one fewer than said number.

4. A method of manufacturing an article of layers of thermoplastic material comprising: forming a blank of at least two layers of said thermoplastic material by heat fusing a peripheral tear-seal, the lowermost one of said layers serving as the outer layer of the finished article; forming an opening in at least the uppermost one of said layers; inserting a first metal plate through said opening, above said lowermost layer and below said uppermost layer; folding a marginal portion of said blank over said uppermost layer and said first metal plate; disposing a second metal plate over said folded over marginal portion and said first metal plate; coupling a dielectric heater to said two plates to heat fuse the layers between said two plates; decoupling said heater and removing said plates.

5. An article of manufacture made of a blank of at least two layers of thermoplastic material which have a peripheral tear-seal, wherein a marginal portion of said blank is folded over onto a major portion of said blank, forming a resultant portion of a number of layers of thickness, a plurality of said number of layers being heat fused together, said plurality being at least one fewer than said number.

6. An article of the class described made up of a folded-up blank; said blank comprising a first lower-outer layer and a second upper-inner layer of thermoplastic material; said blank being divided into at least a central portion and a marginal portion, wherein at least said central portion is comprised of said first and second layers and said marginal portion is comprised of at least said first layer, the periphery of said second layer being fused to the underlying first layers; said first marginal portion being folded over said central portion and fused to the underlying central portion to a depth less than the total thickness of said underlying central portion by at least the thickness of the lowermost first layer.

7. An article of the class described made up of a folded-up blank; said blank comprising a first lower-outer layer and a second upper-inner layer of thermoplastic material; said blank being divided into at least a central portion and a first and a second marginal portions, wherein at least said central portion is comprised of said first and second layers and said first and second marginal portions are comprised of at least said first layer, the periphery of said second layer being fused to the underlying first layer; said first marginal portion being folded over said central portion and fused to the underlying central portion to a depth less than the total thickness of said underlying central portion by at least the thickness of the lowermost first layer; a first sub-portion of said central portion being folded over another, underlying second sub-portion of said central portion; said second marginal portion being folded over said first sub-portion and fused to the underlying central portion to a depth less than the total thickness of said underlying central portion by at least the thickness of the lowermost first layer.

8. An article of the class described made up of a folded-up blank; said blank comprising a first lower-outer layer and a second upper-inner layer of thermoplastic material; said blank being divided into at least a central portion and a first and a second marginal portions, wherein at least said central portion is comprised of said first and second layers and said first and second marginal portions are comprised of at least said first layer, the periphery of said second layer being fused to the underlying first

layer; said first marginal portion being folded over said central portion and fused to the underlying central portion to a depth less than the total thickness of said underlying central portion by at least the thickness of the lowermost first layer; an opening through said second layer of said central portion providing access to said lowermost first layer, adjacent said folded over first marginal portion; said second marginal portion being folded over said central portion, covering said opening, and fused to the underlying central portion to a depth less than the total thickness of said underlying central portion by at least the thickness of the lowermost layer.

9. A wallet made up of a folded over blank having a first major distal portion, a second major medial portion, and a third major distal portion, to form a first and a second compartment; said first compartment having as side walls said first and third major portions, said second compartment having as side walls said third and second major portions; said first major portion having a lateral marginal portion which is folded over said third major portion and under said second major portion and is fused to said underlying third major portion.

10. A wallet made up of a blank having a first major distal portion, a second major medial portion, and a third major distal portion folded up to form a first and a second compartment; said first compartment having as side walls said first and third major portions, said second compartment having as side walls said third and second major portions; said first major portion having a first longitudinal marginal portion which is folded into said

first compartment and is fused to said first major portion along the length thereof; said first major portion having a second lateral marginal portion which is folded over said third major portion and under said second major portion and is fused to said underlying third major portion.

11. A wallet made up of a blank formed of two layers of thermoplastic material having a first major distal portion, a second major medial portion and a third major distal portion folded up to form a first and a second compartment; said first compartment having as side walls said first and third major portions, said second compartment having as side walls said third and second major portions; said first major portion having a first longitudinal marginal portion which is folded into said first compartment and is fused to the inner layer of said first major portion along the length thereof; said first major portion having a second lateral marginal portion which is folded over said third major portion and under said second major portion and is fused to said underlying third major portion.

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FRANKLIN T. GARRETT, *Primary Examiner.*