Sept. 4, 1951 W. E. RADIG 2,567,122

PLYWOOD SHAPING APPARATUS

Filed Oct. 19, 1946 2 Sheets-Sheet 1

Fig. 1

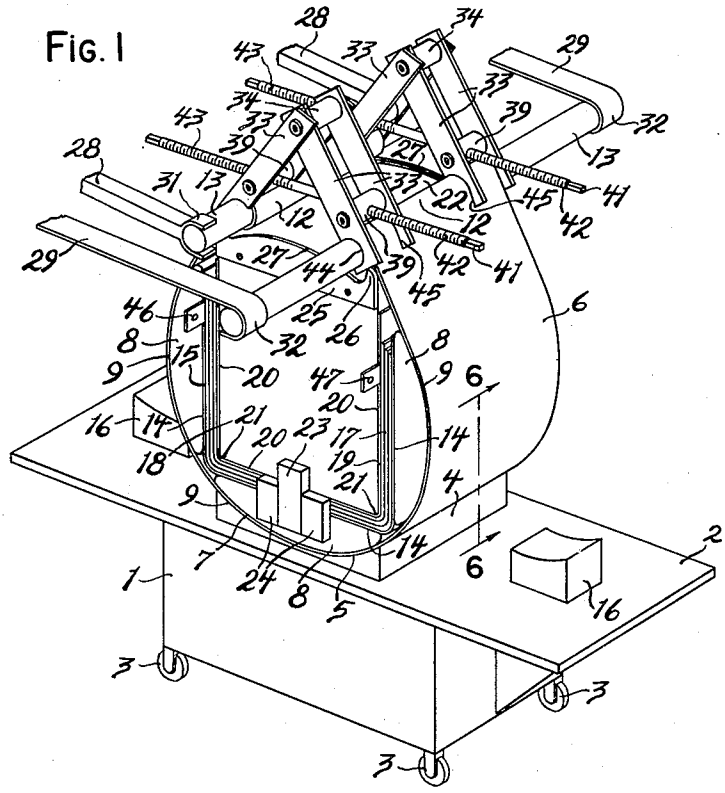
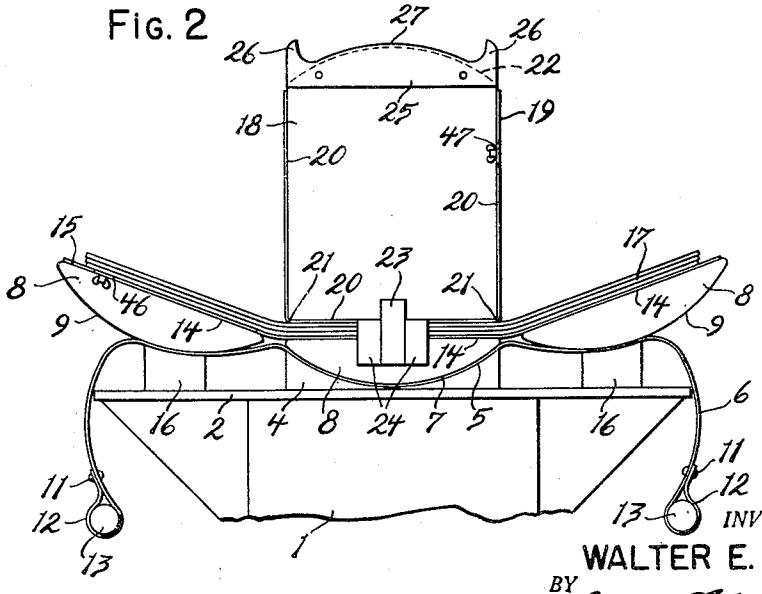


Fig. 2



INVENTOR.
WALTER E. RADIG
BY Robert F. Miehle, Jr.
ATTY.

