

Jan. 1, 1952

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2,581,222

BENDING PROCESS

Filed July 19, 1948

3 Sheets-Sheet 1

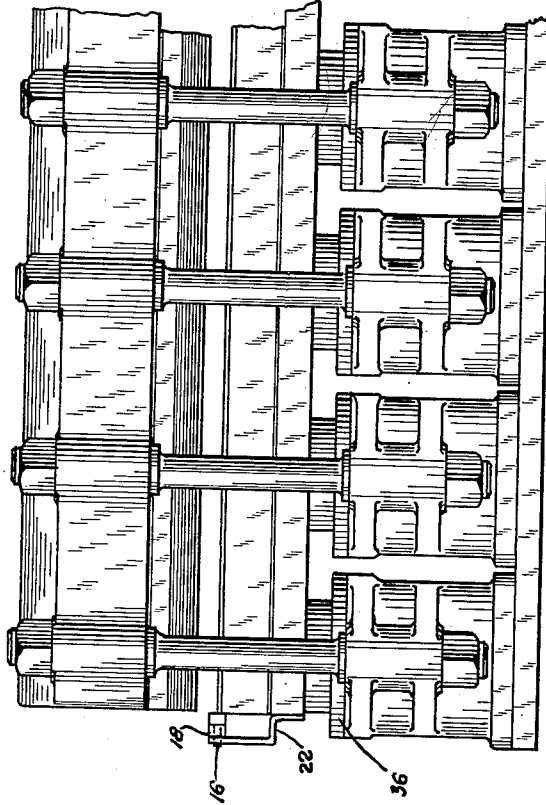


FIG. 1

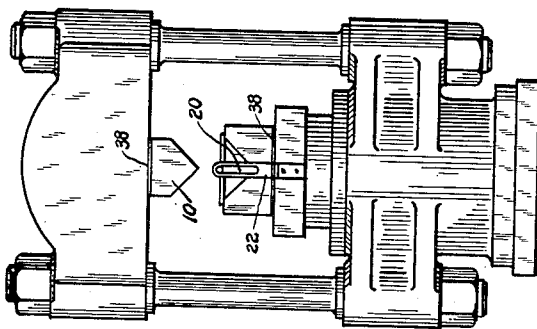


FIG. 2

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3 Sheets-Sheet 2

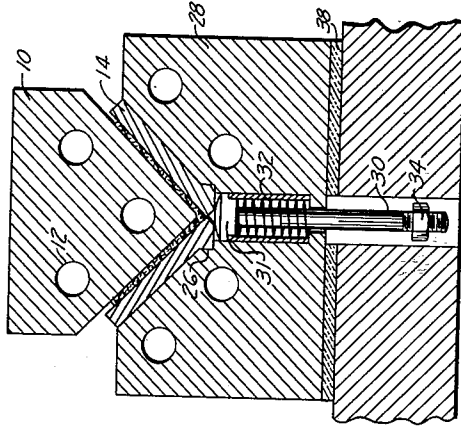


Fig. 5

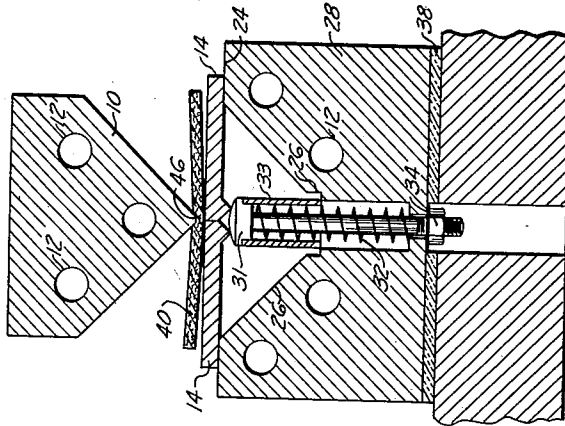


Fig. 4

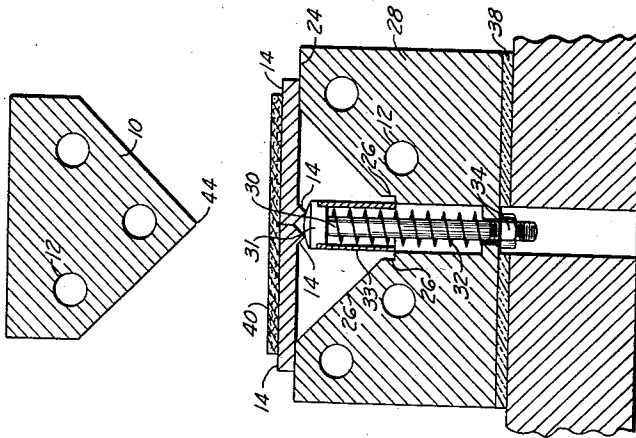


Fig. 3

