June 21, 1938. J. H. BROWN 2,121,013

ARTICLE AND MATERIAL CONTAINING ORGANIC DERIVATIVES OF CELLULOSE

Filed Nov. 7, 1935

Fig. 1.

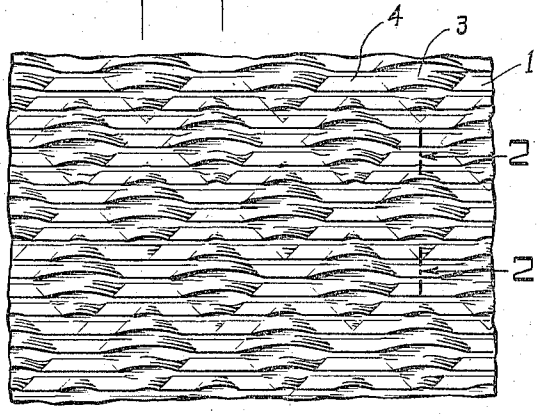


Fig. 2.

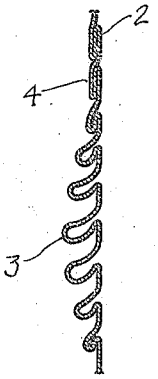


Fig. 3.

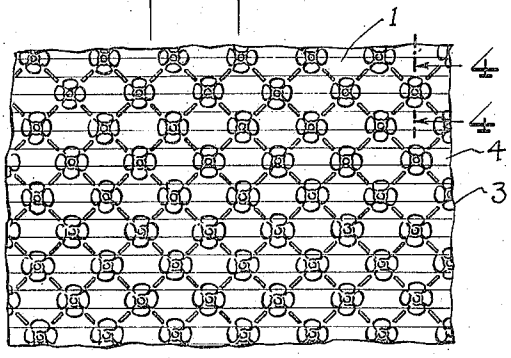


Fig. 4.

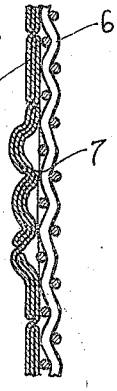


Fig. 5.

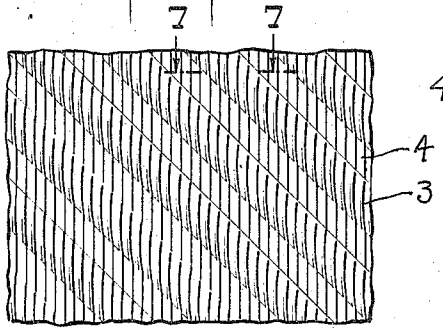


Fig. 6.

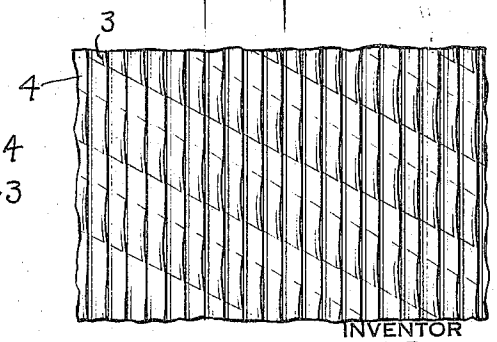


Fig. 7.



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UNITED STATES PATENT OFFICE

2,121,013

ARTICLE AND MATERIAL CONTAINING ORGANIC DERIVATIVES OF CELLULOSE

Joseph H. Brown, Brooklyn, N. Y., assignor to Celluloid Corporation, a corporation of New Jersey

Application November 7, 1935, Serial No. 48,663

4 Claims. (Cl. 41—24)

This invention relates to a permanently pleated and shaped sheet, film or foil containing a derivative of cellulose and to the articles made therefrom.

This application is a continuation-in-part of my co-pending application S. No. 19,384, filed May 2, 1935, which has issued as Patent No. 2,025,568, and my copending application S. No. 41,629, filed September 21, 1935.

