Nov. 11, 1947. R. A. FARRELL ET AL 2,430,459

LAMINATED SHEET HEAT-SEALABLE CONTAINER

Filed Jan. 22, 1944 2 Sheets-Sheet 1

Fig. 1.

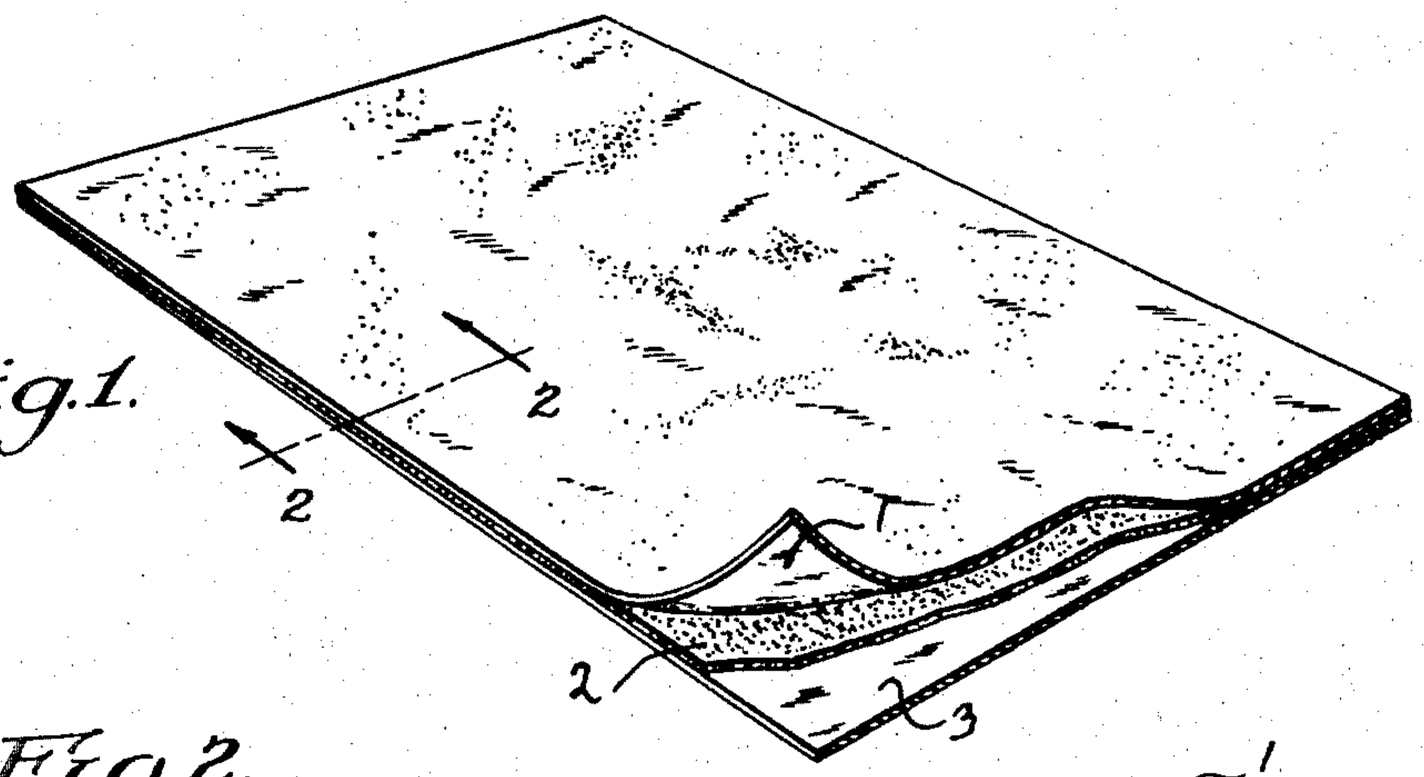


Fig. 2.

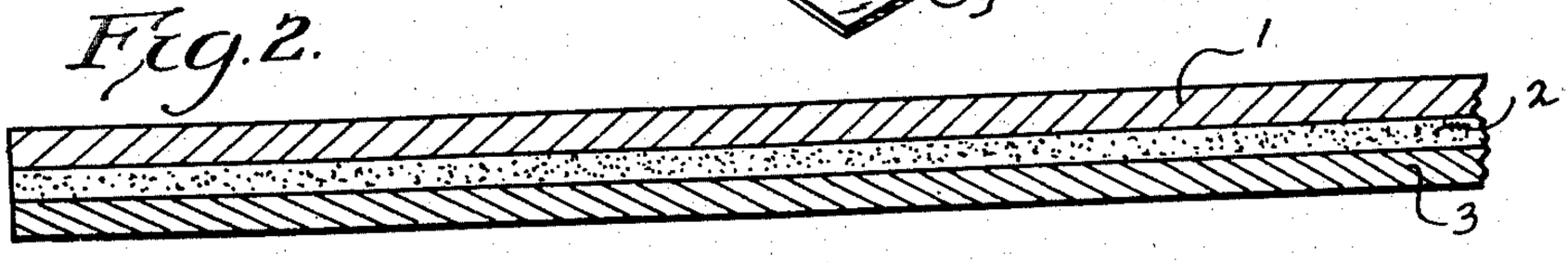


Fig. 3.

