Nov. 30, 1937. P. R. ZINSER 2,100,891

METHOD OF DRAWING FIBROUS THERMOPLASTIC SHEET MATERIAL

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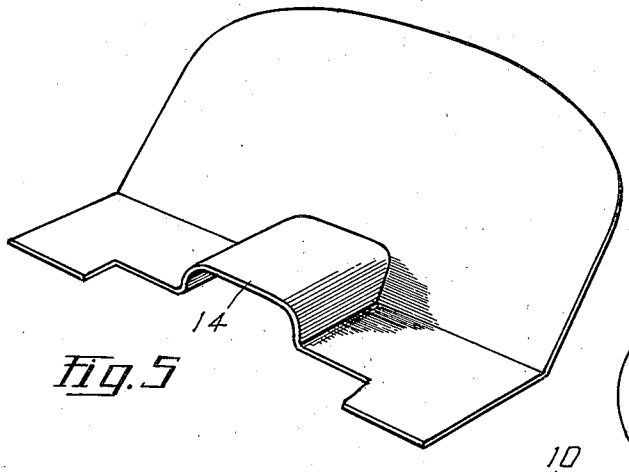
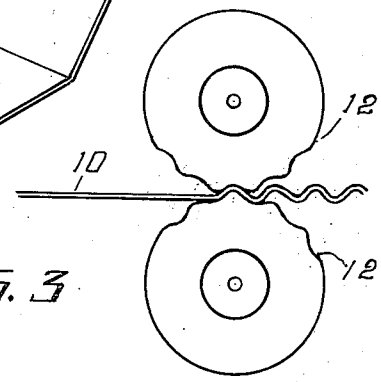


Fig. 5

Fig. 1



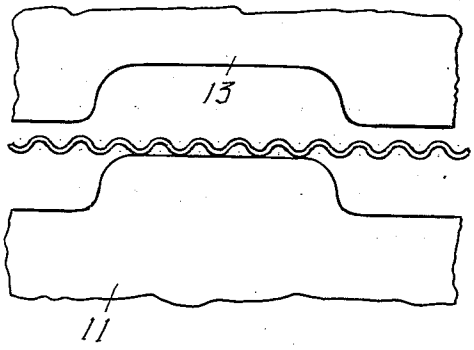


Fig. 3

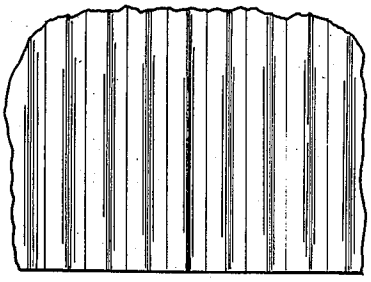


Fig. 2

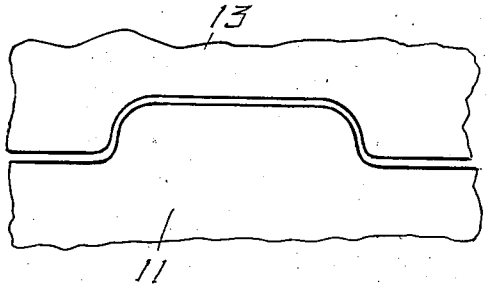


Fig. 4

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METHOD OF DRAWING FIBROUS THERMOPLASTIC SHEET MATERIAL

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7 Claims. (Cl. 18—56)

My invention relates to an improved method of drawing fibrous thermoplastic sheet material and to an improved drawn sheet of such material.

It applies particularly to the deep drawing of such material wherein the required draw is of such depth that rupture or breakage of material during the drawing operation is likely to result and to the drawing of material which possesses little capacity for stretch. An example of such a material is composition fiber board formed of a multiplicity of relatively short cellulose fibers held together by a suitable thermoplastic binder such as an asphalt composition.