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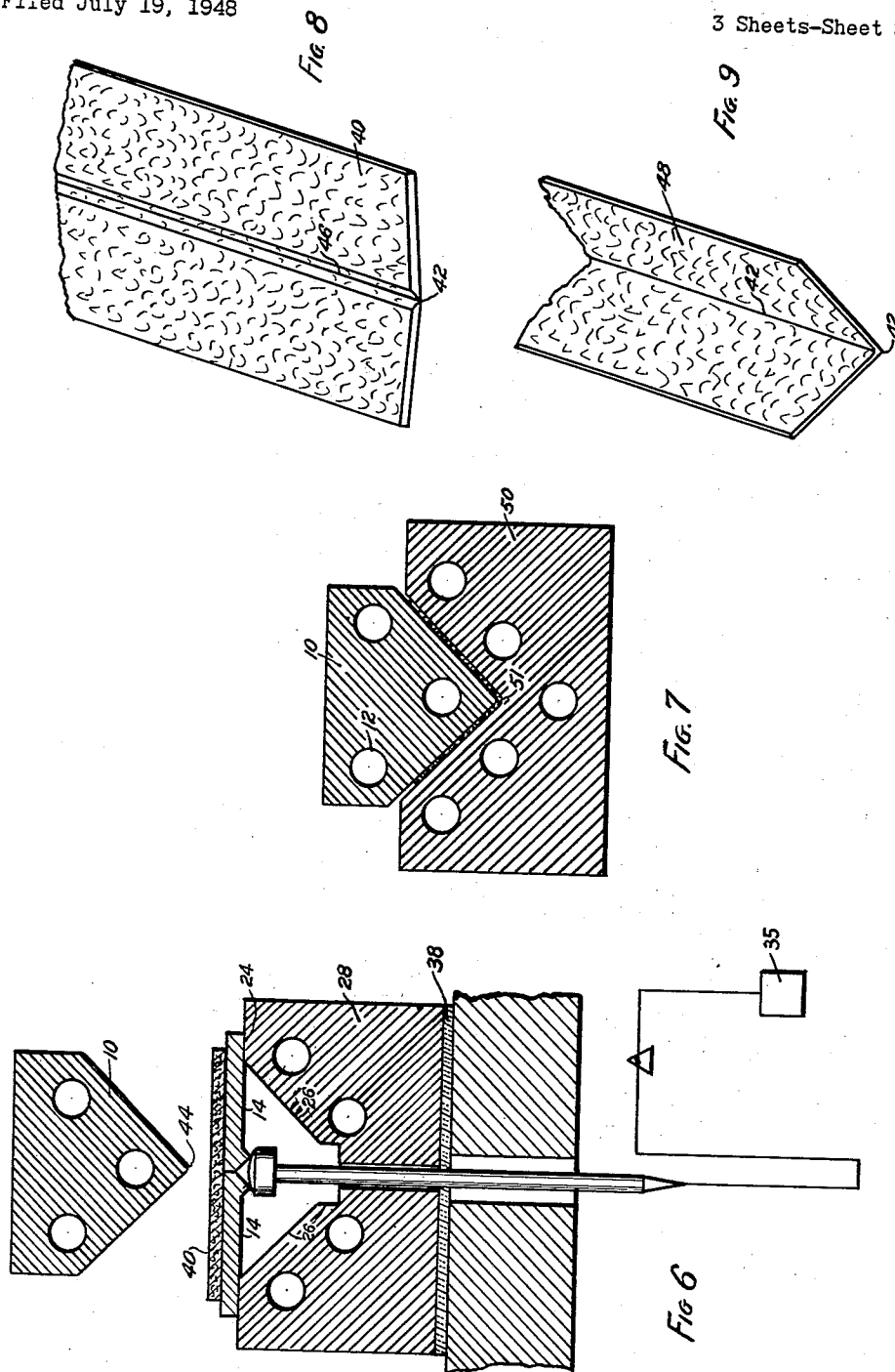
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3 Sheets-Sheet 3



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2,581,222

BENDING PROCESS

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Application July 19, 1948, Serial No. 39,503

2 Claims. (Cl. 18—56)

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My invention relates to a process of making integral fiber hardboard products which are of angular cross-section.