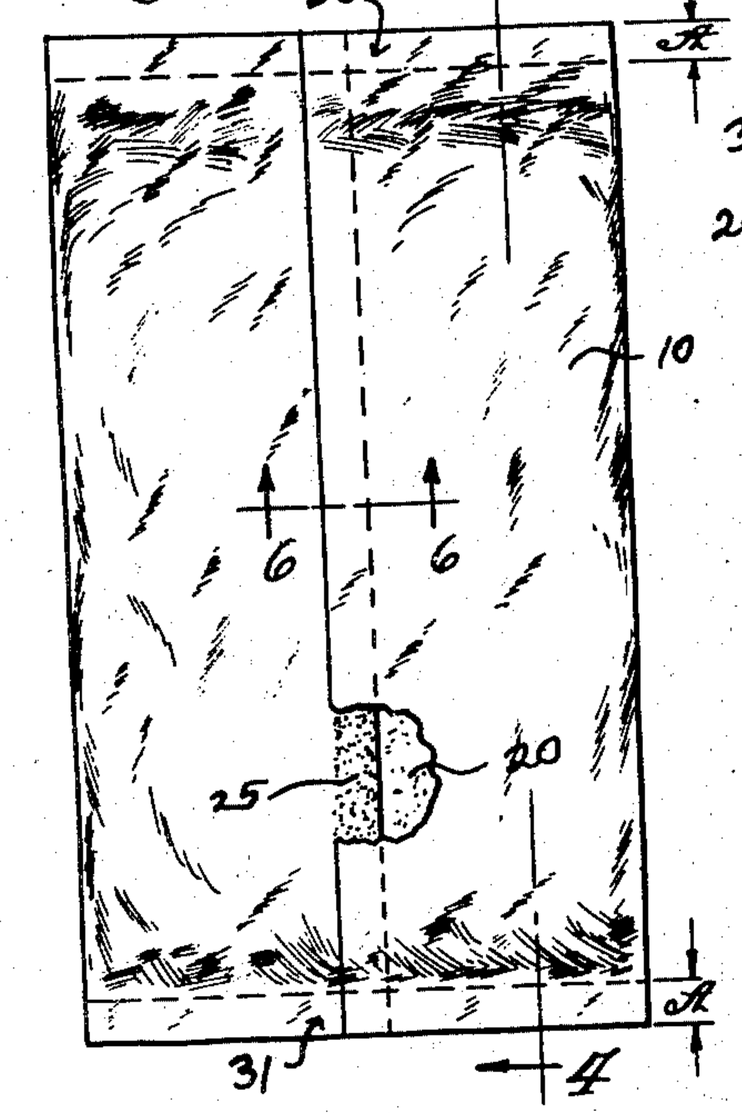


Fig. 4.

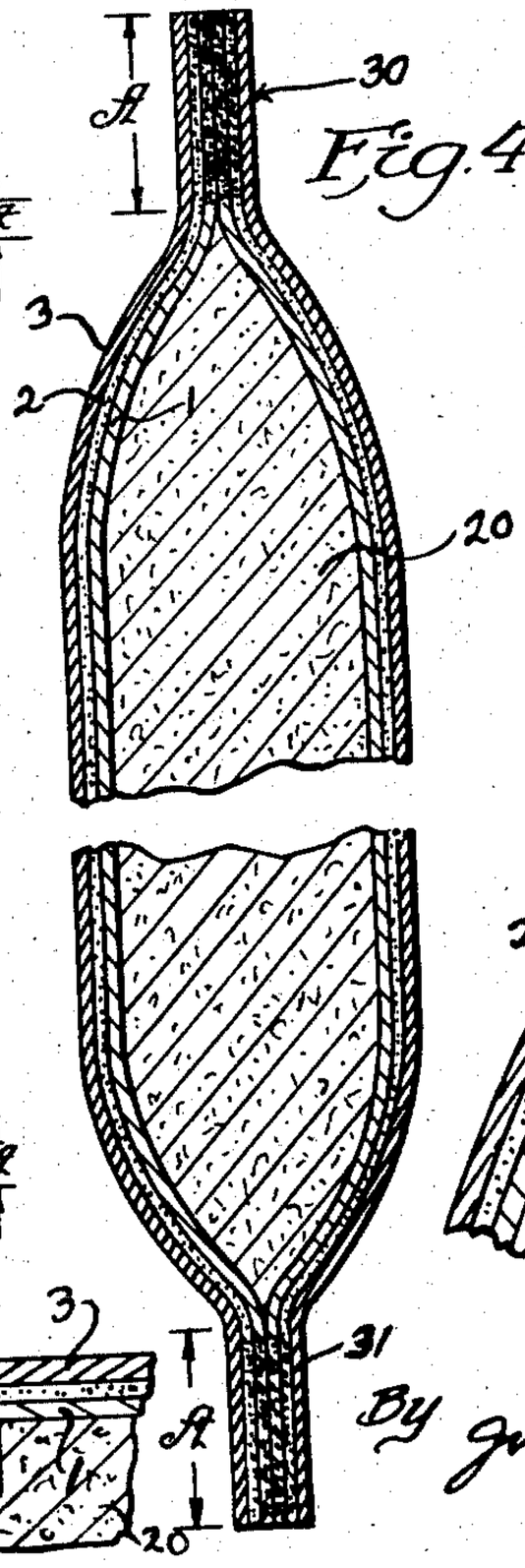


Fig. 5.

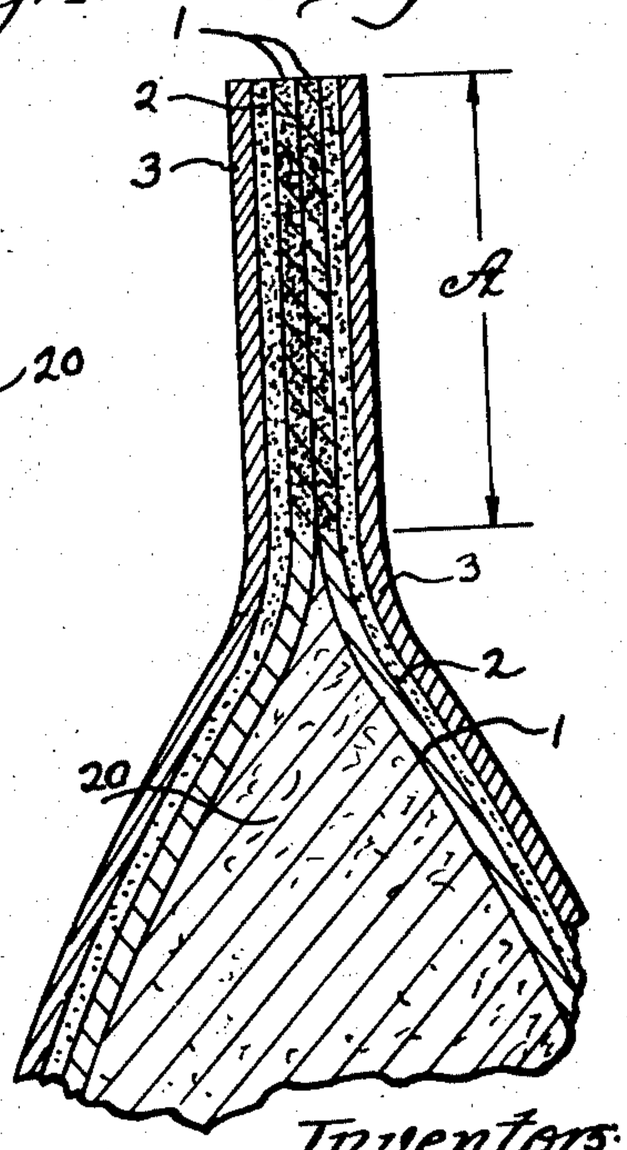
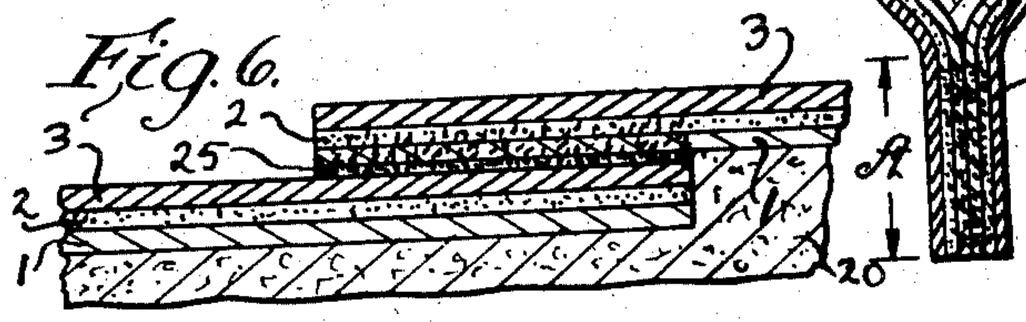


