

[54] **LAMINATING METHOD AND APPARATUS**

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Related U.S. Application Data

- [63] Continuation-in-part of Ser. No. 510,597, Nov. 30, 1965, abandoned.
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 [51] Int. Cl. **B29c 17/04**
 [58] Field of Search 156/200-202, 212, 156/216-223, 299, 443, 475-482, 486, 492, 581, 583, 588, 499; 100/92, 93 P, 254, 269, 295; 219/10.43, 339, 354, 520, 531, 536, 550; 338/226, 306; 18/19 BM, 19 BE, 35, DIG. 58

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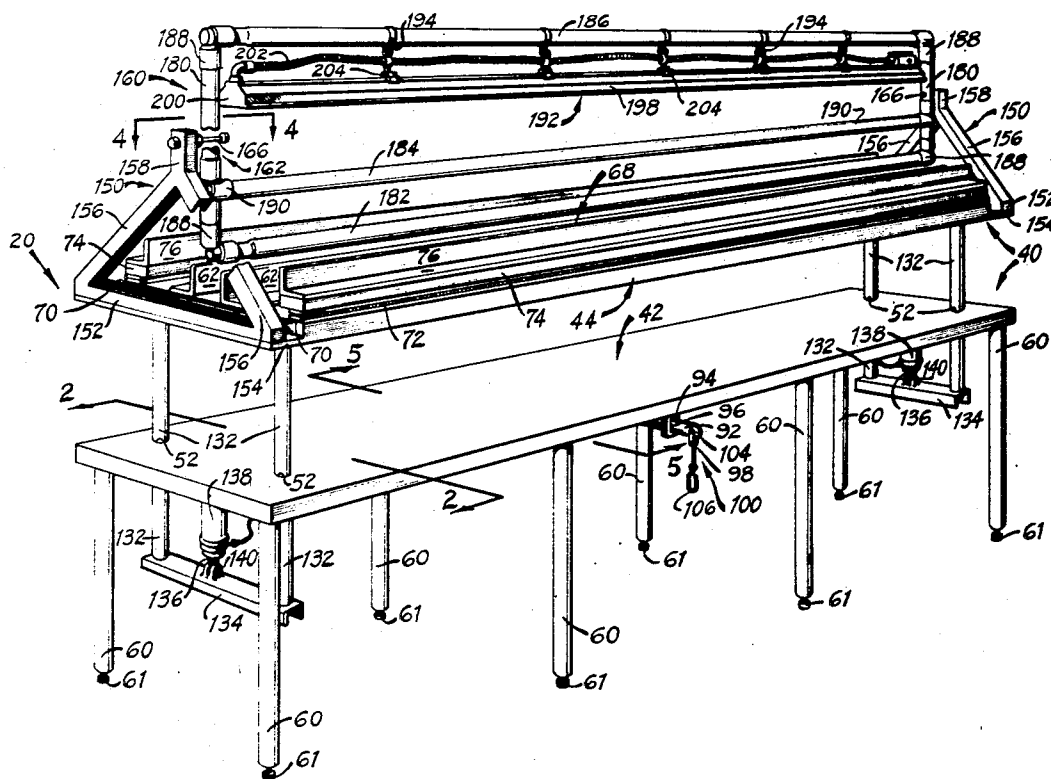
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[57]

ABSTRACT

A method and apparatus for making a configured, laminated workpiece, the apparatus being comprised of a forming press having a lower, stationary platen and an upper reciprocable platen which cooperate to apply pressure to selected portions of the laminated workpiece. Movable edge members are hingedly attached to the upper platen and are adapted to be manually rotated to bend veneer into a generally contiguous configuration with a base component. Alternatively, a latch mechanism may be used to forcibly rotate each edge member and bend the veneer. A heater is pivotally supported above the upper platen and upon a carrier frame or turnstyle which is freely, arcuately swingable through all or nearly all of 360° so that it may be easily positioned in the most effective location to accommodate softening of the veneer immediately prior to bending. A stationary heating element may be supported near the upper edge of the lower platen to aid the pivotal heater in the softening process.