An object of this invention is the economic and expeditious production of pleated and embossed sheets, films or foils containing derivatives of cellulose. A further object of this invention is the preparation of materials suitable for decorative purposes, which materials are substantially moistureproof and resistant to weather changes. Other objects of the invention will appear from the following detailed description.

As is known, pleated sheeting materials of paper, fabric, etc. have been used in the lamp shade industry. Such pleated materials have not been entirely satisfactory, due to the fact that the pleats thereof had to be stitched in to hold them in shape and after stitching it was impossible to place the same over irregular lamp shade forms or other articles. Where paper, parchment and like materials in pleated form were used, the pleats when once pulled out, either intentionally or accidentally, rendered the material unfit for its intended purpose as it no longer hugged and fit the form but remained permanently distorted. By employing this invention, which in general terms may be described as pleating then embossing thin sheets or foils of a derivative of cellulose, there is produced an article which may be stretched over forms of irregular shape and which always tend to resume the shape it had before being stretched over the form.

In accordance with this invention, there may be formed lamp shades or other articles that have a crystal clarity which feature cannot be produced in paper, parchment, fabric, etc. Moreover the material may be formed of any desirable thickness of sheet material so that it may possess a degree of strength suitable for the purpose intended and still retain its crystal clarity.

A further advantage of the article produced in accordance with this invention is that it is practically moisture-proof and resistant to weather changes. Thus, the material may be used in moist or damp places or extremely dry places without any substantial change in its form being effected, such as, for example, the release of the pleats or the drooping of the material when the article is kept in damp places, or the cracking and splitting of the material when the article is kept in extremely dry places. Another desirable property of the material produced in accordance with this invention is that an article made therefrom may be sponged, washed and otherwise cleaned without damage thereto since the pleats are not removed, and the material is not streaked by the dirt, in the cleaning of the article.

The material made in accordance with this invention also has the advantage over paper, fabrics and parchment, etc. in that it has no nap or filament ends to catch dust and other materials such as normally collect on lamp shades of paper, parchment and textile fabric. The surface of the new material is substantially smooth and does not act as a trap for dust particles and lint.

A further advantage of this invention is that although the sheeting material may be very thin and light in weight it is very durable even when pleated, and unlike paper, parchment or other sheeting material, is not readily torn. Not only is the material durable but it also retains its pleated shape under all atmospheric conditions without necessitating the sewing thereof, thus offering a marked advantage over silk and other fabrics whose edges must be sewed together to maintain the pleat.

The pleated and embossed sheets or foils made in accordance with this invention exhibit a unique "rubber" elasticity. They can be stretched an appreciable distance before permanent deformation takes place. In making a lamp shade, for example, a rectangular blank of pleated and embossed sheeting material containing a derivative of cellulose is cut and the two ends are cemented together with any suitable cellulose ester film cement. When this sheet which is in tubular form is stretched over the frame of a lamp shade, it will be found that the formed sheet hugs the frame tightly and conforms to the shape of the frame even in the case where the form of the frame is concave. This is a distinct advantage, since it not only makes for economy of material but also insures permanency of form. Lamp shade blanks, as heretofore made, were usually stamped out in irregular or circular form. However, in the case of pleated sheets containing derivatives of cellulose, the blanks may be rectangular in form regardless of the shape of the frame they are to fit, thereby resulting in very little, if any, wastage of material. The elasticity of the pleated product can be appreciated when it is known that there is usually a length shrinkage of about 80% when placing the pleats in the material, which pleated product may be pulled out or stretched to substantially its original length and upon being released returns to its shrunken length. In other words, a strip of foil 100 inches long when pleated in pleats of about ⅛ of an inch measures only 20 inches in length. The resultant elasticity, resiliency or tendency to return to its short length when the pleated foil is

stretched is profitably utilized in covering and wrapping many articles of irregular shape. All other products such as paper, parchment, sheets of gelatin, sheets of regenerated cellulose, fabric, etc. do not exhibit this remarkable stretching characteristic which makes the material of the present invention particularly desirable for use in wrapping, covering or decorating articles of irregular shape.

