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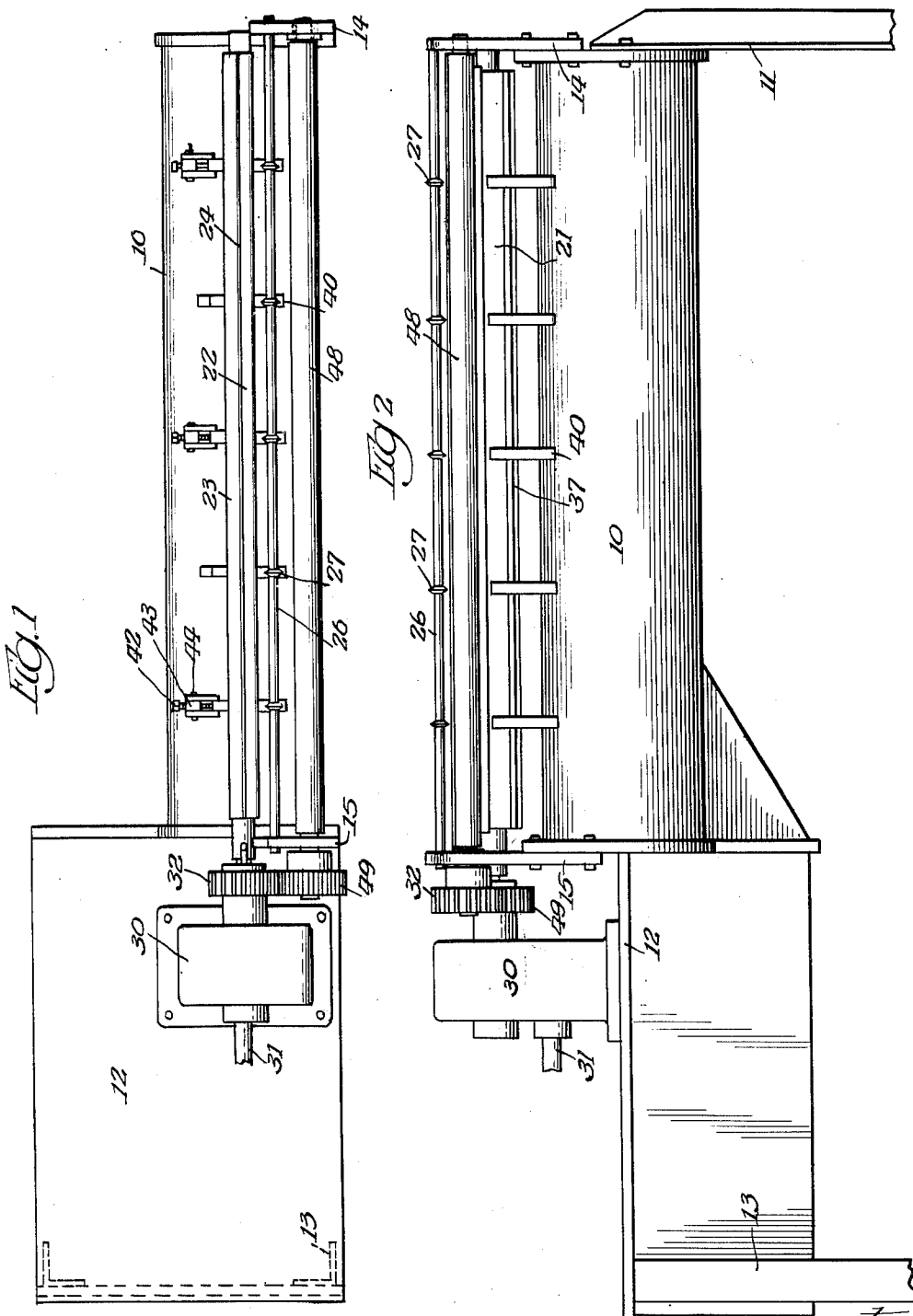
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2,616,463