12 Claims, 25 Drawing Figures

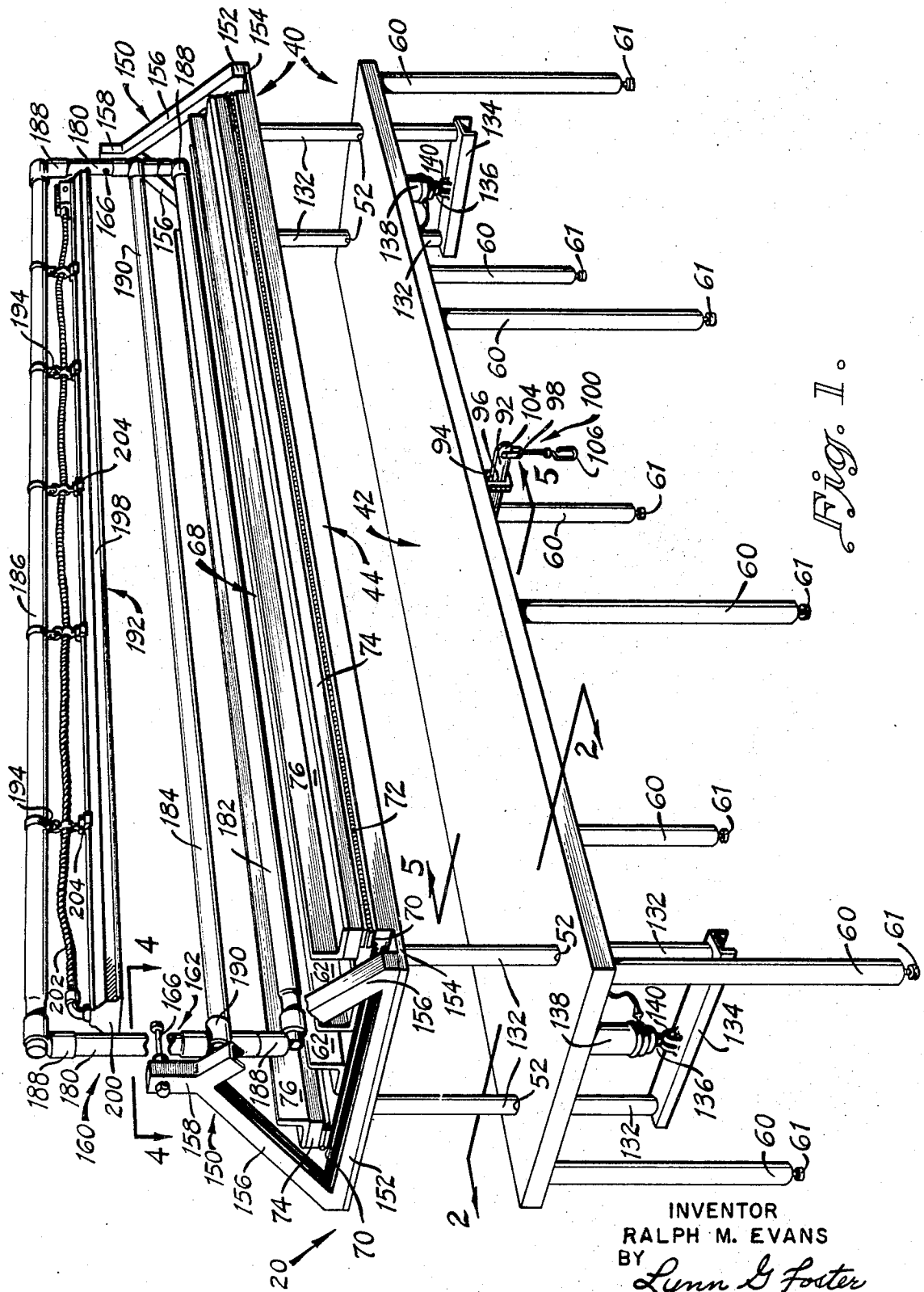
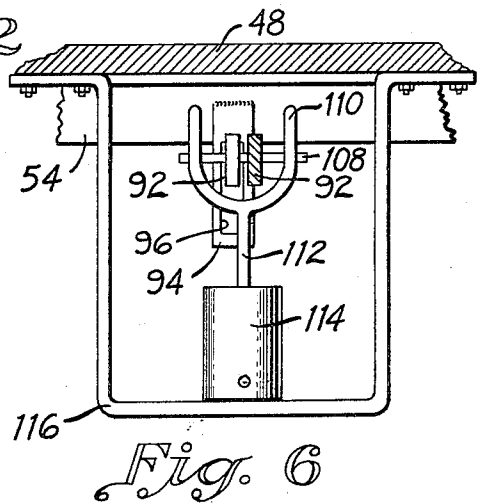
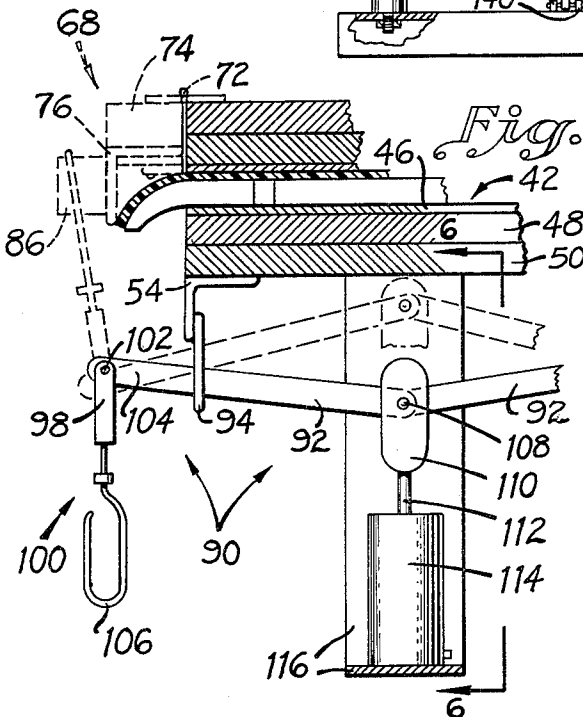