The principal object of my invention is the provision of a process whereby such products, hereafter designated angular products for short, can be manufactured substantially free from cracking, breakage, and the like. A further object is the provision of such a process whereby such angular hardboard products can be made from originally flat sheets.

While my process can be used on fiber boards which have been previously consolidated or on sheets in several laminations, it is preferably applied to a relatively thick porous blank which, although preferably dried nearly or completely dry, has not been previously subjected to consolidating pressure and heat, and which will be considerably reduced in thickness by conversion to hardboard through application of heat and pressure. The porous blanks are about $\frac{1}{2}$ to $\frac{3}{4}$ inch thick and the finished angular fiber board product is about $\frac{1}{8}$ to $\frac{1}{4}$ inch thick. The specific gravity of the blank is about .5 to .7 and the specific gravity of the angular fiber board product is at least 1 and preferably 1.2.

The first application of the process to such a blank consists in hot-pressing and thereby consolidating the blank locally along a narrow substantially linear region or line where the apex of the angular formation is to be located. This initial hot-pressing along such substantially linear region or line is preferably performed in such manner as to leave the outer surface of the blank substantially flat or plane in the neighborhood of such line, while forming a substantially V-shaped indentation at the surface which will be the interior surface of the product. The material is thus reduced in thickness to about the thickness it will have in the final product and is correspondingly consolidated, strengthened, and densified locally along the desired line (see Fig. 8).

The consolidated and densified linear portion produced by such local hot-pressing treatment is so located that it will be at and near the exterior surface of the product, with the interior-side indentation opposite such outer consolidated line portion. In performing the linear densification along such line with the consolidated portion confined principally to that part of the blank which will be at the exterior of the product and in forming the interior-side indentation opposite such locally densified linear portion, the lateral or leg portions of the blank on each side of such line may be slightly cocked or bent into angular

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or V-formation with an interior angle of slightly less than 180° (see Figs. 4 and 8). This slight cocking or bending is favorable in that it is in the same direction that the further bending will be performed later on.

The linear-consolidation treatment which has been described is preparatory for bending along the densified line portion so provided. This treatment has the effect of providing a comparatively thin, densified linear exterior portion between the lateral or leg portions extending outwardly therefrom at either side, on which thin, linear densified portion the lateral or leg portions can be turned or bent toward one another with practical absence of stretching at the exterior surface. The interior indentation will permit approachment of the lateral portions toward one another in the bending operation, and this will avoid interior leverage effects being created in bending adjacent to the consolidated linear portion which otherwise would tend to produce stretching of the material at the exterior surface.

When such linear consolidation has been performed, I bend or bring the lateral parts or leg portions of the blank at each side of such linear indentation toward each other into angular formation with the apex of the angle along the previously-consolidated line portion. The combination of interior-side indentation with exterior-side consolidation having served to bring all the blank material in this region into a dense, strong, thin portion located at and near exterior surface, it becomes practicable to accomplish such bending with practically complete absence of stretching or rupture of the exterior surface of the material along or adjacent to the apex line.

In performing the bending operation, I hold the blank solidly at the line of first consolidation, and bring the lateral or leg portions of the blank on each side of such line toward one another into angular formation in such manner that each of these portions is kept substantially flat or plane and will remain so in the final product.

I next hot-press the bent angular structure so produced, and thereby obtain a final angular fiber hardboard product which is permanently consolidated and densified throughout (see Fig. 9). It is not necessary ordinarily to chill the finished product before it is released from consolidating pressure and it may be released while hot. The thickness of the finished product is less than about 50% of the thickness of the starting blank.

It is to be understood that the steps of the process may be separate and distinct, or may merge into one another in carrying out the production

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of the product, particularly when done rapidly.