APPARATUS FOR FABRICATION OF PLYWOOD TUBING

Filed July 14, 1945

4 Sheets-Sheet 1



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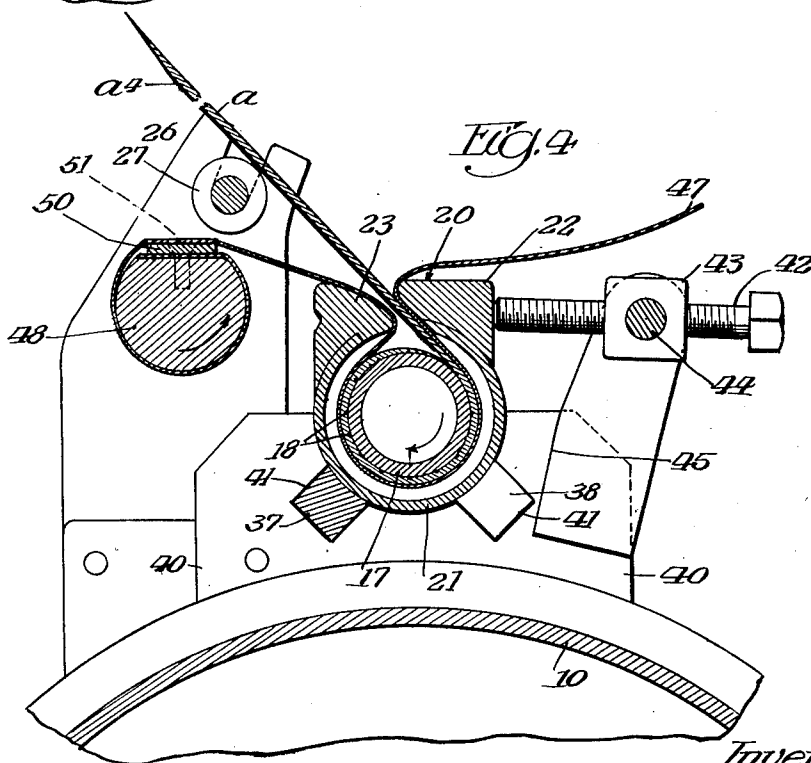
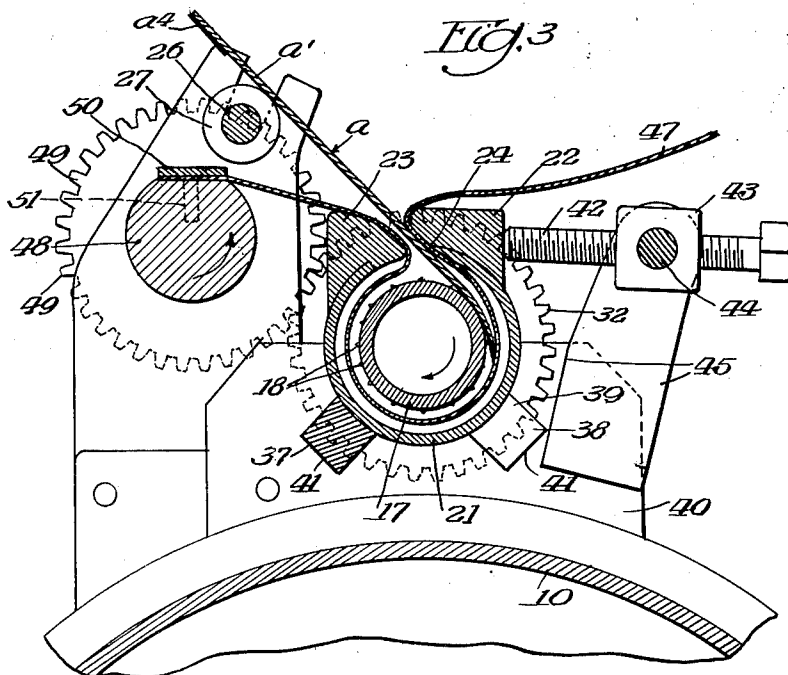
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APPARATUS FOR FABRICATION OF PLYWOOD TUBING