While the material of this invention may be of crystal clear transparency, it may also be attractively decorated with designs by printing, lacquering, stenciling, etc. applied prior to, during or subsequent to the embossing thereof. Furthermore, the base material may contain various effect materials which alter its transparency, thus producing a material which may be translucent, opaque or mottled. These transparent, translucent and opaque effects may be uniform throughout the whole area of the material or may be contained in the base material only in local areas. Moreover, these various effects may be produced in the material without adding materially to the weight thereof and without afterwards altering the physical characteristics of the clear product. The articles made therefrom are extremely light in weight, are odorless and are permanent as to their shape, color, transparency, etc.

A distinct advantage of the material in the present invention is that when using the crystal clear product it allows for the transmission of ultra violet light rays. This quality is of great advantage when employing the material as lamp shades, screens, etc.

In accordance with my invention, I prepare a sheet, film or foil containing a derivative of cellulose with or without a plasticizer by inserting bends or pleats in the sheet, film or foil under heat and pressure so that they are retained by the sheet, film or foil substantially permanently. These pleated sheets, films or foils are then smoothed out or flattened in a part of the pleated area, leaving the pleats of other areas of the material raised above the plane of the flattened portions and at an angle thereto. The pleating and embossing of the sheet material in this manner results in a product which may be pulled out to straighten it, and while under this stress the material exerts a strong force to resume its pleated shape, giving the effect of an elastic material. The product of this invention, therefore, is a sheet material containing pleats with the pleats of certain areas of the sheet lying in substantially the plane of the sheet while the pleats of other areas are raised and are at an angle to the plane of the sheet.

Any suitable thermoplastic sheet, film or foil made of or containing derivatives of cellulose may be pleated and embossed or employed as the base material in forming the pleated and embossed sheets. Sheets, films and foils of organic derivatives of cellulose, organic derivatives of cellulose mixed with plasticizers, and organic derivatives of cellulose mixed, with or without plasticizers, with effect materials may be employed. The sheet, film or foil which is pleated may be of any suitable thickness, for instance, from .0005 inch to .015 inch, preferably from .0008 inch to .003 inch. Although cellulose acetate is the organic derivative of cellulose which is preferably employed as the base of sheet material, other suitable organic derivatives of cellulose may be employed, such as the organic acid esters of cellulose and the cellulose ethers. Examples of the organic acid esters of cellulose are cellulose formate, cellulose butyrate and cellulose propionate while examples of ethers are methyl cellulose, ethyl cellulose and benzyl cellulose. While organic derivatives of cellulose as the base materials are preferred, cellulose nitrate foils and films may also be satisfactorily pleated with heat and pressure. After the sheet of cellulose nitrate has been formed into pleats, the pleated sheet may be given a denitrating treatment with alkaline solutions such as caustic soda, sodium hydrosulphide, etc.

The sheet stock to be pleated and then embossed preferably contains from 5–100% or more, based on the weight of the cellulose derivative present, of any suitable plasticizer. The amount of plasticizer employed depends upon the type and amount of effect materials, if any, contained in the sheets. Although any suitable plasticizer may be employed for forming the crystal clear thin organic derivative of cellulose sheets having especially high resiliency, it is preferable to employ from 5–30%, based on the weight of the organic derivative of cellulose present, of dibutyl phthalate.