A final interior angle of 90° opening in the product is ordinarily desirable for purposes such as mentioned below, but such angle may be more than 90° or slightly less than 90° as may be called for (see Fig. 9).

With the use of relatively porous blanks made of hydrolyzed wood fiber produced by treatment of wood chips with steam and explosive disruption into fiber, as by means of the gun described in U. S. Patent to Mason #1,824,221, and the resulting fiber somewhat refined, and its content of water solubles preferably reduced as by washing, formed into sheets containing about 2%-3% of preferably petrolatum for sizing purposes, and dried in a hot air drier without material pressure, the described operations can be performed and good sound products made without need of addition of other materials for bonding or plasticizing purposes. In the case of using such blanks the linear consolidation and the bending operation and the later consolidation throughout are preferably performed at a die-temperature of about 200°-220° C. If these blanks contain some moisture, as, say, about 5%-10%, the pressure used in hot-pressing the bent blanks is preferably released one or more times to permit breathing or escape of vapors.

In case of blanks made of ground wood it is advantageous to add a small proportion of resinous material, such as about 10%-30% of "Vinsol" for example, since otherwise some rupture of the product may be caused at the exterior and adjacent to the line of bending. Addition of plasticizers, as about 5%-10% of moisture or a like percentage of alcohol, is useful toward making good bends as described, and when resinous material is incorporated, as "Vinsol," for example, it may be applied to the blank in an alcoholic solution. In case of incorporation of such added binders, as "Vinsol," for example, somewhat lower hot-pressing temperatures may be used, as about 150° C. for example. In case of using volatile alcohols for plasticizing, breathing is ordinarily unnecessary but may be resorted to if desired.

Use of wood fiber is preferred, and especially hardwood. However, woody materials of annual growth may be used as a source of lignocellulose fiber if desired.

My process can be performed without special apparatus or performed by apparatus of various kinds. In the accompanying drawings I have illustrated one form of apparatus which can be used for carrying out my new process, and also shown stages in the conversion of the blank to the final product.

In such drawings Fig. 1 is a side view partly broken away, and Fig. 2 an end view of an elongated press apparatus;

Figs. 3, 4, and 5 are transverse views with the elongated die bars in open, partially closed, and closed positions respectively, and illustrating the blank and product in stages of the process as carried out with the form of apparatus shown.

Fig. 6 is a transverse view showing use of weights instead of springs.

Fig. 7 is a transverse section of separate finishing dies, which may be used for effecting the final consolidation in a separate step or stage; and

Figs. 8 and 9 are perspective views with parts broken away of a partly converted blank and of a finished fiber-board product respectively.

The interior die bar 10 shown in the drawings

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of an elongated press apparatus is adapted for use in making angular products having a 90° opening. This die bar 10 is illustrated as being fixed and with other parts moved up toward it, but other arrangements may be resorted to if desired. Provision is made for heating, cavities 12 for steam or for electrical heating elements or the like being indicated.

The exterior die arrangement consists of two die bars 14, 14 which are hinged together as by one thereof having at each end (one end only shown) a stud shaft 16 secured to it and extending through a journal 18 in the second die bar of the pair. The axes of stud shafts 16 are in alignment with the meeting edges of the upper faces of die bars 14, 14 so that movement of the die bars 14, 14 takes place without any substantial opening being formed therebetween. The stud shafts 16, 16 extend through slots 20 in brackets 22, thus permitting vertical movement of die bars 14, 14 at their meeting edges. The die bars 14, 14 are provided on their under sides with reinforcing parts 14', 14' to be referred to later. Die bars 14, 14 are supported near their outer edges on ledges 24 at each side of the trough-like depression 26 in the heated, vertically movable press bar 28. The inner edges of die bars 14, 14 are supported upon headed push rods 30 extending through bores in press bar 28 and urged upwardly by springs 32. The springs 32 are preferably enclosed in short tubular guards 33, attached to the heads 31 of push rods 30, and serving to prevent collection of foreign materials by the springs 32. Various other means may be provided to perform the functions of springs 32. For example, Fig. 6 shows the weights 35 for this purpose. Nuts 34 serve to limit the upward movement of push rods 30 as shown in Fig. 3. Elevation of press bar 28 by the preferably hydraulic rams 36 serves to bring the apparatus parts shown from the open position shown in Fig. 3 to the position of Fig. 4, and to the closed position of Fig. 5 respectively. Die bar 10 and press bar 28 are preferably heat-insulated from adjacent bodies of metal as indicated at 38.

