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2,603,579

APPARATUS FOR MANUFACTURING PLYWOOD TUBES

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3 Sheets-Sheet 2

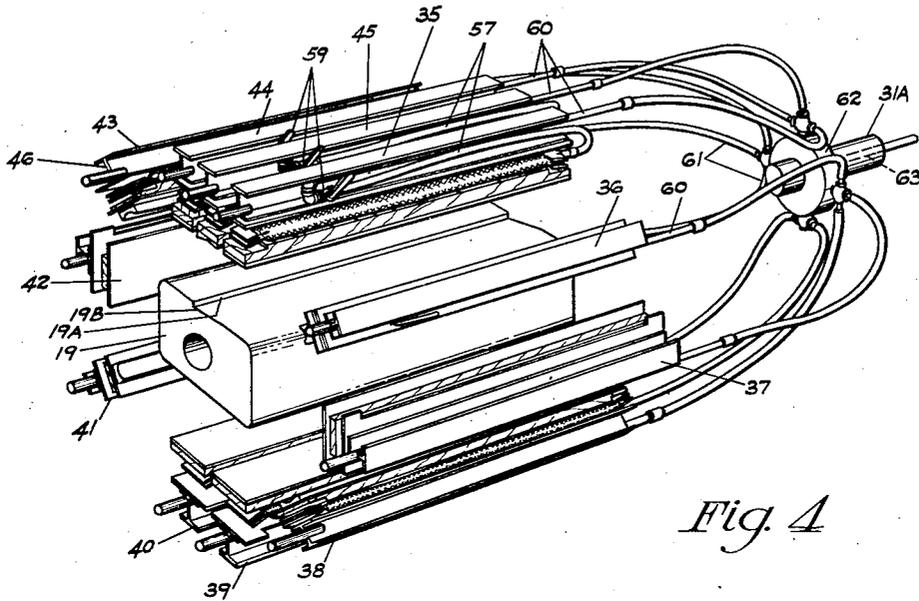


Fig. 4

Fig. 5

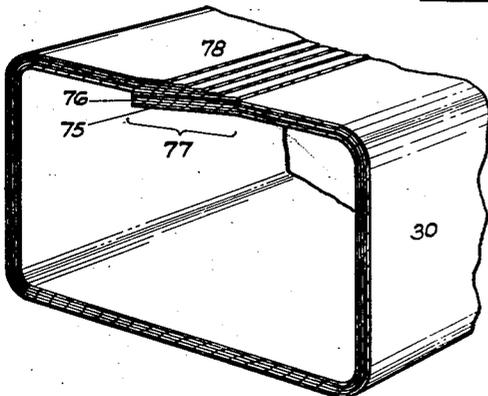
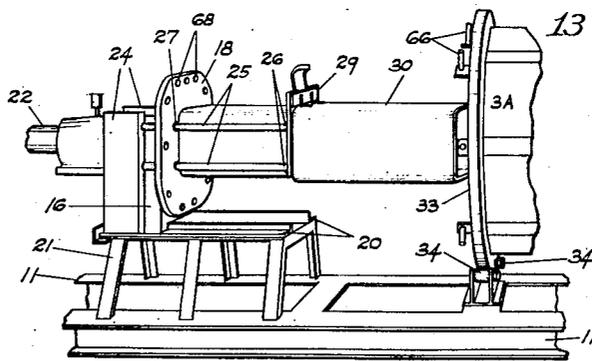


Fig. 6

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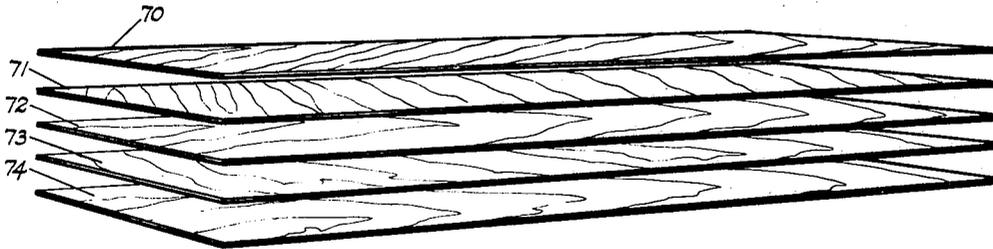