Fig. 6.



Inventors:
Robert A. Farrell +
Charley L. Wagner
By Joseph Rossman
Atty.

Nov. 11, 1947. R. A. FARRELL ET AL 2,430,459

LAMINATED SHEET HEAT-SEALABLE CONTAINER

Filed Jan. 22, 1944 2 Sheets-Sheet 2

Fig. 7.

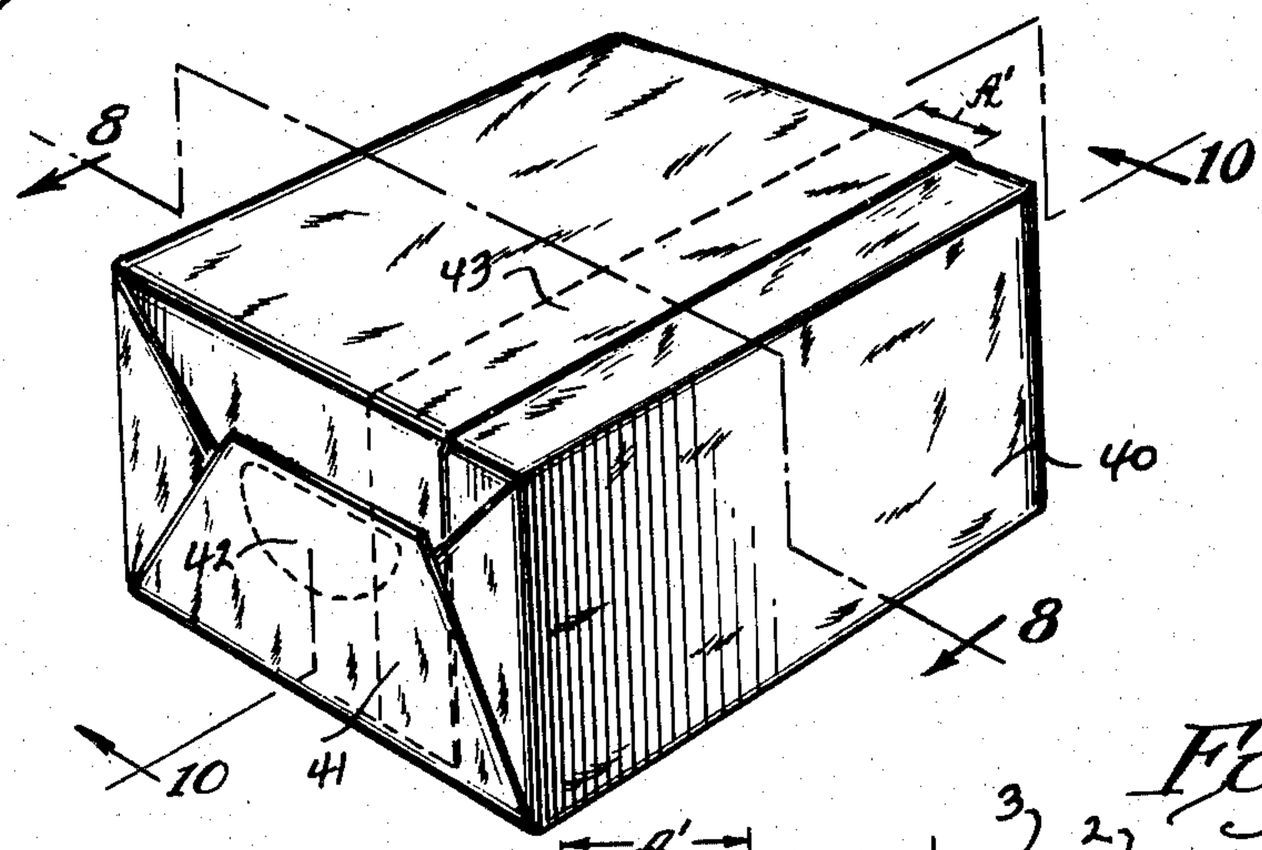


Fig. 8.