Sept. 4, 1951 W. E. RADIG 2,567,122

PLYWOOD SHAPING APPARATUS

Filed Oct. 19, 1946 2 Sheets-Sheet 2

Fig. 3

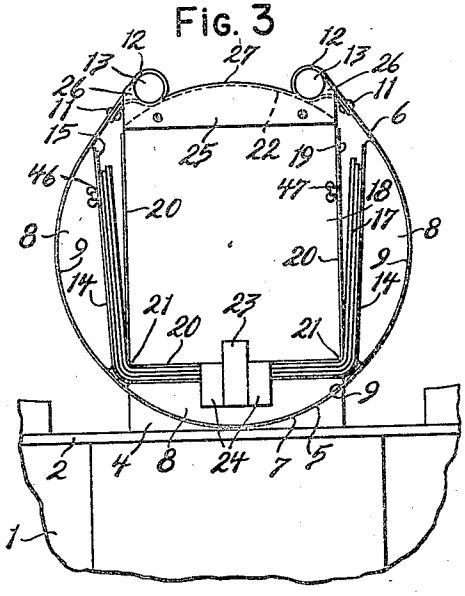


Fig. 5

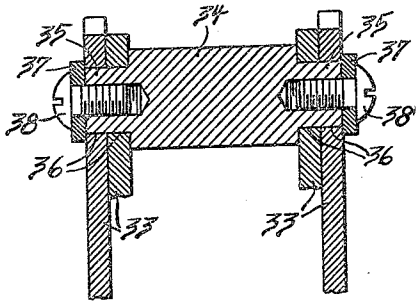


Fig. 4

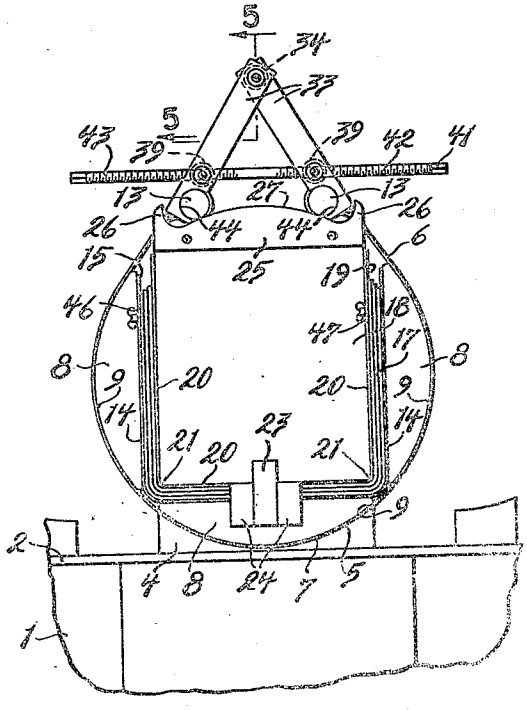
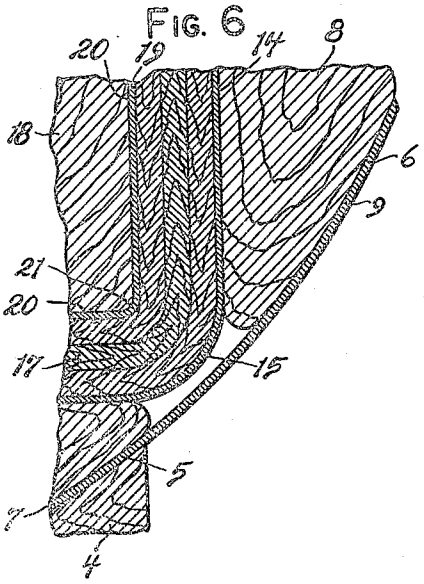


Fig. 6



INVENTOR.
WALTER E. RADIG
BY
Arthur F. Mueller Jr.
ATT'Y.

Patented Sept. 4, 1951 2,567,122

UNITED STATES PATENT OFFICE

2,567,122

PLYWOOD SHAPING APPARATUS

Walter E. Radig, Chicago, Ill., assignor to Bell & Howell Company, Chicago, Ill., a corporation of Illinois

Application October 19, 1946, Serial No. 704,392

4 Claims. (Cl. 144—265)

1

My invention relates particularly to apparatus for forming blanks of pliable material and more particularly for forming blanks of laminated material such as plywood, the invention contemplating the forming of laminated blanks the adhesive or bond between the laminations of which, is set or cured as an incident of the forming operation.

Objects of the invention reside in the provision of a novel, simple and effective forming apparatus, which is particularly adapted for forming plywood blanks the adhesive or bond between the laminations of which, is set or cured as an incident of the forming operation, which develops adequate and properly distributed forming pressure, which is convenient in use, which lends itself to mass production, which is comparatively inexpensive to manufacture, and which is particularly adapted for forming blanks into U-shapes.