Fig. 7

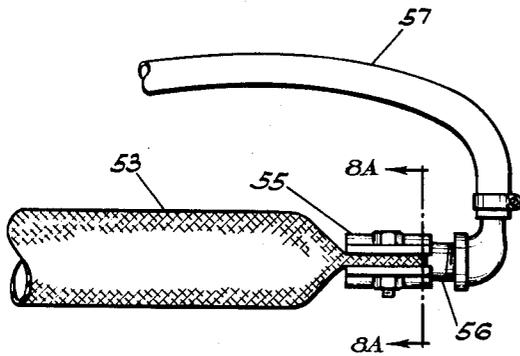


Fig. 8

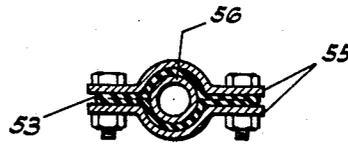


Fig. 8A

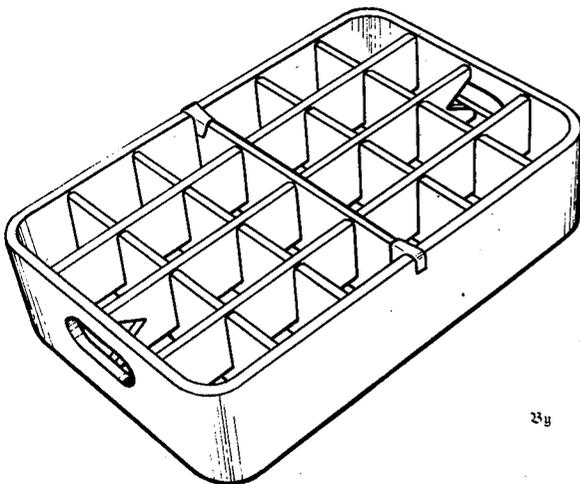


Fig. 9

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APPARATUS FOR MANUFACTURING PLYWOOD TUBES

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9 Claims. (Cl. 154-1.8)

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This invention pertains to apparatus for forming, on a production basis, a plurality of individual planiform sheets or plies of wood veneer or of very flexible plywood into a finished unit to constitute the four sidewalls of a box, case, crate or similar article and concurrently setting or curing glue disposed between the juxtaposed faces of said sheets while the entire outer surface of the unit is subjected to pressure that has been applied progressively.

The primary object of the present invention is the provision of improved means and method of producing, on a large scale and at a low cost, tubes of the type adverted to above and of an outstanding high grade quality as to appearance and structure affording service of longer duration than heretofore attained from articles of this general classification, especially those pertaining to delivery of bottled liquids, currently referred to as "beverage cases."

Another object of this invention relates to the apparatus for expeditiously forming plies of wood into high grade tubes by operators who can be developed into experts through short periods of training.

A further object of this invention relates to a method and means for effecting a lap-joint at the loose ends of a plurality of individual planiform plies of wood after they have been formed into an incomplete tube of plywood to complete a tube thereof.

This invention also provides improved methods and means of producing plywood tubes as will be described with reference to the drawings and set out in the accompanying claims.

With reference to the drawings:

Figure 1 is a perspective view of apparatus employed to wind a stack of loosely assembled plies of wood veneer about a mandrel and to fuse them into a unit by means of an adhesive, heat and pressure;

Figure 2 is an elevation, on an enlarged scale, of the central portion of Fig. 1 showing an end portion of a stack of loose plies applied and secured to a horizontally disposed mandrel mounted for rotation.

Figure 3 is a sectional elevation of Fig. 2 on line 3-3.

Figure 4 is a diagrammatic view of the pressure applying apparatus and the mandrel for forming a loosely assembled stack of plies as seen in Fig. 2 into a composite tube as shown in Fig. 6.

Figure 5 is a perspective view of the "ram end" of the apparatus on which the mandrel is mounted and a fragment of the right hand side or "pressure end" of Fig. 1.

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Figure 6 is a perspective view of a portion of the product, a plywood tube and the lap-joint at the ends thereof.

Figure 7 is a perspective view, on a reduced scale, of a stack of loose plies from which the tube is formed.

Figure 8 is a perspective view of the right hand end portion of a fabric hose of one of the eleven pressure units.

Figure 8A is a section of Fig. 8 on line 8A-8A of Fig. 8.

Figure 9 is a perspective view of bottle case, the end product of one embodiment of the present disclosure.