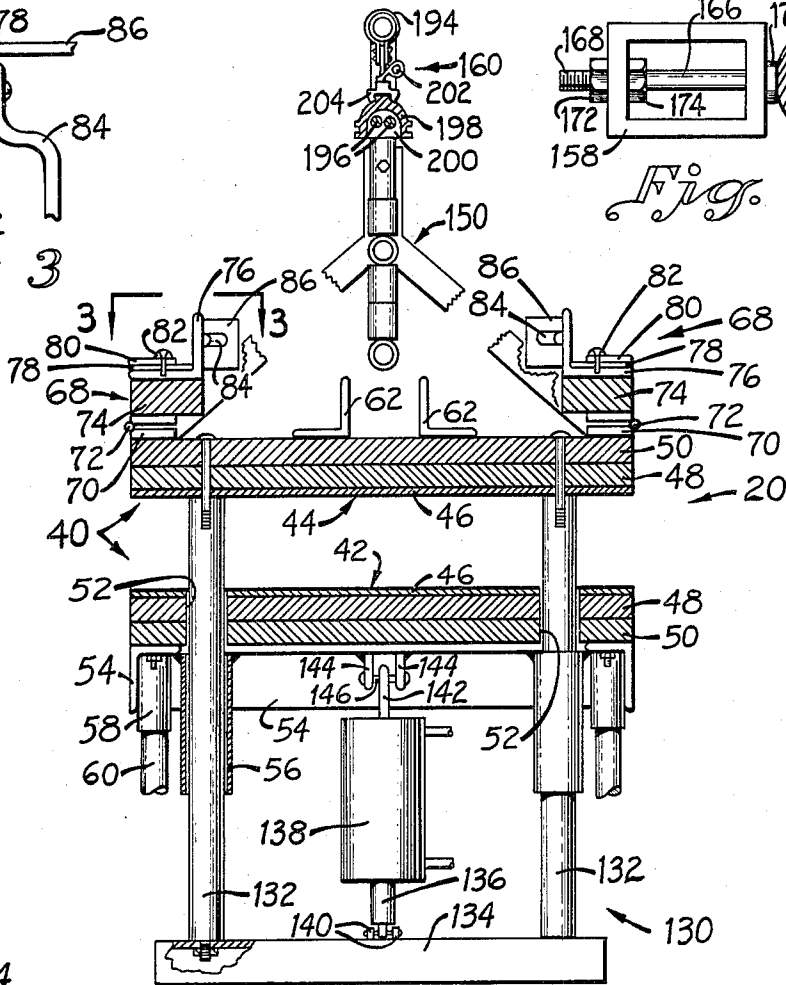
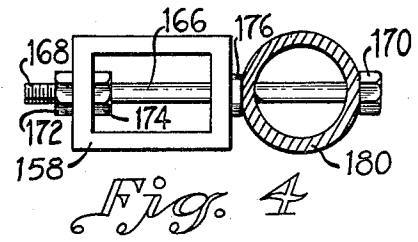
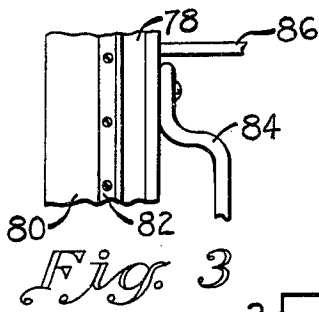