However, any plasticizer which is suitable for the particular cellulose derivative or mixture of cellulose derivatives employed may be used. The plasticizers may be any of the high boiling solvents or softening agents, as for example, aryl sulphonamides, e. g. para-ethyl-toluol sulphonamide; the alkyl phthalates, e. g. dimethyl phthalate; the dialkyl tartrates, e. g. dibutyl tartrate; the alkoxy esters of polybasic organic acids, e. g. dimethoxy ethyl phthalate; the polybasic acid esters of the mono alkyl ethers of polyhydric alcohols, e. g. diethylene glycol ethyl ether ester of phthalic acid; the alkyl esters of phosphoric acid, e. g. triethyl glycol phosphate; the aryl esters of phosphoric acid, e. g. tricresyl phosphate; the mixed alkyl and aryl phosphates, e. g. ethyl-glycol dicresyl phosphate; and camphor.

The sheet stock which is to be pleated may contain any suitable effect materials to alter the transparency, resiliency, color, handle, fluorescence or other properties of the material. Thus, such effect materials as pigments, filling materials, dyes or lakes, fire retardants, plasticizers, waterproofing agents, etc. may be employed. Examples of fire retardants are beta chlornaphthalene, triphenyl phosphate, tricresyl phosphate, etc. Examples of filling materials that may be employed are powdered metals such as aluminum powder, bronze powder, etc., oxides and salts of metals such as antimony oxide, tin oxide, silky variety of mercurous chloride, lead iodide, lead oxide, lead carbonate, etc., or other filling materials such as powdered glass, metallic threads or lahm, organic materials such as fibres of cotton, wool, etc. or organic compounds such as resins, etc. Those resins may be employed that have a tendency to improve the retention of the plasticizer by the cellulose derivative as more fully disclosed in U. S. Patent No. 1,930,069. These effect materials may be incorporated in the sheet, film or foil stock by mixing the same with the solution from which they are formed, or by rolling them into the material during the formation of the film, foil or sheet, or by applying the same to the formed sheet in the presence of suitable solvents or swelling agents.

The sheet, film or foil may be pleated in any suitable manner, for instance, by running the same through a fabric pleating machine after having placed on either or both sides of the sheet

a thin sheet of paper as a guide and/or protection. The stock may be conditioned prior to passing it through the pleating machine by passing the same through a steam chamber, a chamber containing solvent vapors for the material of the stock, through a heated chamber, or through a heated liquid such as water. The material may be shaped into any desired form of pleat. I prefer, however, that the space between the bends of the material upon itself be of the order of less than one-half inch and more preferably of the order of ⅛ inch or less. Sheets having pleats of about one-eighth inch between bends have been found to be highly suitable for lamp shades and similar uses. However, larger or smaller pleats may be employed. The material may be formed into accordion pleats, box pleats, crystal pleats or other types of pleats, or the material may have more than one type of pleat formed therein.

When inserting pleats in the sheet, film or foil, it is preferable to set the pleat in the material by the aid of heat. The pleating roll of the pleating machine may be heated by any suitable means, as by steam, electric conductance or resistance coils or open flame, in such a manner that the material while being held in the pleated form, by steel bands or other pressing device, is plasticized or softened sufficiently that any stress in the material to straighten out is removed. For the purpose of setting the bends in the material prior to any considerable amount of handling of the material, the material, while in the pleated form, is cooled by the air or it may be cooled by passing the same over a metallic roll or other device having a cooling medium circulating therein. By this means the micelles in the base material are rearranged in such a manner that the bends forming the pleats are made permanent or substantially so, giving to the material the property of exerting a force such that when pulled out it tends to return to its tightly pleated condition.

The sheet base material after having been pleated may be subjected to an embossing action, by means of heat and pressure, whereby local areas on the surface of the sheet have the pleats flattened to a very tightly closed position while other areas which are not subjected to heat and pressure have the pleats in a partially opened condition. By embossing the pleated material by means of heat and pressure and then cooling the material prior to extensive handling the embossed figure may be permanently set in the material. The embossing of the sheet material may be accomplished by means of flat presses having a male and female plate or a flat plate and an engraved plate, one or both of which are heated or by embossing rollers one or both of which are engraved and one or both of which are heated. Furthermore, the sheet material may be embossed by a swedging action, i. e. where one plate or roll of the embossing device is of a resilient material that pushes the sheet material into the opening of the other plate or roll.