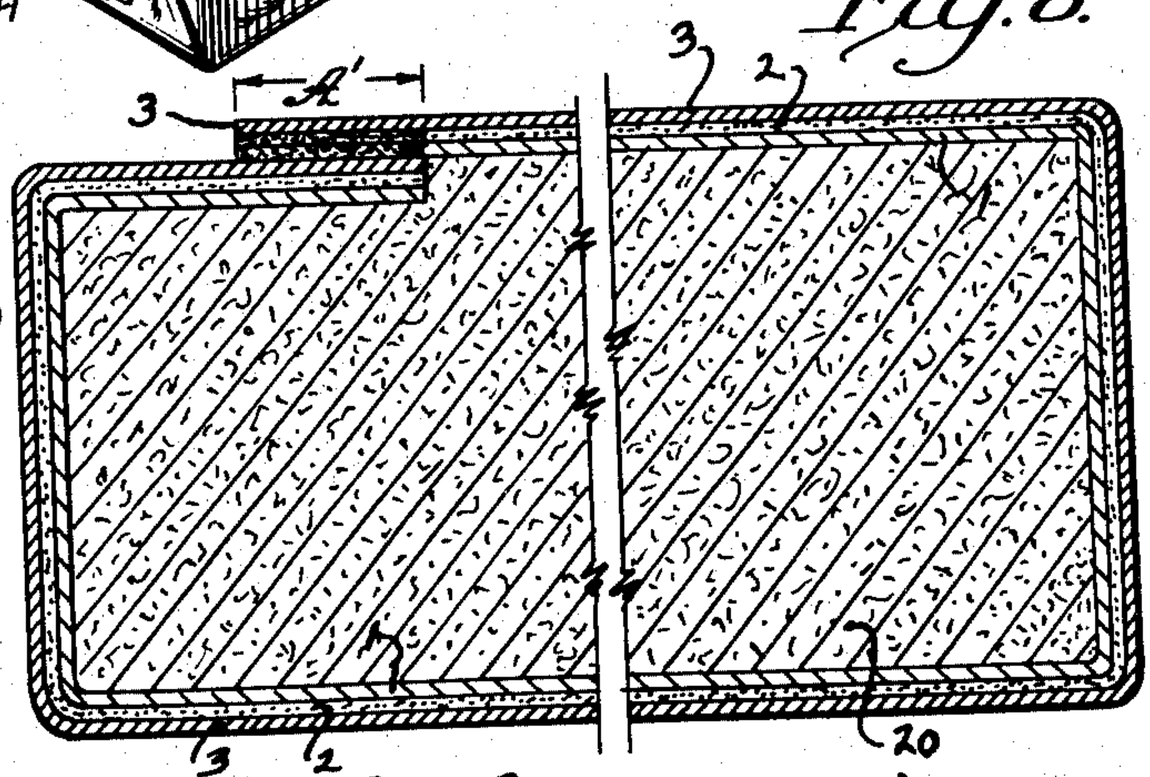
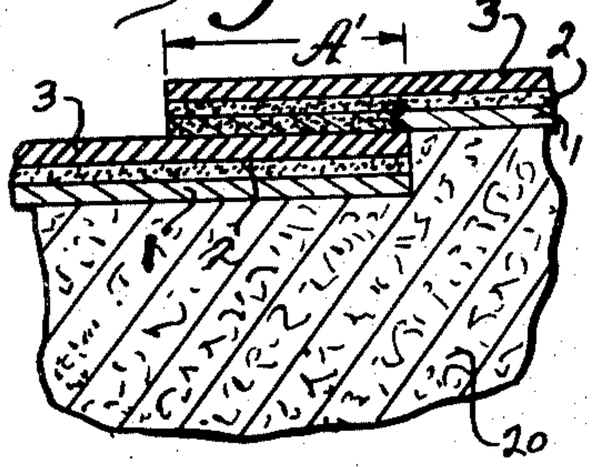


Fig. 9.



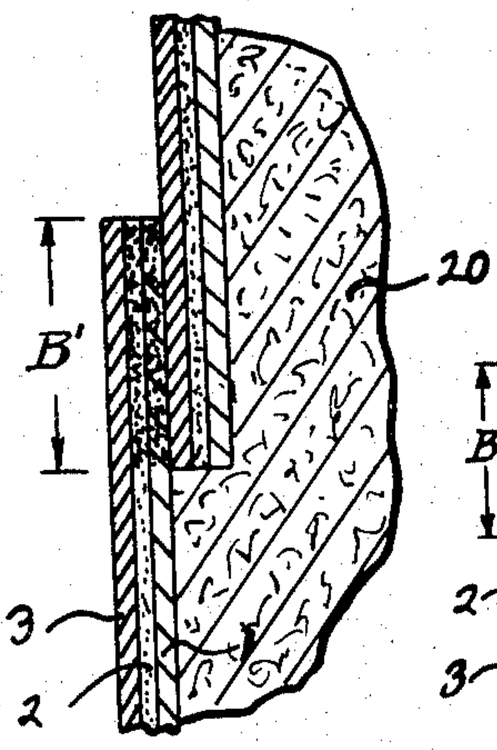


Fig. 11.