This type of material is capable of being shaped under pressure in a heated die into various forms. A common use of such material is in the fabrication of panels such as here employed in the interiar of closed automobile bodies. These panels are decoratively embossed, being provided with beads and other decorative designs. The material readily responds to this heat and pressure treatment to assume and permanently retain a deformed shape. It is frequently desired to give the sheet of material a deeply drawn deformed shape wherein the draw is of such a depth that the material is stretched or drawn beyond its safety limit and rupture or breakage of the sheet is the result. One practice which has been followed to facilitate such deep drawing is to subject the sheet to two operations. In the first operation the sheet of material is given a deep draw contour. In the second operation the sheet is subjected to the same dies but the dies are heated to a higher temperature and the asphaltum or other thermoplastic binder is fused and caused to flow so as to seal up any breaks or cracks which may have resulted from the first operation. While this improves the appearance and also the structure of the sheet it does not weld the sheet together along the line of breakage throughout its interior in such manner as to give it the strength it once possessed and as a consequence the sheet is substantially weakened by this drawing operation.

An object of this invention is to subject a sheet of the desired material to a preliminary deforming operation which facilitates its deep drawing. In the preliminary operation here shown the sheet is subjected to what might be termed a corrugating treatment whereby a succession of relatively small deformations or corrugations are progressively imparted to the sheet without appreciably stretching the structure thereof and in this form the sheet is subjected to the deep drawing operation. Material necessary for the draw is obtained from the flattening out of the deformations. The deep draw therefore is accomplished with a minimum of stretch of the sheet and a minimum strain imposed thereon and the drawn sheet is not weakened appreciably by the drawing operation.

Specifically, my improvement consists in deforming a flat sheet by successively corrugating the same in such a manner that the material is given the corrugated shape without any undesirable weakening of the material. In the corrugating operation illustrated the sheet is corrugated through progressively forming individual corrugations therein without undesirable stretching of the material at any point. The corrugated portion of the sheet is then subjected to the drawing operation and the material necessary for the draw is taken up from what might be termed the slack of the folds or corrugations without stretching the material of the sheet.

Other objects, advantages, and meritorious characteristics of my invention will more fully appear from the following description, appended claims, and accompanying drawing, wherein:

Figure 1 is a diagrammatic illustration of the first step in my improved process,

Fig. 2 is a fragmentary plan of a sheet of material following the first step in my improved process,

Fig. 3 is an elevation of a fragment of a press disposed to carry out one of the steps in my improved process,

Fig. 4 is an elevation of the fragment of the press shown in Fig. 3 in the operative position, and

Fig. 5 is a perspective of a panel fabricated according to my improved process.

In the primary step of corrugating the sheet preparatory to the drawing thereof such corrugation is accomplished without appreciably stretching the sheet or undue tension tending to separate the fibers. For example, a sheet 36'' long before being passed through the corrugating rolls might have a length of only 32'' after being passed therethrough. The depth of the corrugations, however, would depend upon the depth of the draw to which the sheet is to be subjected. It is apparent that a corrugation of one depth would take care of a draw of 3'' while a corrugation of a greater depth would be necessary to take care of 6''. The excess of material in the corrugations should all be taken up in the draw or at least such portion of it should be taken up in the draw that the sheet, when finally formed, would not exhibit undue thickness at any particular

point. The sheet might be corrugated only through a portion of its area, the extent of such corrugated area being determined by the extent of the deformed area desired in the final product.

In the drawing I have illustrated a sheet of suitable fibrous composition thermoplastic material 10 such as hereinabove described. This sheet is pressed between corrugating rolls 12. The sheet may be subjected to a steam heating operation prior to being passed therethrough to soften the binder and render the fibers pliable and the rolls may be heated to the temperature best suited to accomplish the corrugating of the sheet. Material which is suitable for this use is on the market under the name of K B board. This material is formed of cellulose fibers held together by a composition asphaltum binder. It is responsive to heat and pressure to assume and permanently retain a deformed shape. A sheet of this material is passed between the corrugating rolls 12 as diagrammatically illustrated herein. After being passed between such rolls it possesses the shape shown in Figs. 2 and 3.