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APPARATUS FOR FABRICATION OF PLYWOOD TUBING

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Fig. 5

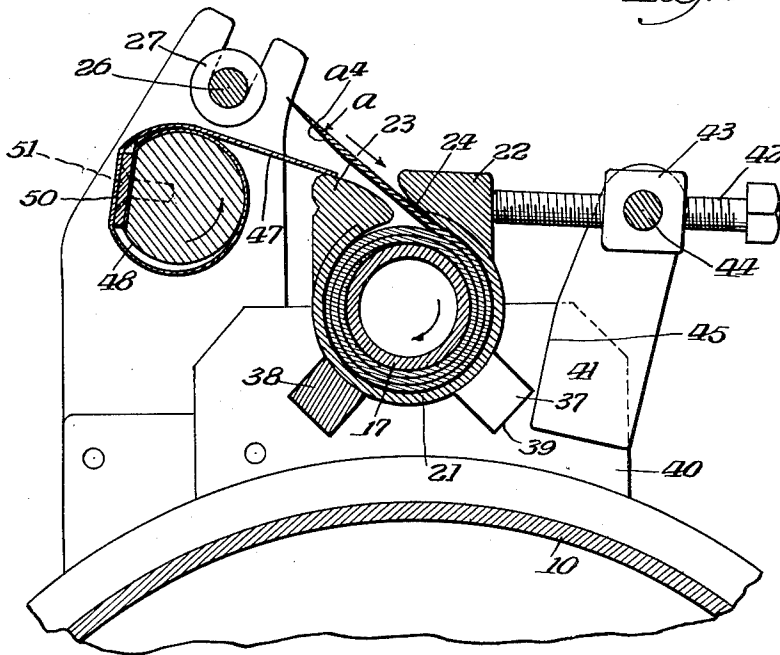
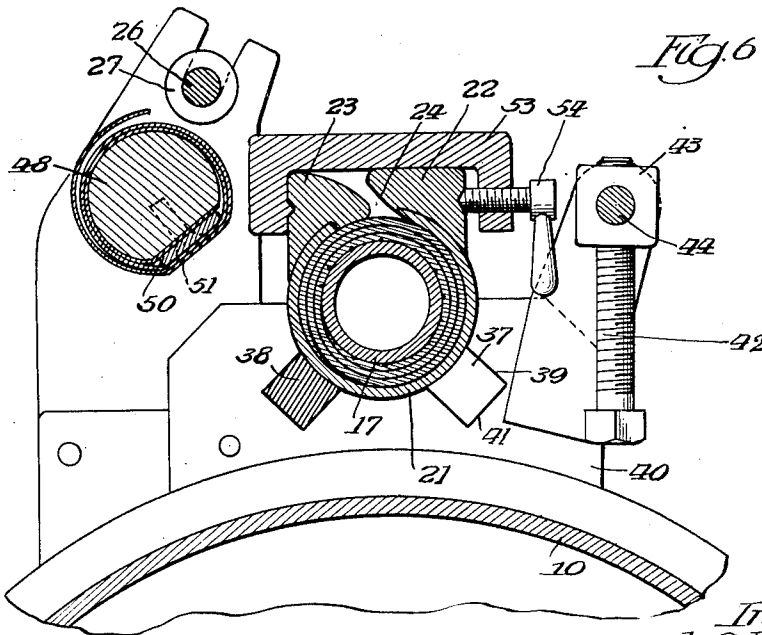