To the supporting base 11, Figs. 1 and 5, are mounted two major units, the "ram section" at the left end, designated generally by numeral 12, and the "pressure section," designated generally by 13, at the other end. The main shaft 14 is organized to slide longitudinally and rotate in fixed bearing 15 and slidable bearing block 16 to which the shaft is permanently located by collar 17 and hub of annular face plate 18 so that the latter and mandrel 19, carried on the shaft, can be moved from the position shown in Fig. 1 to that shown in Fig. 5. This bearing block slides on the top surface 20 of bench 21 that is permanently attached to the supporting base. This bearing block is slid in response to fluid pressure applied to a piston in stationary cylinder 22 to actuate ram 23, the right end of which is articulated to block 16. Also permanently attached to bench 21 are two columns 24 provided for fixedly supporting four horizontally disposed stripper rods 25, the free ends 26 of which project freely into holes 27 of but not beyond the face plate when block 16 is extended to locate the mandrel for service as shown in Fig. 1. The right hand faces of these stripper rods are located for register with the left hand edge face of tube 30 as shown in Fig. 5. Between this face and the ends of the rods is stripper plate 29 to prevent the rod ends from damaging the tube, since considerable force is required to strip the tube from the mandrel. In Fig. 5 the tube is shown stripped to the right hand of the mandrel ready to be manually removed.

With reference to Fig. 1, the right hand end of rotating unit 31 of pressure section 13 is carried on shaft 31A mounted and retained in fixed bearing 32 with suitable collars for rotation, herein-after amplified, while the periphery of the open ended ring 33, left hand end thereof, is carried on rollers 34, 34 mounted on base 11. Under case 3A are stored ten of the eleven substantially duplicate-independent pneumatic pressure units,

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35 through 45 (revealed in Fig. 4), while out of use. In Fig. 1, unit 45 is shown withdrawn. Each unit is provided with a pressure bar support 46 organized for withdrawal by manual operation. These eleven pressure bar supports 46 are each mounted on correlated bracket arms 48 that are rigidly secured to pressure slider bars 47 that are spaced equally around the periphery of rotating unit 31 and rigidly affixed to case 3A so as to constitute a permanent integral part of the framework thereof. In Fig. 4, the diagrammatic portraiture of these pressure units shows them removed from case 3A and extended in position for applying pressure to a plurality of plies of wood (not shown in this figure) when wrapped around mandrel 19. In Fig. 2 one unit is shown completely and another partially withdrawn from the case.

The pressure bar supports 46 and pressure slider bars 47 are each steel beams having an I section as shown in Fig. 3. From the vertical web of the former, at the left hand end, under ring 33, are secured a pair of bracket arms 48, 48, on the lower ends of which are mounted rollers 49, 49 for movably carrying the pressure bars. At the right hand end of each of these bars are slides (not shown) for embracing the lower horizontal webs for supporting and maintaining these bars in a substantially horizontal path when stored under case 3A and as they are withdrawn.

In each of the lower corner areas of pressure plate 52, permanently secured to the lower face of bar 47, is a hole in which is slidably lodged a long bolt 50, the lower ends of which are secured to corresponding corners of shoe 51 which has a flat top face corresponding in area to the pressure plate. Between the lower face of the pressure plate and the top face of the shoe is a pneumatic hose 53 sealed at the left hand end with clamp 54 and at the other end with clamp 55 (Fig. 8) which is provided with a nipple 56 to which is attached hose 57 for servicing the hose. A compression spring 58 surrounds each bolt and exerts pressure tending to squeeze the hose, between the shoe and pressure plate, to collapse it after manually operated two position valve 59 has been moved to place the interior of the hose into communication with the atmosphere. In the first position, the valve is closed to prevent passage of air from pipe 60 which in turn is supplied by hose 61 that is fed from manifold 62 mounted on shaft 31A from the center of which extends feed duct 63 that is connected to an air compressor (not shown) by means of a rotatable packed joint 64. In this position the interior of the hose is in communication with the atmosphere as stated and the spring maintains it in a collapsed state until air pressure is applied. To limit the travel of the shoe, sleeve stops 65 are provided, they surround the bolts 50. When the valve is in the other position air under pressure is fed to the hose to expand it and force the exposed or outer face of shoe into contact with the outer surface of the top ply of a stack of wood veneer as shown by unit 35 in Figs. 2 and 3.

At the extreme left hand end of each of the pressure slide bars 47 are a vertical handle 66 for manually sliding the bars and a horizontal lock pin 67 for engagement with face plate 18 by means of entering the correlated one of the eleven pin holes 68 in face plate 18. It will be perceived that when each of the slide bars is completely withdrawn, as shown in Figs. 1 and 2, it is firmly anchored at one end to ring 33 and to face plate 18 at the other end and that it is capable of re-

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sisting the pressure exerted upwardly in response to inflation of hose 53. It should also be noted that when the pressure unit is inflated "ram section" 12 is effectively tied to the pressure section 13 since the shoe or shoes are exerting heavy pressure on mandrel 19 as explained above. After the hose of one pressure section has been inflated, power, either intermittently or continuously, is applied to shaft 31A through sprocket 31B.