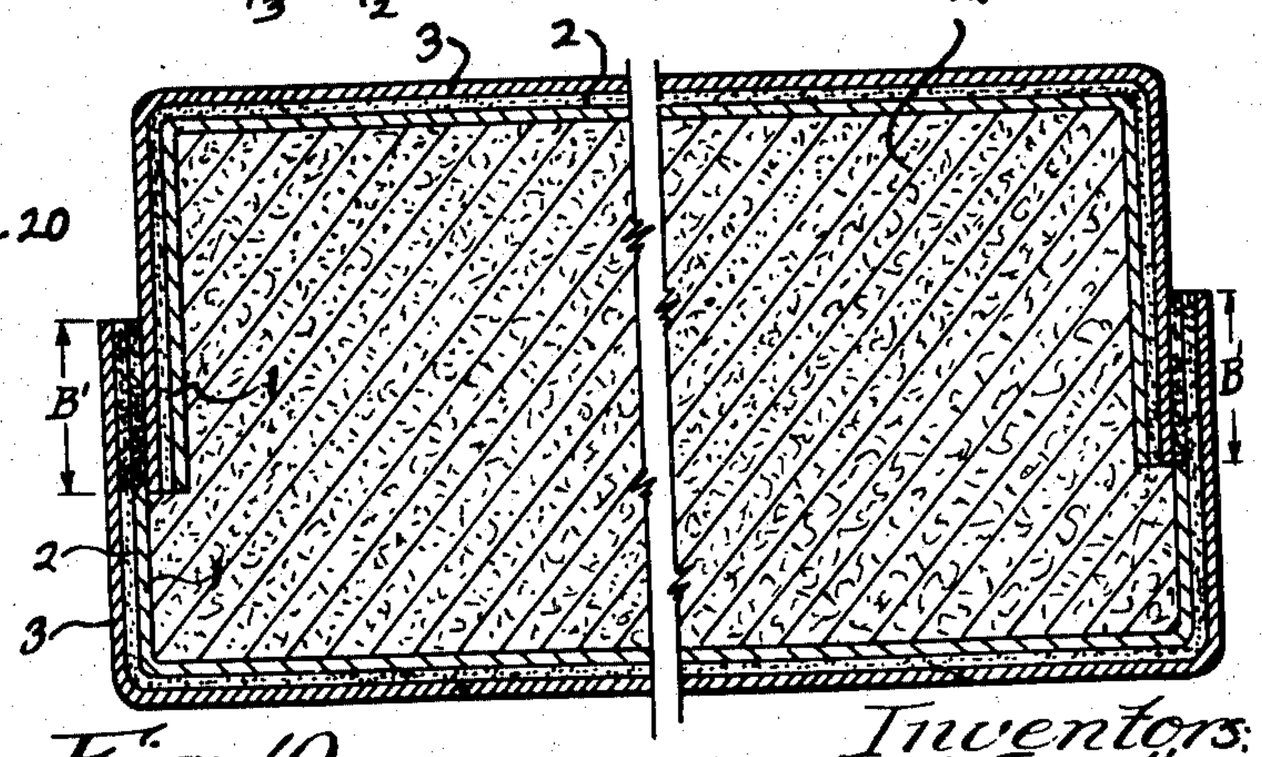


Fig. 10.

Inventors:
Robert A Farrell +
Charley L. Wagner
By Joseph Rossman Atty.

Patented Nov. 11, 1947

UNITED STATES PATENT OFFICE

2,430,459

LAMINATED SHEET HEAT-SEALABLE CONTAINER

Robert A. Farrell and Charley L. Wagner, Menasha, Wis., assignors to Marathon Corporation, a corporation of Wisconsin

Application January 22, 1944, Serial No. 519,392

7 Claims. (Cl. 229—55)

1

This invention relates to packages and containers formed from heat-sealable sheet materials not having any exposed coating material on its outer surfaces. More specifically, this invention relates to packages and containers made of heat-sealable sheet material having a composition provided internally of the sheet material that is not normally exposed, but which is activated and brought to the surface to provide an adhesive film which forms a seal upon application of heat and pressure to any suitably selected area desired to be sealed.

Further details and advantages of the invention will be apparent from the following specification and drawings wherein:

Figure 1 is a perspective view of the heat-sealable sheet material partly broken away to show the components thereof that is used for making packages and containers,

Figure 2 is an enlarged sectional view taken on lines 2—2 of Figure 1,

Figure 3 is a plan view of a bag made of the heat-sealable sheet material illustrated in Figure 1,

Figure 4 is an enlarged fragmental sectional view taken on lines 4—4 of Figure 3,

Figure 5 is an enlarged fragmental sectional view of the upper portion of Figure 4,

Figure 6 is an enlarged sectional view taken on lines 6—6 of Figure 3,

Figure 7 is a perspective view of a package wrapped and sealed in the heat-sealable sheet of Figure 1,

Figure 8 is an enlarged fragmental sectional view taken on lines 8—8 of Figure 7,

Figure 9 is an enlarged fragmental sectional view of the seam portion A' shown in Figure 8,

Figure 10 is an enlarged fragmental sectional view taken on lines 10—10 of Figure 7, and

Figure 11 is an enlarged fragmental sectional view of the seam portion B' shown in Figure 10.

Hitherto available heat-sealable sheet materials for packaging purposes and for making containers have been provided with a surface coating of suitable compositions which are activated or softened by action of heat when a seal or seam is to be formed. Such sheet materials are difficult to handle prior to use due to their pressure sensitive properties when they are stacked or rolled up as the outer coating composition has a tendency to cause blocking or sticking together of the contacting sheets or layers. Furthermore, such prior external coatings cause difficulty when the sheet materials are handled by wrapping machinery as the coating may adhere to machine parts or scrape off and accumulate on moving parts and thus prevent efficient operation. There are also many sticky and soft types of heat-sealable compositions that could not be possibly used as exposed external coatings that can now be used in heat-sealable sheets made in accordance with our invention as the composition in our sheet is not exposed and will not cause blocking or cause adhesion of any contacting materials.

2

These disadvantages and difficulties have been effectively overcome by our invention as we utilize an efficient heat-sealable sheet made of superposed plies of sheet materials without having any external coating thereon of any kind. The sheets are united by an intermediate continuous film formed of a suitable composition and of suitable thickness on basis weight (pounds per 480 sheets size 24 x 36 in.) so that upon application of heat and pressure to any selected area thereof an adhesive film will be generated on the outer surface of one of the sheets. According to one embodiment of our invention we utilize a combined sheet material, comprising a base sheet 3, as shown in Figures 1 and 2, and a relatively porous sheet material 1, these sheets being united by an intermediate continuous flexible smooth uniform thermoplastic film 2 of a suitable composition. An important characteristic of sheet 1 is that it is relatively porous and permeable as compared with the base sheet 3 in regard to the intermediate layer 2 when in softened or molten condition. When the combined sheet is subjected to heat and pressure, the film 2 will migrate, pass or strike through the porous sheet to provide a sealing adhesive film on the surface of the porous sheet in sufficient amount to form a strong seal, seam or bond at any area where desired. The porous sheet not only permits the adhesive film to migrate to the surface of the sheet, but it also serves to reinforce the adhesive film thereby preserving its continuity when the sheet is creased, folded or seamed. The continuity of the intermediate film is thus not broken or impaired by handling, use, or when the sheet is converted into containers and receptacles, or during any packaging operations, thereby tending to retain the initial vapor and moistureproof and other protective properties of the combined sheet.

Such sheet material is used to form bags, receptacles, containers, cartons, packages, linings for receptacles, tubes and the like of any suitable construction which are generally referred to as a "container" in the appended claims. For ex-

ample, in forming bags from the sheet material, the longitudinal edges 32 of a sheet 10 of suitable dimensions may be folded so as to form an overlapped longitudinal seam as shown in Figure 3. The sheet is folded so that the dense sheet 3 is on the exterior of the bag and the porous sheet 1 is on the interior surface of the bag as shown in Figure 4. The longitudinal seam is formed by heat sealing the sheet to itself as illustrated in Figure 6 or by use of any suitable external adhesive. The bottom seam 31 is then formed by applying heat and pressure to the bottom edge area A of the bag. The seam is shown in larger scale in Figure 4. Any substance 20 desired to be packaged is then placed within the bag and then the upper seam 30 is formed by applying heat and pressure to the area A. As shown in Figure 5, in forming the top and bottom seams superposed areas of the porous sheets are brought in face to face relation and the film 2 at these areas is driven through to the inter faces between the contacting areas of the sheet 1 so as to form a very strong and tight seam.