Fig. 6



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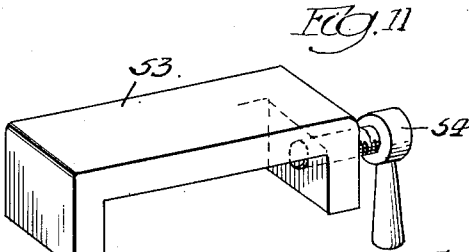
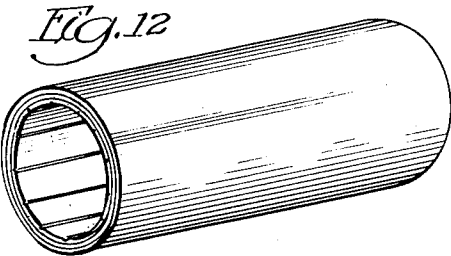
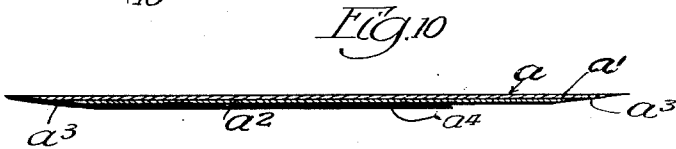
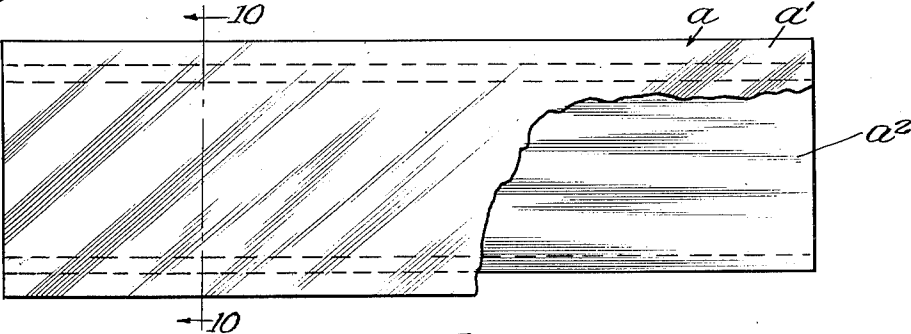
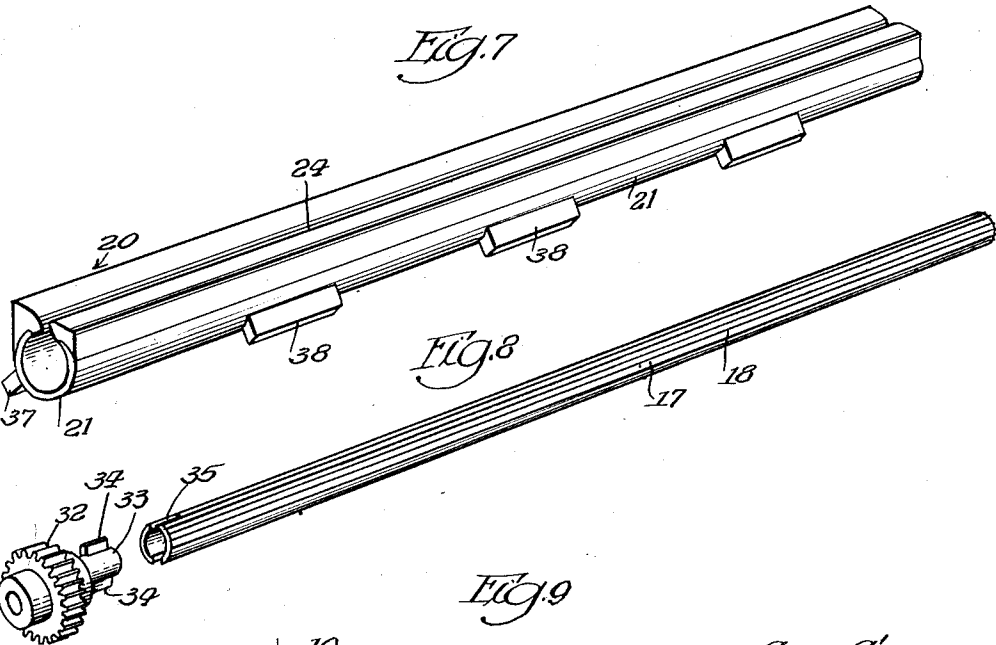
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APPARATUS FOR FABRICATION OF PLYWOOD TUBING

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4 Sheets-Sheet 4



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APPARATUS FOR FABRICATION OF
PLYWOOD TUBING

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2 Claims. (Cl. 144—268)

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The invention relates to the fabrication of plywood tubing.