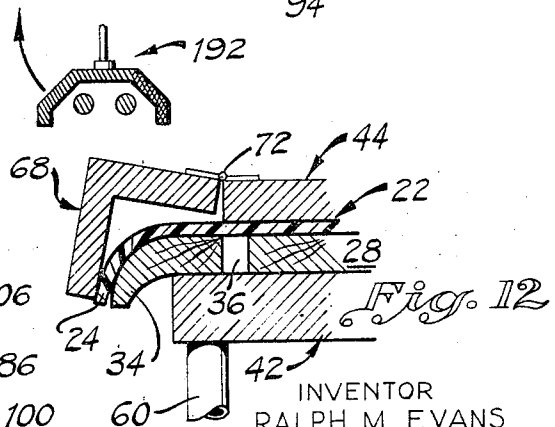
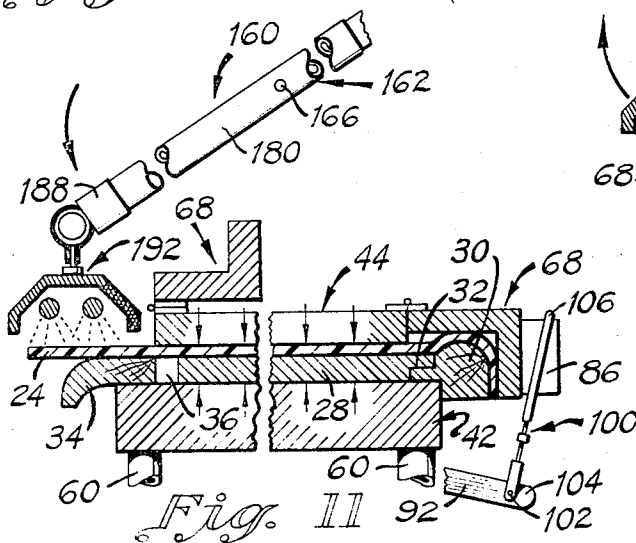
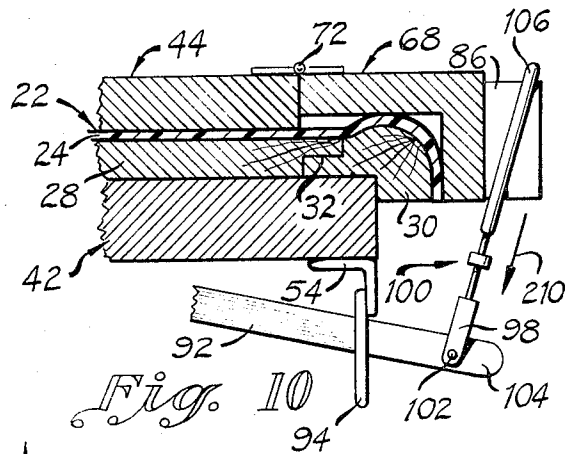
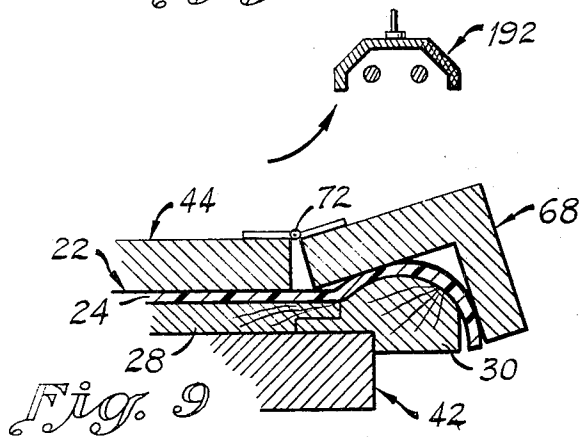