Many other types of packages may be made with our heat-sealable sheet material as illustrated, for example, in Figures 7 to 11. The article is fully enclosed in the sheet material by overlapping the longitudinal edges 43 to form an overlapped portion of width A'. This overlapped area may be sealed if desired by applying heat and pressure thereto so as to cause the adhesive film 2 to migrate through the porous sheet 1 and form a bond at the overlapped portions to form a seam 43 as illustrated in Figures 8 and 9. If desired, ordinary adhesives may be applied between the overlapped portions instead of using heat and pressure. The ends of the sheet material are then folded over in any suitable desired folds as shown, for example, in Figure 7. Heat and pressure may then be applied to the ends over the entire area, or at selected areas as indicated by numeral 42, to drive the adhesive layer 2 through the porous sheet and generate an adhesive bonding film at the surface so as to retain the folds as illustrated in Figures 10 and 11. If the wrapper is folded so as to bring portions of the porous sheet together in face to face contact then a seal of the character as illustrated in Figure 5 will also be formed. Obviously, many types of folds and seams can be formed with our sheet material, and by application of heat and pressure the interposed intermediate adhesive layer 2 will generate an adhesive film at the interface of the folded or overlapped areas to provide a good bond for the package.

In practical production of our heat-sealable sheet material we apply the homogeneous thermoplastic heat-sealing composition preferably as a smooth continuous flexible coating of suitable uniform thickness on the base sheet by any suitable means and under such controlled conditions as to prevent formation of a surface film on the exposed face of the porous sheet. We may apply our molten adhesive composition between the base sheet and cover sheet by means of suitable rotating rolls adjusted so as to provide a controlled and predetermined thickness of film between the sheets. The combined sheets may be chilled to control the degree of penetration of the adhesive therethrough. The viscosity and physical characteristics of the adhesive composition may also be suitably controlled to prevent migration of the composition through the porous sheet when the sheets are combined with the adhesive. Instead of applying the adhesive as a continuous film

we may apply the composition only in certain predetermined areas and of any suitable contour. The composition, for example, may be applied in the form of bands or stripes at the margins or other portions between the sheets so that the sheets are heat-sealable only in such areas. The adhesive composition may also be applied by means of knurled or specially contoured rollers so as to apply the adhesive in suitably spaced areas or in the form of discrete particles or spots instead of in a continuous film form. In such application a sufficient quantity of the adhesive is applied so that it will migrate through the porous sheet to form a seal or bond.

Any suitable base sheet material 3 is selected depending upon the particular usage of the final product, such as paper, paper board, regenerated cellulose, glassine, parchment paper, rubber hydrochloride, cellulose acetate, ethyl cellulose, vinyl resins, any suitable synthetic resin foils, metal foils and the like. The sheet material may be treated so as to impart any desired additional characteristics thereto such as greater imperviousness to the adhesive used, wet-strength, greaseproofness and flexibility. In the case of paper, it may be suitably coated and supercalendered for printing purposes.

The sheet 1 is selected so as to be relatively porous as compared with the base sheet 3, and of such structure as to permit migration of the molten or softened intermediate layer 2 to the surface of the porous sheet, through the material of the sheet itself or through any interstices, pores, channels, openings or perforations present in the sheet 1. In other words, the sheet 1 is selected so as to have suitable physical or structural characteristics so as to permit the molten or softened adhesive layer 2 to migrate or pass outwardly to the exposed surface of the porous sheet. Depending upon the type of porous sheet selected, the molten adhesive will migrate either through the substance of which the sheet may be made or through any interstices, pores, channels, slits or openings existing in the sheet. Light weight paper tissue, for example, has a porous structure formed by interlacing of cellulosic fibers which permits the molten or softened adhesive to pass through the sheet readily.

Our invention, however, is not restricted to the use of paper tissue sheets. We may use any suitable type of porous, woven or reticulated sheets, such as woven and knitted fabrics, netting, and the like. We may also use comparatively dense or impervious sheets, such as parchment paper, glassine, regenerated cellulose, and even metal foils, by providing slits, holes, or openings of suitable dimensions and suitably distributed throughout such sheet materials or in selected and predetermined areas so as to permit the molten or softened adhesive layer 2 to pass through such openings. The expression "porous sheet" is intended to include any of the previously described sheets which permit the softened or molten adhesive layer 2 to migrate to the surface thereof in sufficient amount to provide an adhesive sealing film on the outer surface of the porous sheet. We prefer to use a porous sheet made of light weight paper tissue relatively lighter in weight than the base sheet, for example, less than 20 lbs. paper sulphite tissue. Such tissue sheet is comparatively porous with respect to the base sheet so as to permit the adhesive layer to migrate differentially in greater amount by weight per unit weight of sheet through the porous sheet rather than the base sheet so as to generate an adhesive

film on the outer surface of the porous sheet. The porous paper sheet may be treated if desired with urea-formaldehyde resins, or melamine resins, in small amounts, say 1 to 5% by weight, to increase its wet-strength without however affecting its porosity and other original physical characteristics. Both the base sheet and porous paper sheet may be wax-sized or dry-waxed to increase their waterproofness, moldproofness, wrapping machine workability, etc.

In any particular combination of base sheet and porous sheet the intermediate adhesive layer is of such character that upon application of heat and pressure to the combined sheet the intermediate layer upon melting or softening will be driven or migrate differentially through the porous sheet and penetrate to the surface thereof, rather than tend to migrate through the base sheet which resists the migration of the adhesive therethrough as it is relatively more impervious and/or dense than the porous sheet. The adhesive, in other words, will take the path of least resistance and will penetrate through the porous sheet and only partially, if at all, through the relatively denser base sheet to generate an adhesive sealing film on the surface of the porous sheet.

The sheet 1 may be treated so as to permit migration of the adhesive only at certain predetermined areas. This may be accomplished, for example, by lacquering a porous paper sulphite tissue sheet in certain predetermined areas so that the adhesive will not migrate through the sheet at such treated areas. A dense type of sheet may also be provided with suitable openings, slits, or pinholes at certain predetermined areas through which the adhesive may migrate, but not elsewhere.