With the parts in the position of Fig. 4, the lower part of blank 40 which will be at the exterior of the product will be consolidated by heat and pressure along a longitudinal line 42 here shown as the longitudinal center line of the blank, while the nose 44 of the interior die bar 10 forms an indentation 46 in that face of the blank which will be at the interior of the product. (See also Fig. 8). During this operation, the exterior die bars 14, 14 are supported by the springs 32 so as to present a flat or substantially flat upper surface.

With further raising of the press bar 28, as indicated in Fig. 5, the exterior die bars 14, 14 will be forced to the closed position, springs 32 being compressed and push rods 30 depressed by the major force of the rams 36. At this stage, outside die bars 14, 14 will become substantially liners for the trough-like depression 26 in the press bar 28, with their extending reinforcing parts 14', 14' being received in seats 26', 26' provided for that purpose. In this way said die bars 14, 14 are firmly and solidly supported by press bar 28 to resist the application of the final consolidating pressure, are prevented from spreading apart or opening up, and are well heated from the internally heated press bar 28. The die bars may be directly heated if desired. When die bars 14, 14 are thus depressed by raising

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press bar 28, they form a female die corresponding to the interior or male die bar 10.

With the parts in the position of Fig. 5, the final consolidating hot-pressing operation can be completed with the production of a finished angular fiber-board product 48. However, if desired, this hot-pressing and consolidating operation may not be completed in the apparatus used for bending, and in such case the bent and partly-pressed angular product can be transferred to separate finishing press dies 10' and 50 (Fig. 7), and the hot-pressing completed by means of such dies 10', 50 if desired. In this way the bending press cycle can be considerably shortened. The female die 50 may be made with a slight fillet, as indicated at 51, so as to slightly round off the apex line if desired. If the blank 40 contains some moisture or other vapor-forming material, the pressure on the dies may be intermittently released in the early part of the operation of hot-pressing the previously bent blank to permit moisture or vapor escape.

With my process, the hot-pressing consolidation is preferably applied progressively and gradually from the line 42 of first compaction outwardly. This is accomplished with the apparatus shown by the die-closing movement taking place against the resistance of the springs 32 as will be readily understood.

Integral angular fiber-board products made from flat sheet blanks in accordance with my new process are strong and substantial, and are practically free from breakage or cracking due to conversion from original flat blank formation to their final state. Being solidly held between dies during the final hot-pressing operation, the final products hold their angular shape and are substantially free from tendency to open or spread. Made smooth or with design impressed on surfaces on each side, they are adapted for many uses, such as wall surfacing at either inside or outside corners, counters with integral backs, desks, furniture, and the like. It is a feature of great advantage that flat or plane sheet blanks can be used and use of specially formed blanks is avoided since such flat or plane blanks can be made on sheet-forming machines at high speeds and with minimum expense.

The showing is for illustration only and not for limitation of my claims.

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The apparatus herein disclosed is claimed in Patent Number 2,431,353 and the present application is a continuation-in-part of my co-pending application Serial Number 547,211 now abandoned.

I claim:

1. Process of making an integral, angular hardboard product having a specific gravity greater than 1 from a porous hydrolyzed ligno-cellulose fiber blank having a specific gravity less than 1, which comprises supporting the entire area of the blank, hot-pressing a single groove indentation in that side of the blank which is to be inside the product and thereby consolidating the blank material in the projected region beyond the groove to substantially its final thickness, bending the blank by applying increased pressure at elevated temperature at the groove line while yieldingly supporting the entire area of the blank portions on each side of the groove and simultaneously partially consolidating said portions by applying pressure gradually outwardly from the groove whereby the final angularly product shape is formed, and then finally consolidating said partially-consolidated portions of the blank to substantially the thickness of said projected region by application of high pressure and temperature.

2. Process as defined in claim 1, and wherein the thickness of the consolidated angular product is less than 50% of the original thickness of the porous blank.

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