One object of the invention is to provide apparatus and a method for forming panels of assembled plies of veneer in a single winding operation with convolutions of the panels closely bonded and compressed together throughout their meeting areas.

Another object of the invention is to provide apparatus for expeditiously wrapping a plywood panel into tubing and subjecting convolutions of the plywood to firm pressure for bonding and compressing them together in closely wrapped relation during the thermo-setting of the glue between the convolutions.

Another object of the invention is to provide apparatus for fabricating plywood tubing which is simple in construction and is adapted for high production.

Other objects of the invention will appear from the detailed description.

The invention consists in the several features hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawings:

Fig. 1 is a plan of mechanism for carrying out the invention.

Fig. 2 is a front elevation.

Fig. 3 is a section of the mechanism for winding the plywood panel into tubing and illustrating the relationship of the panel and said mechanism at the commencement of a wrapping operation.

Fig. 4 is a similar view illustrating the wrapping mechanism when the panel has been partially wound.

Fig. 5 is a similar view illustrating the wrapping mechanism near the end of a wrapping operation.

Fig. 6 is a section through the wrapping mechanism after the panel has been wound into tubing and is compressed therein for thermo-setting the glue between the convolutions of the panel.

Fig. 7 is a perspective of the tubular casing in which the panel is wound.

Fig. 8 is a perspective of the mandrel and the detachable coupling for driving the mandrel.

Fig. 9 is a plan of a pre-assembled plywood panel for fabrication into tubing.

Fig. 10 is a section taken on line 10—10 of Fig. 9.

Fig. 11 is a perspective of one of the clamps for contracting the casing around the tubing.

Fig. 12 is a perspective of the finished tubing. The mechanism for winding the panel into

tubing is supported by a structure which comprises a tubular member 10, supported at one of its ends by a leg 11, a table 12, and supporting legs 13, all rigidly secured together, for example, by welding. Brackets 14 and 15 are rigidly secured to the ends of tubular member 10 for removably supporting the wrapping mechanism.

The invention is adapted for fabricating tubing from a pre-assembled plywood panel which comprises sheets of wood veneer secured together by glue which has been thermoset. The grain of the plywood extends in different directions for producing rigidity and strength in the fabricated tubing. For example, the panel *a* is formed of a sheet of veneer *a*¹ having the grain of the wood extending diagonally across the panel, and a sheet of veneer *a*² having its grain extending longitudinally of the panel. Sheets *a*¹ and *a*² are assembled with glue which has been thermoset to form a fabricated plywood panel. The panel is formed of a length which corresponds to the length of tubing desired with the grain of the sheet of veneer *a*² extending longitudinally of the panel and the panel is wound so that said grain will extend longitudinally of the finished tubing. The grain of sheet *a*¹ extends diagonally thereof, for example, an angle of 35° from the longitudinal edges of the panel. The edges of the panel, at the longitudinal sides, are bevelled, as at *a*³. The panel is dimensioned in width to form the desired number of convolutions with the bevelled ends *a*³ of the panel terminating so as to produce tubing of uniform cross-sectional wall-thickness throughout its circumference.

The mechanism for shaping the panel into tubing comprises a hollow or tubular mandrel 17 around which the panel is wound. Ribs 18 on the outer periphery of the mandrel extend longitudinally thereof for gripping the panel for rotation during the winding operation. The plywood panel is wrapped around the mandrel in a tubular contractible casing, generally designated 20, which is provided with a gap or throat 24 through which the panel is fed to the mandrel. This casing comprises a longitudinally split tubular member 21 which is formed of slightly resilient metal so it will be contractible to compress the panel around the mandrel; rigid members or bars 22 and 23 which are welded to the portions of tubular member 21 at the gap or throat 24 through which the panel *a* is adapted to be inserted into the casing. The casing is open at its ends for the insertion and removal of the mandrel. The gap 24 extends from end to end of the casing to permit the tubular member 21

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to be contracted during the winding of the panel on the mandrel and thereafter.