The invention will be better understood by reference to the accompanying drawing forming a part hereof and in which—

Figure 1 is perspective view of a forming apparatus embodying my invention and showing it in forming condition;

Figure 2 is a front elevation of the same showing it in open or blank receiving condition;

Figure 3 is a front elevation of the same showing it in preliminary blank forming condition;

Figure 4 is a front elevation of the same showing it in final blank forming condition;

Figure 5 is a partial section on the line 5—5 of Figure 4; and

Figure 6 is a partial section on the line 6—6 of Figure 1.

Referring to the drawing, a base, designated at 1, is provided with an elongated top 2 and with wheels or casters 3 by means of which it may be conveniently moved about. A cradle 4 is secured downwardly on the intermediate portion of the top 2 and the top surface 5 of the cradle is concave longitudinally of the top.

A flexible metal tension member 6 of sheet metal overlies the top 2 and cradle 4 and, arranged to extend lineally of the top, the tension member has its intermediate portion 7 secured downwardly upon the surface 5 and curved correspondingly therewith. Three outer form members 8 of suitable material such as wood, overlie the tension member 6 and are arranged in adjacently spaced succession along the same. The tension member engaging surfaces 9 of these form members are convex longitudinally of the tension member and correspond in radius with the curvature of the intermediate portion 7 of the tension member, and the intermediate of the form members engages in the curvature of the intermediate portion of the tension member and is secured together with the tension member downwardly on the surface 5 of the cradle. The end portions of the tension member extend outwardly beyond the outer form members and are doubled back and secured, as designated at 11, to form closed loops 12 through which clamping rods 13 extend, these clamping rods projecting from both sides of the tension member. The surfaces 14 of the outer form members 8, opposite the tension member engaging surfaces 9, comprise the forming surfaces of these form members and are flat, and a flexible metal form member 15, extending correspondingly with the tension member 6, overlies the forming surfaces 14 and extends between adjoining ends of these form members and is secured in a usual manner with each of the form members 8.

2

Noting that the top 2 of the base underlies the tension member 6 and that the tension member, the outer form members 8 and the flexible form member 15 are arranged to extend lineally of the top and that the intermediate portion 7 of the tension member, the intermediate of the form members 8 and the intermediate portion of the flexible form member are secured with the base 1, support blocks 16 secured on the top 2 adjacent the ends thereof are adapted to support the tension members, outer form members and flexible form member in generally flat condition, as shown in Figure 2, in which condition a blank 17 of pliable material in unformed or flat condition is placed on top of the flexible form member for the forming thereof.

An inner form 18 of suitable material such as wood and which as shown is of generally rectangular form, is provided with a forming surface extending partially thereabout and having a metal sheet 19 overlying the same and secured to the inner form, the forming surface comprising three angularly related flat forming surface portions 20 respectively corresponding with the forming surfaces 14 of the outer form members and arranged in a U-shape and convexly curved corner forming surface portions 21 between adjacent ends of the surface portions 20. The surface 22 of the inner form between the ends of the forming surface thereof is convex peripherally of the inner form.

With the blank 17 placed as aforesaid, the inner form 18 is placed on top of the blank with the intermediate of the forming surface portions 20 of the inner form registered with the forming surface 14 of the intermediate of the outer form members 8, as shown in Figure 2, preparatory to the forming operation. This registration is predeterminately effected by locating lugs 23 secured on opposite sides of the inner form 18 and projecting outwardly from the intermediate of the forming surface portions 20 of the inner form and slidably engageable between pairs of spaced lugs 24 secured on opposite sides of the intermediate of the outer form members 8, the lugs cooperating to predeterminately locate the intermediate portion of the forming surface of the inner form with that of the tension member 6 and the flexi-

ble form member 15 and the intermediate of the outer form members 8.

With the blank 17 and the inner form 18 so placed, the forming operation is effected by wrapping the tension member 6 and with it the outer form members 8 and the flexible form member 15 about the inner form and blank and lineally tensioning the tension member, as shown in Figures 1 and 4, to apply forming pressure to the blank. When the outer form members are in forming relation with the inner form, the forming surfaces 14 of the outer form members 8 lie opposite the forming surface portions 20 of the inner form 18 and the convex tension member engaging surfaces 9 of the outer form members and the convex surface 22 of the inner form generally conform with a circle so that the tension member is generally conformed with this circle and the forming pressure is properly distributed over the area of the blank being formed, it being observed that as the tension member is tensioned as hereinafter described, the end loops 12 thereof engage inwardly against the convex surface 22 of the inner form, or the clamping rods 13 have an equivalent engagement as hereinafter described, to exert pressure on the portion of the blank between the intermediate of the forming surface portions 20 of the inner form and the forming surface 14 of the intermediate of the outer form members 8, and it also being observed that as the tension member is tensioned, the end members of the outer form members 8 are drawn away from the intermediate of the outer form members in the direction toward the ends of the forming surface of the inner form by reason of the coaction of the tension member with the convex tension member engaging surfaces 9 and with the convex surface 22 of the inner form, so that the portions of the flexible form member 15 opposite the corner forming surface portions 21 of the inner form are wrapped and tensioned about the corresponding portions of the blank, see particularly Figure 6, to exert adequate forming pressure throughout these portions of the blank and when a plywood blank is being formed and prevent fracture of the outer lamination or laminations of the blank.