With the exception of the face contour of the shoes that contact the outside face of the tube in response to pneumatic pressure, as it is formed from wood veneers on the mandrel, the pressure units are duplicates. Units 36, 38, 41 and 43 have concave faces to embrace the round corners of mandrel 19 while units 35, 37, 39, 40, 42 have broad flat faces and 45 has an irregular but symmetrical contour, best seen in Fig. 3. Explanation of the function and manipulation of these pressure units follows:

Reference numerals 70 to 74 designate a plurality of layers of veneer stacked and aligned in position to be brought together as a preliminary step in the manufacture of the plywood tube, adverted to above. For the production of this tube, a section of which provides the ends and sides as a unit for a bottle case, shown in complete form, in Fig. 9, five plies are used; the center one being approximately $\frac{1}{8}$ of an inch in thickness and the others $\frac{1}{16}$ of an inch. The next step in the process, end 75, Fig. 6, of the stack of plies is manually laid on mandrel 19 with the edge 76 of the leading or far end aligned with, but disposed above the vertical face 19A of notch 19B in mandrel 19 and with the longitudinal edges of the stack aligned with the side faces of the mandrel. When thus aligned pressure unit 35 is withdrawn and located with pin 67 inserted in hole 68 as shown in Fig. 2, then valve 59 is operated to inflate the hose and force the shoe into contact with the stack of plies and firmly grip it onto the mandrel. The adjacent unsecured portion of the stack toward the operator is then manually pulled and pressed against the mandrel while the latter is rotated slowly away from the operator, stationed at the front of the apparatus as viewed in Fig. 1. Concurrently, as the stack of plies is thusly prepared for being pressed, pressure units are withdrawn seriatim, located and manipulated as explained, from unit 35 up to but not including units 44, 45 which remain in case 3A until the lap-joint 77 is prepared for pressure thereby. The preparation consists of applying adhesive to the top surface of the secured end 75 and the under surface of the unsecured end of the stack of veneers. These ends are then lapped as shown in Fig. 3. After pressure units 44, 45 have been withdrawn and pressure applied to this lap-joint by unit 45, these ends are forced to assume the form shown in Fig. 6. As pressure is applied through the shoe of unit 46 the end area 75 is forced into notch 19B. As will be noted in Fig. 3, this shoe straddles the irregularly disposed ends of the several plies and applies pressure to all of these ends since the shoe is preferably faced with rubber.

After the plies are located and secured under the shoes the adhesive is cured according to the specific nature thereof. Preferably a dielectric mandrel 19 is covered with electrode 19C, in sheet form, likewise the stack of veneers with electrode 79 and high frequency electricity applied to these electrodes for the required period of time to unify the assembly. Details of this part of the method

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are not described since this art is well understood and it is no part of this invention.

After the plywood has been removed from the mandrel, as explained above, the offset edges of the plies at the lap-joint are removed in order that all the walls of the tube will be of uniform thickness as they appear in Fig. 9.

While it will be apparent that the illustrated embodiments of my invention herein disclosed are well calculated to adequately fulfill the objects and advantages primarily stated, it is to be understood that the invention is susceptible to variation, modification and change within the spirit and scope of the subjoined claims.

What I claim is:

1. Apparatus for forming a stack of individual flexible sheets of wood with adhesive therebetween into a tube comprising a mandrel rotatable about a given axis and adapted to have said sheets wrapped thereon; and a plurality of mobile pressure units disposed radially of said axis on a common carrier and mounted for rotation about said axis with said mandrel; each pressure unit having an inflatable member for alignment with and adapted to exert and retain pressure on a portion of said sheets at places applied after said portion has been laid on said mandrel.

2. Apparatus for forming a stack of individual flexible sheets of wood with adhesive therebetween into a tube comprising a mandrel rotatable about a given axis and adapted to have said sheets wrapped thereon; and a plurality of mobile pressure units disposed circumferentially spaced radially of said axis and mounted for rotation thereabout; each pressure unit having means adapted to exert and retain pressure on the portion of said sheets thereunder after said portion has been laid on said mandrel to force said sheets into tubular form.