A shaft 26 is journaled in open-ended bearings in brackets 14 and 15 and is provided with rollers 27 by which the panel is guided to the gap 24 in casing 20. The mandrel 17 is removable and insertable endwise into the casing 20 and is adapted to be driven by power in any suitable manner, for example, a reduction gear 30 mounted on table 12 with an input shaft 31 which is driven by an electric motor (not shown) usually supported on table 12. The output shaft of the reduction gear has fixed thereto a gear 32. A detachable driving coupling for the mandrel comprises a stud 33 rigid with gear 32 and provided with wings 34 which are adapted to enter slots 35 in one end of the mandrel. The mandrel 17 is unsupported at the opposite end so that it will be free to position itself radially in the tubular member 21 of the casing 20 and is detachable at said coupling for removal with the casing and a wound panel.

The casing 20 is removably supported on the supporting structure so that it may be transported with the mandrel and tubing therein to an oven for thermosetting the glue in the tubing. The lower portion of one side of casing member 20 has welded thereto a bar 37 and the lower portion of its opposite side has lugs 38 welded thereto. Brackets 40 are welded to the tubular member 10 of the supporting structure and provided with slots 41 for receiving bar 37 and lugs 38 to removably support the casing 20. Bar 37 and lugs 38 are endwise removable from slots 41 in brackets 40 for endwise insertion into and removal of the mandrel from the supporting structure. The tubular member 21 of the casing 20 is resilient so that the casing can be contracted to press together the convolutions of a plywood panel while it is being wound on the mandrel 17 and after it has been completely wound thereon. The bars 22 and 23 are rigid for contracting the casing from end to end. The contracting means for the casing 20 comprises a series of screws 42 which are adapted to engage the outer side of bar 22 at one side of the throat 24 and threaded through blocks 43 which are provided with studs 44 which are pivoted in lugs 45 which are welded to brackets 40. The screws 42 are thus pivoted in lugs 45 to permit them to be rotated for clearance in the removal of the casing 20 from the supporting structure. As the screws 42 are tightened, the bar 22 will be forced toward bar 23 and reduce the width of throat or gap 24, the resiliency of tubular member 21 permitting the bar 22 to be moved by screws 42.

The panel *a* is drawn into contact with the mandrel 17 after the leading end of the panel has been inserted into the casing 20, as illustrated in Fig. 3, by means which comprises a sheet of flexible fabric 47 which is adapted to pass through the throat 24 and into and out of the casing. The flexible sheet 47 is wound on a shaft 48 which is rotated simultaneously with the mandrel. Shaft 48 is journaled in brackets 40 and has fixed to its inner end a gear 49 which meshes with gear 32 which drives the mandrel. Strip 47 is removably secured to shaft 48 by a bar 50 and screws 51. The strip 47 is bent into the form of a loop which is insertable endwise into the casing 20 before the mandrel 17 is inserted therein preparatory to a winding operation.

The operation of the apparatus and the method

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of forming the tubing will be as follows: casing 20, which is detachable from the supporting structure, is inserted endwise therein with the lugs 38 and bar 37 fitting in the notches 39 in brackets 40 and the throat 24 disposed adjacent the top. Flexible sheet 47, while detached from shaft 48, is inserted endwise into the casing with a portion thereof bent to form a loop. The mandrel 17 is then inserted endwise into the casing and into the loop of the flexible sheet 47 and its inner end is coupled to the stud 33 on gear 32. One end of sheet 47 is then secured by bar 50 to shaft 48.