We find it advantageous to form the intermediate adhesive film so as to have a basis weight of at least about 1½ to 2 times or preferably more than the basis weight of the porous sheet when using, for example, a paper base sheet of 17 lb. sulphite and 9 lb. porous sulphite paper sheet. When such thickness of the intermediate film is provided there will be sufficient adhesive composition to bond the sheets together, and also upon application of heat and pressure, the intermediate composition will penetrate and saturate the porous sheet to such extent as to migrate to the surface and form a suitable bonding film at the outer surface thereof.

Suitable thermoplastic intermediate adhesive layers which we may use are selected or blended microcrystalline waxes; microcrystalline waxes having one or more added ingredients such as various elastomers, resins, gums, rubber, synthetic rubber, isobutylene and butylene polymers, metallic soaps such as aluminum soaps of the higher fatty acids as aluminum stearate, oleate or palmitate in amounts from 1 to 30% by weight; paraffin wax containing any of the previously mentioned ingredients added thereto and in about the same amounts; cellulose derivative compositions; synthetic resins, such as phenol-formaldehyde resins, ureaformaldehyde resins, vinyl resins; asphalts; natural gums; protein-containing compositions such as zein; and casein. These compositions are utilized for combining and adhering the base sheet to the porous sheet in any known manner, as previously explained, so as to control selectively the degree of penetration of the composition into the base and relatively porous sheet. When using thermoplastic hot-melt compositions having wax as the base ingredient, we may chill the combined sheets at the point of

combining so as to control penetration or migration of the composition through both combined sheets. The ingredients of the composition used may be suitably selected and compounded so as to have suitable viscosity so as to be non-penetrating with respect to the sheets to be united during the uniting operation. The conditions under which the sheets are combined, such as speed of uniting, temperature of application of the adhesive, chilling of the combined sheets also can be controlled in any known manner to prevent penetration. In this way we obtain a heat-sealable sheet which has a continuous flexible uniform layer of the intermediate sealing composition without any of the composition being present on the outer exposed surfaces of the sheet. We may retain the original unimpaired physical surface characteristics of the sheet materials used so that they can be printed, coated, glued or treated in any desired manner without disturbing the intermediate layer which is activated and provides a sealing means only upon application of heat and pressure to selected areas of the combined sheet.

The following are typical specific examples of our sheet material, the numerals preceding each component being the same as in the drawings, weights being given per ream (480—24 x 36):

Component	Pounds weight per ream
Example 1	
1. Porous dry-waxed sulphite tissue paper	13.2
2. Microcrystalline wax M. P. 140°-160° F.	19.3
3. High wet strength bleached kraft paper	33.5
Total	66.0
Example 2	
1. Porous sulphite tissue paper	9.0
2. 3% aluminum stearate, 5% ester gum, and 92% microcrystalline wax M. P. 145° F., by wt.	22.0
3. One side clay coated paper	40.0
Total	71.0
Example 3	
1. Porous sulphite tissue paper	9.0
2. 3% aluminum stearate, 5% ester gum, and 92% microcrystalline wax M. P. 145° F., by wt.	20.0
3. Supercalendered sulphite paper	17.0
Total	46.0
Example 4	
1. Porous dry waxed sulphite tissue paper	11.0
2. 3% aluminum stearate, 5% ester gum, and 92% microcrystalline wax M. P. 145° F., by wt.	25.0
3. Regenerated cellulose	20.0
Total	56.0
Example 5	
1. Porous sulphite tissue paper	9.0
2. 3% aluminum stearate, 5% ester gum, and 92% microcrystalline wax M. P. 145° F., by wt.	25.0
3. Highly plasticized glassine	30.0
Total	64.0

Example 6

1. Porous sulphite tissue paper	9.0
2. 97% by wt. microcrystalline wax M. P. 145–7° F. and 3% by wt. aluminum stearate	19.0
3. Highly hydrated greaseproof sulphite paper	17.0
Total	45.0

Example 7

1. Porous sulphite tissue paper	9.0
2. 3% aluminum stearate, 5% ester gum, and 92% microcrystalline wax M. P. 145° F., by wt.	30.0
3. 0.016 in. machine calendered paper board	200.0
Total	239.0

Our sheet materials are suitable for making heat-sealable containers and for packaging or wrapping any desired articles. Overlapped portions of the container or wrapper can be sealed by applying heat and pressure thereto as previously explained to form a very strong and tight seal. Inasmuch as our intermediate film is not exposed, any materials packaged in our sheet material will not come into direct contact with the sealing film. In the previous types of externally coated heat-sealable sheet materials there was a tendency for these coatings to peel and crumble, particularly at low temperatures prevailing for packaging and storing frozen foods, thereby contaminating the packaged foods. Our inner film is protected against damage, puncture, abrasion, adhesion of foreign substances, dirt, etc. by being covered by the porous sheet. Our sheets will not block or stick together since they have no external coatings to cause adhesion. Both outer sides of some of our laminated sheets may be printed if desired. Usually only the exposed face of the base sheet is printed for packaging purposes.

Our combined sheet material has many characteristics which make it highly suitable as a container or wrapper for foodstuffs. It is highly moistureproof in both flat condition as well as after folding or scoring as the adhesive layer is supported by the porous sheet and is highly flexible, water and moistureproof. Our composite sheet is very pliable, flexible and easily folded. It has a little spring-back as compared with ordinary sheets when folds are made during packaging operations, in both manual and automatic packaging operations. When our sheet material is folded it tends to remain in the folded condition and does not resist bonding when seams are formed. Thus a minimum of heat is required for forming seals at the overlapped portions and the packaged contents are thus less likely to be deteriorated by the heat applied. Some materials such as yeast, for example, are very sensitive even to slight heat. Our sheet materials provide very effective heat-sealable wrappers for yeast. Such yeast packages have excellent keeping qualities and longer shelf life than prior packages. On account of the flexibility and continuity of our intermediate film our sheet material produces square and well formed packages. No disruption of the intermediate film will occur at the corners of the folds when packages are made as the porous sheet serves to reinforce and protect the intermediate film in those areas where the previous types of exposed coatings are liable to crack and peel during folding and creasing operations, losing their protective qualities.