The sheet so shaped is then pressed in a suitable press such as indicated in Figs. 3 and 4 and subjected to the required stamping operation of a hot die 11 and force 13 to give to it the desired final shape as shown in Fig. 5. The sheet of material may be preheated before the die stamping operation to facilitate its shaping. A conventional deep draw is shown in Fig. 5 wherein the sheet is shaped as appears in certain dash panel formations now being used, and given a deep draw contour as at 14.

With the sheet corrugated in one direction only the flattening out of the corrugations facilitates the draw in one direction better than it does in the other but the corrugated character of the sheet is such that the material flows under the pressure of the die from where there is an excess of material to where material is needed. Due to this flow of material the sheet is built up in one place and thinned out in another as the requirements of the draw demand. There is such an excess of material in the folds or corrugations as to cause material to flow therefrom to the place where it is needed.

In a sheet so prepared it will be found that the excess of material in the corrugations is sufficient to permit the material to flow so that the sheet will assume the desired deep draw contour without undue strain or tension being placed on the sheet at any point and without breakage or rupture of the sheet as a result of such drawing. When the drawing of the sheet is carried out according to this disclosure the gauge or thickness of the material therein will not be appreciably different following the drawing from what it was preceding the drawing.

In the deep drawing operation the corrugations may be completely ironed out through the entire area of the sheet or only partially ironed out making a corduroy type of appearance. The corrugations may be ironed out through that portion of the sheet which is deeply drawn and left in other portions of the sheet which are not subjected to the deep drawing operation serving to stiffen or strengthen such other portions.

What I claim is:

1. That method of imparting a permanently deformed shape to a sheet of composition fibrous thermoplastic material which includes the preparatory step of subjecting the sheet to an operation which imparts progressively and successively a multiplicity of relatively small deformations thereto without appreciable stretching of the sheet and thereafter shaping said corrugated portion of the sheet flattening out said corrugations.

2. That method of imparting a permanently deformed shape to a sheet of composition fibrous thermoplastic material which comprises subjecting the sheet to a forming operation which imparts a multiplicity of relatively small deformations thereto and thereafter drawing the sheet to a permanently deformed shape through the flattening out of said plurality of relatively small deformations during said drawing operation.

3. That method of imparting a permanently deformed shape to a sheet of composition fibrous thermoplastic material which comprises subjecting the sheet to a forming operation which imparts a multiplicity of relatively small deformations thereto and thereafter drawing the sheet to a permanently deformed shape through the flattening out of said plurality of relatively small deformations throughout that portion which is drawn to the permanently deformed shape and smoothing out said plurality of relatively small deformations upon one face of said drawn portion.

4. That method of deforming a sheet of composition material made up of a plurality of relatively short cellulose fibers held together by an asphaltum binder which includes the preparatory step of corrugating that portion of the sheet which is to be so deformed by progressively rolling successive corrugations into the sheet prior to the deforming operation and thereafter deforming said corrugated portion.

5. That method of drawing a sheet of composition fibrous thermoplastic material which includes the preparatory step of corrugating the sheet from one edge to the opposite edge by progressively individually forming a succession of corrugations therein and thereafter drawing the corrugated sheet to a deformed shape by flattening out said corrugations.

6. That method of imparting a permanently deformed shape to a sheet of composition fibrous thermoplastic material which comprises subjecting the sheet to a forming operation which progressively imparts a multiplicity of relatively small deformations thereto without appreciably stretching the sheet and thereafter drawing the sheet to a permanently deformed shape through flattening out of said plurality of relatively small deformations without undue stretching of the sheet.

7. That method of shaping a sheet of thermoplastic composition material which includes subjecting the sheet to progressive rolling operation to progressively form a succession of corrugations therein, and thereafter stamping the corrugated portion of the sheet to a deformed shape.

PAUL R. ZINSER.