By this invention very desirable flat, flexible, high decorative materials may be formed. For instance, the pleated foil which may have a colored lacquer applied on one or both sides may be attached to any suitable base, such as flannel, felt, paper, natural or artificial silk, artificial sheet material, etc., by any suitable cement. Contact between the pleated material and these bases is made only at the edges of the pleats. The assembly with raised pleats is then placed into a press and embossed in any desirable manner, producing effects in raised and flat pleats, and at the same time a lamination between the flat pleats and the backing of sheet material is effected. The same lacquering and embossing operation may be performed on pleated material wherein the pleated film, foil, etc. is not attached to a backing of flexible sheet base material. The sheet material formed by pleating and embossing the sheet, film or foil of an organic derivative of cellulose which has no backing or base attached thereto may be readily cemented at the seams to make a stretchable tubing for countless applications. The cement may be applied to the edges of the pleated material to hold or weld it to metal frames, such as lamp shade frames and the like. Thus, in the case of a concave lamp shade, when the pleated and embossed cylindrical "stocking" is stretched over the frame, there will be a tendency of this material to spring upwards unless it is attached to the frame either by welding it thereto with cement or binding it thereto with a suitable tape or braiding. Suitable tape or braiding may be formed or molded from an organic derivative of cellulose or woven from textile materials, and the same may be attached to the pleated sheet material by applying a solvent or cement to the pleated material and pressing the tape or braiding into the softened material.

The pleated and embossed sheet material may be laminated onto other sheet material such as fabrics, paper, felt, leather, wood, glass, etc. For the purpose of causing an adhesion, between the preformed pleated and embossed sheet material and other sheet material, any suitable cementing agent may be employed.

Two or more layers of the pleated and embossed material having the same size pleats or different size pleats may be imposed one upon the other with or without additional material between the layers. The pleats in the two layers may be caused to run parallel and the embossing matched or the pleats may be run at right angles to each other to produce novel effects, particularly when the different layers have variegated color effects. The layers may be superimposed upon each other before, during or after the embossing step. The pleated and embossed material may also be stretched fan shaped and the fan may be cemented to glass or other base material to yield ornamental radiating effects suitable for placing at the back of wall lights, lights on mirrors and the like. This use of the material produces a most striking effect when lacquered with pearl essence.

Prior to pleating and embossing the film or foil, the same may be laminated with paper, silk and cellulosic fabrics, cellulosic sheet material, and other relatively flat, thin materials that may be lacking in that property that gives the elastic-like springiness to the pleated films containing an organic derivative of cellulose. The film or foil containing an organic derivative of cellulose may be laminated with the other materials by cementing agents with or without heat and pressure. Examples of cementing agents that may be employed are those described in U. S. Patents Nos. 1,981,141 and 1,835,619. Thus, an elastic-like material may be formed that has a cloth-like appearance by cementing a fabric to one or both sides of a film containing an organic derivative of cellulose and pleating the same in the presence of heat and under pressure. Also the film or foil containing an organic derivative of cellulose may be laminated with a film

or foil having an embossed surface in imitation of crepe or other ornamental effects.

A further modification may be formed by laminating an edging, such as a fold of paper, metal foil, cotton fabric, rayon fabric, cellulose acetate fabric or transparent sheet material of regenerated or reconstituted cellulose, to the sheet material containing an organic derivative of cellulose which itself may be laminated as described above. After laminating the sheet material with the other materials the same may be pleated and embossed. By this means both ornamental and protective edgings may be placed on the material. An example of this modification is in pleated and embossed collars for women or children, which are edged with a fabric to reduce the tendency of the sharp corners of the pleated material to irritate the skin by contact therewith.

The material, regardless of the shape in which it is formed, may be sprayed, brushed, dipped or otherwise treated with lacquers, varnishes, etc. in the form of solid colors, variegated colors in patterns, or flowers. Other designs may be stencilled or painted on the material. This produces, when using the crystal clear material, novel effects not attainable by the use of any other material now known in the art.