3. Apparatus for forming a stack of individual flexible sheets of wood with adhesive therebetween into a tube and removing it from the apparatus comprising a solid mandrel rotatable about and slidable in terms of a given axis; said mandrel adapted to have said sheets wrapped thereon; and a plurality of pressure units spaced circumferentially and disposed radially of said axis so as to envelope said mandrel completely and mounted for rotation in terms of said axis; each pressure unit having a member adapted for engagement with and means to exert and retain pressure on a portion of said sheets after said portion has been laid on said mandrel to force said sheets into tubular form; and means to retain the tube at the location of formation after the adhesive has set and all applied pressure has been released therefrom while the mandrel is slid from the tube and means to slide said mandrel out of said tube after the adhesive has set and said pressure has been released.

4. Apparatus for forming a stack of individual flexible sheets of wood with adhesive thereon into a tube comprising a solid mandrel rotatable about a given axis; said mandrel adapted to have said sheets wrapped thereon; and a plurality of spaced pressure units disposed circumferentially and radially of said axis; and disposed for engagement with said sheets when laid on said mandrel; each unit having an inflatable member and a shoe as an integral part thereof adapted to force said shoe on a portion of said sheets after said portion has been laid on said mandrel.

5. Apparatus for forming a stack of individual flexible sheets of wood with adhesive therebetween into a tube comprising a mandrel rotatably

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mounted on a slidable shaft at a given axis; an annular face plate mounted on said shaft adjacent one end of said mandrel; said mandrel adapted to have said sheets wrapped thereon; and a plurality of mobile pressure units, each mounted on a pressure bar support disposed radially of said axis and mounted as a cylindrical unit for rotation with said mandrel about said axis; each pressure unit when disposed between said face plate and said cylindrical unit and having an inflatable member adapted to exert pressure outwardly on its correlated pressure bar support and inwardly in terms of said axis on a portion of said sheets after said portion has been laid on the mandrel to form said sheets into said tube.

6. Apparatus for forming a stack of individual flexible sheets of wood with adhesive therebetween into a tube comprising a mandrel rotatably mounted on a suitable shaft at a fixed axis; an annular face plate mounted on said shaft adjacent one end of said mandrel; said plate having a plurality of perforations adjacent its perimeter; said mandrel adapted to have said sheets wrapped thereon; and a plurality of mobile pressure units, each mounted on a pressure bar support spaced radially of said axis and mounted as a cylindrical unit for rotation thereabout; each of said bar supports having a projection to enter one of said perforations when suspended between said face plate and said cylindrical unit and having an inflatable member adapted to exert pressure outwardly on its correlated pressure bar support and inwardly on a portion of said sheets after they have been wrapped on the mandrel to form said sheets.

7. Apparatus for forming a stack of individual flexible sheets of wood with adhesive therebetween into a tube and removing the tube from the apparatus, comprising a solid mandrel rotatably mounted on a shaft; an annular plate mounted on said shaft adjacent one end of said mandrel; said mandrel adapted to have said sheets wrapped thereon; and a plurality of pressure units, each mounted on a pressure bar support disposed radially of a given axis and mounted as a cylindrical unit so as to envelop said mandrel completely; each pressure unit adapted to be suspended between said plate and said cylindrical unit and having an inflatable member adapted to exert pressure outwardly on its correlated pressure bar support and inwardly on a portion of said sheets after they have been wrapped on the mandrel to form said sheets into said tube; and means to retain the tube at the location of formation after the adhesive has set and all applied pressure has been released therefrom while the mandrel is slid from the tube.

8. Apparatus for forming a stack of individual flexible sheets of wood with adhesive therebetween into a tube comprising a rotatable solid mandrel mounted on a given axis and adapted to have said sheets wrapped thereon; and a plurality of pressure units arranged in spaced relation radially of said axis and lodged in a carrier located axially away from said mandrel and arranged to encompass said mandrel when projected in part thereover from said carrier; each of said units having means for exerting pressure on a portion only of said sheets and the mandrel after said portion has been placed thereon and to retain said pressure while the adhesive sets to secure the sheets in the form determined by the mandrel.

9. Apparatus for forming a stack of individual flexible sheets of wood with adhesive therebe-

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tween into a tube comprising a rotatable mandrel mounted on a given axis and adapted to have said sheets wrapped thereon; and a plurality of pressure units slidable in a path parallel to said axis and arranged in spaced relation radially of said axis and lodged in a carrier located axially from said mandrel and arranged to encompass said mandrel when projected in part thereover from said carrier; each of said units having means for exerting pressure on a portion only of said sheets and the mandrel after said portion has been placed thereon and to retain said pressure while the adhesive sets to secure the sheets in the form determined by the mandrel.

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