Two retaining members 25 are secured on opposite sides of the inner form 18 in the region of the convex surface 22 and extend lineally of the curvature thereof, and the opposite end portions of the retaining members are provided with spaced opposing retaining latches 26 extending outwardly from the surface 22. The retaining latches are operative on the ends of the tension member 6, by reason of the projecting ends of the clamping rods 13 being engageable therewith, to retain the tension member and outer form members 8 in a preliminary forming relation with the inner form 18 and blank 17 into which they are movable against only a small degree of resistance from the blank, as shown in Figure 3, this arrangement providing for the tension and outer form members being manually moved into and retained in such preliminary forming relation in which the clamping rods are desirably adjacently spaced for cooperation with clamping means hereinafter described for further drawing the ends of the tension member together and bringing the inner and outer form members into final forming relation and exerting pressure on the blank 17 as shown in Figures 1 and 4. The surfaces 27 of the retaining members 25 between the retaining latches 26, which correspond with the convex surface 22 of the inner form, are convex in concentric relation with the surface 22 and form offset continuations of the surface 22, and the end loops 12 of the tension member engage inwardly against the convex surface 22 and/or the projecting ends of the clamping rods 13 engage inwardly against the convex surfaces 27 from the time the tension and outer form members are in said preliminary forming relation until they are in final forming relation with the inner form to exert pressure on the portion of the blank 17 between the intermediate of the forming surface portions 20 and the intermediate of the outer form members 8.

With the tension member 6 and the outer form members 8 in the aforesaid preliminary forming relation, as shown in Figure 3, the apparatus is positioned in proper relation with a power clamping device, not shown, and oppositely acting clamping members 28 and 29 of the power clamping device are respectively detachably oppositely engaged with the projecting ends of the clamping rods 13, as designated at 31 and 32 in Figure 1, and the power clamping device is energized to draw the clamping rods together and so tension the tension member.

Additional or final manually operable clamping means is provided for tensioning the tension member 6 and maintaining the same in tensioned condition until the blank is set in formed condition, it being observed that the apparatus is intended for the forming of plywood blanks the adhesive or bond between the laminations of which is not set or cured previous to the forming operation and is set or cured as an incident of the forming operation and while the blank 17 is maintained under pressure in formed condition by the apparatus.

The additional or final clamping means shown consists of two screw clamps, see Figures 1, 4 and 5, and each clamp comprises two pairs of levers 33 corresponding ends of which are pivotally connected by means of a stud 34 extending between the pairs of levers and having reduced ends 35 thereof pivotally engaged in apertures 36 through the levers, retaining washers 37 secured on the ends of the stud by screws 38 to retain the levers engaged on the stud, two studs 39, respectively extending between the pairs of levers adjacent the free ends of the levers and pivotally connected therewith in a manner similar to the manner in which the stud 34 is connected with the levers, a clamping screw 41 screw-threaded diametrically through the intermediate portions of the studs 39 respectively with right and left hand threads 42 and 43, and opposing clamping rod engaging recesses 44 on the free ends of the pairs of levers.

With the tension member 6 tensioned by the power clamping device, see Figure 1, the two screw clamps are connected with the clamping rods 13 by engagement of the opposing recesses 44 of the pairs of levers 33 respectively with the clamping rods and the clamping screws 41 are rotated to cause the pairs of levers to draw the clamping rods together and exert tension on the tension member 6. The two screw clamps are disposed respectively in the regions of opposite sides of the tension member and the inner pairs of clamping levers 33 extend through slots 45 in the tension member to engage the clamping rods.

After the tension member 6 has been tensioned by the screw clamps, the power clamping device is deenergized and the clamping members 28 and 29 are disengaged from the clamping rods 13, so that the apparatus, with the tension member 6

tensioned by the screw clamps as shown in Figure 4, may be moved away from the power clamping device to another location, the power clamping device being thus released for further use.