Numerous modifications and other combinations of laminated sheet materials may be made utilizing the essential features of our invention. For example, instead of using a single base sheet we may utilize a suitable base sheet made of two or more plies of sheet materials selected so as to have any desired characteristics. The base sheet may also be provided with a continuous thermoplastic film on both faces to which a relatively porous sheet is united so that such triple-ply sheet will be heat-sealable on either face.

Our sheet materials are suitable for forming heat-sealable bags, receptacles, containers, cartons, tapes, labels, tags, pouches, envelopes, tubes, gaskets, caps, bottle closures and the like. In making bags, cartons and receptacles of any kind the base sheet can constitute the exposed surface of the package, while the porous sheet provides the inner surface of the container which contacts the materials packaged therein. After packaging the materials the open ends can be readily sealed by application of heat and pressure, either contacting superposed portions of the porous sheet in face to face contact or by sealing overlapped portions in the same manner.

Numerous changes and modifications may be made in the specific embodiments of our invention utilizing the essential and significant features of our invention as fully disclosed herein. It is intended to include such modifications within the scope of the appended claims.

We claim:

1. A laminated container having wall portions thereof formed of a heat-sealable sheet comprising in adhered condition a relatively dense base sheet material, an intercalated continuous flexible thermoplastic film and a thin relatively porous tissue sheet adhered to said film, said film not substantially penetrating said sheet materials and being of a predetermined basis weight and confined to the inner surface of the porous sheet, the outer exposed surface of said porous sheet being substantially unchanged from its original characteristics, selected portions of said sheet being overlapped and having at least one porous tissue surface at the interfaces of the overlapped area and adhered together by an adhesive film generated at the interfaces of said overlapped portions by application of heat and pressure to said selected portions and migration of said intercalated film through said porous sheet to the surface area thereof.

2. A laminated container having wall portions thereof formed of a heat-sealable sheet comprising in adhered condition a base sheet material of cellulosic material having a relatively dense structure, an intercalated continuous flexible thermoplastic film and a thin relatively porous tissue sheet adhered to said film, said film not substantially penetrating said sheet materials and being of a predetermined basis weight and confined to the inner surface of the porous sheet, the outer exposed surface of said porous sheet being substantially unchanged from its original characteristics, selected portions of said heat-sealable sheet being overlapped and having at least one porous tissue surface at the interfaces of the overlapped area and adhered together by an adhesive film generated at the interfaces of said overlapped portions by application of heat and pressure to said selected portions and migration of said intercalated film through said porous sheet to the surface area thereof.

3. A laminated container having wall portions thereof formed of a heat-sealable sheet comprising in adhered condition a base sheet material of metal foil, an intercalated continuous flexible thermoplastic film and a thin relatively porous tissue sheet adhered to said film, said film not substantially penetrating said sheet materials and being of a predetermined basis weight and confined to the inner surface of the porous sheet, the outer exposed surface of said porous sheet being substantially unchanged from its original characteristics, selected portions of said sheet being overlapped and having at least one porous tissue surface at the interfaces of the overlapped area and adhered together by an adhesive film generated at the interfaces of said overlapped portions by application of heat and pressure to said selected portions and migration of said intercalated film through said porous sheet to the surface area thereof.

4. A laminated container having wall portions thereof formed of a heat-sealable sheet comprising in adhered condition a relatively dense base sheet material, an intercalated continuous flexible thermoplastic film comprising microcrystalline wax and a thin relatively porous tissue sheet adhered to said film, said film not substantially penetrating said sheet materials and being of a predetermined basis weight and confined to the inner surface of the porous sheet, the outer exposed surface of said porous sheet being substantially unchanged from its original characteristics, selected portions of said sheet being overlapped and having at least one porous tissue surface at the interfaces of the overlapped area and adhered together by an adhesive film generated at the interfaces of said overlapped portions by application of heat and pressure to said selected portions and migration of said intercalated film through said porous sheet to the surface area thereof.

5. A laminated container having wall portions thereof formed of a heat-sealable sheet comprising in adhered condition a relatively dense base sheet material, an intercalated continuous flexible thermoplastic film comprising a wax and an elastomer and a thin relatively porous tissue sheet adhered to said film, said film not substantially penetrating said sheet materials and being of a predetermined basis weight and confined to the inner surface of the porous sheet, the outer exposed surface of said porous sheet being substantially unchanged from its original characteristics, selected portions of said sheet being overlapped and having at least one porous tissue surface at the interfaces of the overlapped area and adhered together by an adhesive film generated at the interfaces of said overlapped portions by application of heat and pressure to said selected portions and migration of said intercalated film through said porous sheet to the surface area thereof.

6. A laminated container having wall portions thereof formed of a heat-sealable sheet comprising in adhered condition a relatively dense base sheet material, an intercalated continuous flexible thermoplastic film comprising a wax and rubber 1 to 30% by weight and a thin relatively porous tissue sheet adhered to said film, said film not substantially penetrating said sheet materials and being of a predetermined basis weight and confined to the inner surface of the porous sheet, the outer exposed surface of said porous sheet being substantially unchanged from its original characteristics, selected portions of said sheet being overlapped and having at least one porous tissue surface at the interfaces of the overlapped area and adhered together by an adhesive film generated at the interfaces of said overlapped portions by application of heat and pressure to said selected portions and migration of said intercalated film through said porous sheet to the surface area thereof.

7. In a container formed of a heat-sealable sheet material having in adhered condition a relatively impermeable base sheet material, an intercalated continuous flexible thermoplastic film and a thin relatively porous tissue sheet adhered to said film, said film being of predetermined basis weight and not substantially penetrating said sheet materials, and being confined to the inner surface of the porous sheet, the outer exposed surface of said porous sheet being substantially unchanged from its original characteristics, a seam formed of selected portions of said sheet material positioned in overlapped relation to bring portions of said porous sheet in face to face contact and adhered together by an adhesive film generated at the interfaces of said overlapped portions by application of heat and pressure to said selected portions and migration of said intercalated film through said porous sheet to the surface area thereof.

ROBERT A. FARRELL.
CHARLEY L. WAGNER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,048,123	Howard	July 21, 1936
2,154,083	Bergstein	Apr. 11, 1939
2,184,139	Cunnington	Dec. 19, 1939
2,371,314	Rhodes et al.	Mar. 13, 1945
2,333,330	Moore	Nov. 2, 1943
2,054,116	Abrams et al.	Sept. 15,1936
1,937,518	Henderson et al.	Dec. 5, 1933