In order to render the plywood sufficiently flexible for the wrapping operation, it is provided with a moisture content of approximately 13%. The panel is coated with glue, as at *a*⁴, over the area commencing on a line where the first convolution of the tubing is completed and extending to the trailing end of the panel. The uncoated leading bevelled end of panel *a* is inserted through throat 24 in casing 20 and into the loop of sheet 47, as illustrated in Fig. 3. The screws 42 are set for pressure engagement against the outer side of bar 22 in casing 20 to prevent expansion of the casing. The driving mechanism is then started and the mandrel 17 and shaft 48 are simultaneously rotated. The rotation of shaft 48 exerts a pull on the sheet 47 which presses the leading end and successive portions of the panel toward the mandrel. The mandrel is pressed against the ridges or ribs 18 on the mandrel to cause the latter to grip the panel and wind it around the mandrel. After one convolution of the tubing has been wound on the mandrel, the glue *a*⁴, on the inner face of the following portion of the panel will be pressed against the outer face of the underlying convolution and succeeding convolutions. The rotation of the mandrel is continued until the entire panel has been wound around the mandrel. Flexible sheet 47 is of such length that its free end will pass out of the casing before the panel is completely wound on the mandrel, for example, when the tubing is formed of three convolutions of plywood, the sheet is of such length that its trailing end will pass out of the casing when approximately two convolutions have been wound on the mandrel, as illustrated in Fig. 5.

During the winding of the panel on the mandrel, the screws 42 will hold the casing against expansion by the tubing wound on the mandrel. When the panel has been completely wound on the mandrel, clamps 53 in any desired number, which are provided with screws 54, are placed on the casing 20 and across gap 24 and the casing is tightened against the tubing. After the clamps 53 have been applied to the casing, rotation of the mandrel is continued for a number of revolutions, during which the screws 54 are progressively tightened. During this rotation of the mandrel and tubing, the latter is under compression, and any contiguous areas between the convolutions of the panel which have not been forced together into intimate bonding contact will be progressively rolled or ironed circumferentially from the leading or inner end of the panel towards the trailing end of the panel and to the outside of the tubing. All contiguous areas in the convolutions of the panel will then be closely and uniformly pressed together into bonding contact and the tubing will have a uniform wall-thickness. The pressure against the tubing will cause the ridges on the mandrel to form fine grooves in the inner periphery of the tubing. The assembled

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clamps 53, casing 20, the tubing and mandrel 17 are then conjointly removed endwise from the supporting structure and placed in an oven or otherwise suitably subjected to heat while the tubing remains under compression until the glue between the convolutions of the tubing has been thermoset. The hollow mandrel permits heat to be applied therethrough to the inner portion of the tubing. After the glue in the tubing has been thermoset, the assembly of the casing, tubing and mandrel are removed from the oven. Clamps 53 are then removed from the casing. The tubing with the mandrel therein is then removed endwise from the casing. The mandrel is then driven endwise out of the tubing. A series of casings and mandrels are provided for successive use in the supporting structure so that winding operations may be continuously carried on while the tubing is being heated for thermosetting the glue.

The invention exemplifies apparatus for fabricating tubing formed of plywood in which a single panel of pre-assembled plies is wound into tubing in the casing and mandrel so that the tubing will be completely formed of plywood by a single winding or wrapping operation. The invention also exemplifies apparatus for fabricating tubing by which the contiguous faces of successive convolutions of the plywood panel are firmly and uniformly bonded together throughout all of their contacting areas. The invention also exemplifies simple and efficient means for initiating the gripping of the panel by the mandrel.

The invention is not to be understood as limited to the details described, since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:

1. Apparatus for fabricating plywood tubing, comprising: a supporting structure, a casing pro-

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vided with a longitudinal gap through which a panel can be fed, supported on the structure; a rotatable mandrel for winding the panel into convolute form, mechanism on the structure for rotating the mandrel in the casing, a flexible member for feeding the panel into the casing, having a free end insertable through the gap, means for winding the other end of the flexible member for drawing the member through the casing, the free end being drawn out of the casing when the panel has been wound on the mandrel.

2. Apparatus for fabricating plywood tubing, comprising: a supporting structure, a casing provided with a longitudinal gap through which a panel can be fed, supported on the structure; a rotatable mandrel for winding the panel into convolute form, mechanism on the structure for rotating the mandrel in the casing, a flexible member for feeding the panel around the mandrel and into the casing, having a free end insertable through the gap, a winding element connected to the other end of said member, the free end passing out of the casing when the panel has been wound on the mandrel.

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