For the purpose of setting or curing the adhesive or bond between the laminations of the blank 17 while it is maintained under pressure and in formed condition in the apparatus, the flexible metal form member 15 overlying the form surfaces 14 of the outer form members 8 and the metal sheet 19 covering the forming surface of the inner form 18, which are electrically insulated from each other, form opposing electrodes by means of which an electrostatic field is set up, embracing the formed blank as it is maintained under forming pressure in the apparatus, when the members 15 and 19 are connected to opposite poles of a source of high frequency electric current, so that the adhesive or bond between the laminations of the formed blank are quickly set or cured by dielectric heating, the members 15 and 19 being provided with terminals, designated respectively at 46 and 47, for the purpose of energizing the same.

After the forming and setting or curing operations are completed the screw clamps are released and disconnected from the clamping rods 13, so that the formed blank may be removed from the apparatus preparatory to another forming operation.

While I have thus described my invention, I do not wish to be limited to the precise details described, as changes may be readily made without departing from the spirit of my invention, but having thus described my invention, I claim as new and desire to secure by Letters Patent the following:

1. In a forming apparatus, the combination of an inner form provided with a forming surface comprising a succession of angularly related forming surface portions of relatively flat character, a flexible tension member, a plurality of outer form members secured in succession and arranged along said tension member in such relation as to respectively lie opposite said forming surface portions for forming a blank disposed between said inner form and outer form members when said tension member and with it said outer from members are wrapped about said inner form and blank, the forming surfaces of said outer form members being of relatively flat character and the tension member engaging surfaces of said outer form members being convex longitudinally of said tension member and generally conforming with a circle when said outer form members are in forming relation with said inner form, and a releasable clamp operative on the ends of said tension member to lineally tension the same with said tension member and outer form members wrapped about said inner form and blank.

2. In a forming apparatus, the combination of an inner form provided with a forming surface comprising a succession of angularly related forming surface portions of relatively flat character, a flexible tension member, a plurality of outer form members secured in succession and arranged along said tension member in such relation as to respectively lie opposite said forming surface portions for forming a blank disposed between said inner form and outer form members when said tension member and with it said outer form members are wrapped about said inner form and blank, the forming surfaces of said outer form members being of relatively flat character and the tension member engaging surfaces of said outer form members being convex longitudinally of said tension member and generally conforming with a circle when said outer form members are in forming relation with said inner form, a registering device operative to predterminately locate the intermediate portion of said forming surface with said outer form members, and a releasable clamp operative on the ends of said tension member to lineally tension the same with said tension member and outer form members wrapped about said inner form and blank.

3. In a forming apparatus, the combination of an inner form provided with a forming surface extending partially thereabout and comprising a succession of angularly related forming surface portions of relatively flat character, a flexible tension member, a pluarlity of outer form members arranged in succession along said tension member, a flexible form element disposed at the forming surfaces of and extending between adjoining ends of and secured with said outer form members, said outer form members being arranged in such relation as to respectively lie opposite said forming surface portions for forming a blank disposed between said inner form and said outer form members and flexible form element when said tension member and with it said outer form members and flexible form element are wrapped about said inner form and blank, the forming surfaces of said outer form members being of relatively flat character and the tension member engaging faces of said outer form members being convex longitudinally of said tension member and the surface of said inner from between the ends of said forming surface being convex peripherally of said inner form and said convex surfaces generally conforming with a circle when said outer form members and flexible form element are in forming relation with said inner form, and a releasable clamp operative on the ends of said tension member to lineally tension of the same with said tension member and outer form members and flexible form means wrapped about said inner form and blank and with said tension member bearing inwardly against said second mentioned inner form surface.

4. In a forming apparatus, the combination recited in claim 3 and further characterized in that said flexible form element is of electrically conductive material and overlies the forming surfaces of said outer form members, and that a sheet of electrically conductive material overlies said forming surface of said inner form and that it is electrically insulated form said flexible form element.

WALTER E. RADIG.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
115,536	Smith et al.	May 30, 1871
220,229	Flora	Oct. 7, 1879
229,198	Steinway	June 22, 1880
874,406	Johnson	Dec. 24, 1907
1,234,665	Hice	July 24, 1917
2,307,344	Zottu	Jan. 5, 1943

FOREIGN PATENTS

Number	Country	Date
97,957	Germany	July 30, 1898