In the claims the term "sheets" is intended to include sheets, films and foils that may be formed by any suitable method. For instance, sheets may be formed by cutting the same from a solid block of an organic derivative of cellulose and plasticizer that may have been block-pressed in the presence of heat, while films and foils may be formed by extruding a solution of an organic derivative of cellulose, in a volatile solvent, through suitable orifices into an evaporative or precipitating medium, or they may be formed by casting the solution upon a surface, preferably a film casting wheel or the like.

For the purpose of aiding in the description of this invention, the same will be described with particular reference to the drawing. In the drawing, wherein like reference numerals refer to the same or similar elements in the respective figures,

Fig. 1 is a plan view of a sheet of material pleated and embossed in accordance with this invention,

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1,

Fig. 3 is a plan view of a sheet material containing a backing produced in accordance with this invention,

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3,

Fig. 5 is a plan view of a sheet material made in accordance with this invention,

Fig. 6 is a plan view of the same sheet contained in Fig. 5, the pleats of same being opened up due to the material being held in a stretched position, and

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 5.

The article 1 formed of the film, foil or sheet of the organic derivative of cellulose may comprise a plurality of pleats 2 which, prior to embossing, remain in a fairly open state as at 3. By heat pressing this pleated sheet material in local areas, the pleats of those areas pressed become flattened as at 4. In this manner novel designs may be made and articles produced having effects that could not be produced in any other way. The material has an elastic-like property, the degree of stretch being inversely proportional to the thickness of the sheet material employed as the base material.

A modified form of the invention is shown in Fig. 3. In this modification the article 1 is formed of a pleated foil 5 cemented to a backing material 6. Prior to embossing the assembly the backing material is cemented to the pleated material only at the edge of the pleats as at 7. This material may be embossed by an embossing device having any suitable design thereon. The resultant product is a sheet material having flattened pleated areas 4 and raised or open pleated areas 3 while the flattened areas of the sheet material is permanently attached to the backing material.

In Figs. 5, 6 and 7 there is shown a sheet material similar to that shown in Fig. 1 but having a different design embossed thereon. This sheet consists of pressed areas 4 wherein the pleats are flattened almost into a single plane and areas 3, where the pleats stand somewhat at an angle to the plane of the material. This material when not under any stress would have the appearance shown in Fig. 5. However, after this material is pulled out or stretched the pleats open up giving the appearance shown in Fig. 6. Upon releasing the material from the stretching stress the material will snap back into the position shown in Fig. 5 in a rubber-like manner. As shown in Fig. 6, the embossed design of the material is not removed when the material is stretched.

It is to be understood that the foregoing detailed description and drawing are merely given by way of illustration, and many variations may be made therein without departing from the spirit of my invention.

Having described my invention, what I desire to secure by Letters Patent is:

1. An article of manufacture comprising a rigid form having the exterior of the same covered with a sheet of an organic derivative of cellulose containing pleats, certain areas of the pleats lying in the plane of the article and the other areas of the pleats standing at an angle thereto, said sheet being extensible without loss of its pleated form.

2. An article of manufacture comprising a rigid form having the exterior of the same covered with a sheet of cellulose acetate containing pleats, certain areas of the pleats lying in the plane of the article and the other areas of the pleats standing at an angle thereto, said sheet be extensible without loss of its pleated form.

3. An article of manufacture comprising a film or foil containing an organic derivative of cellulose and having pleats formed therein, certain areas of the pleats lying in substantially the plane of the article and the other areas having the pleats standing at an angle thereto, said sheet being extensible without loss of its pleated form.

4. An article of manufacture comprising a film or foil containing cellulose acetate and having pleats formed therein, certain areas of the pleats lying in substantially the plane of the article and the other areas having the pleats standing at an angle thereto, said sheet being extensible without loss of its pleated form.

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