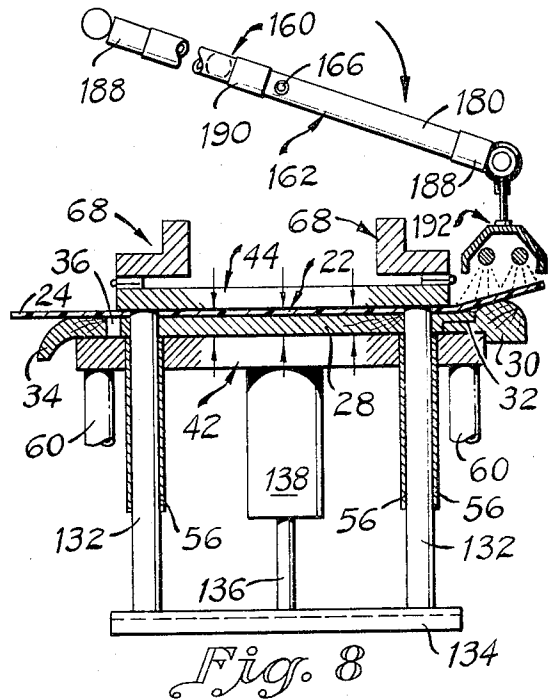
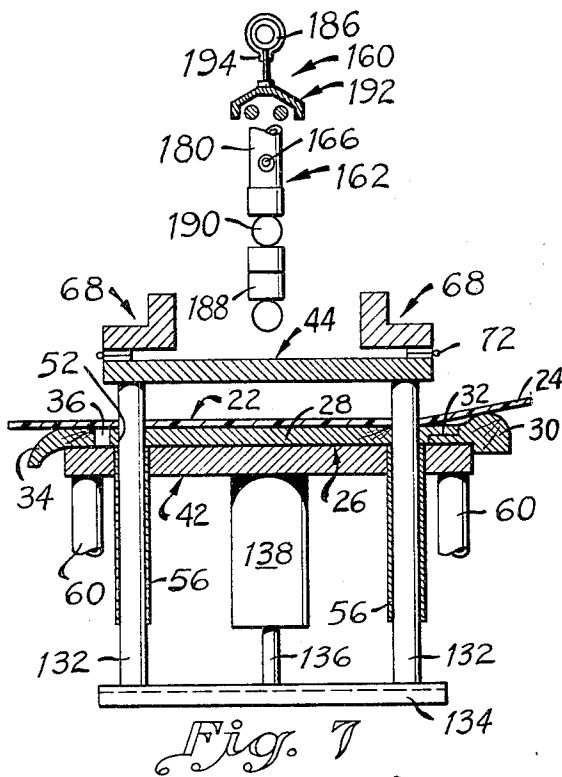


Fig. 1.

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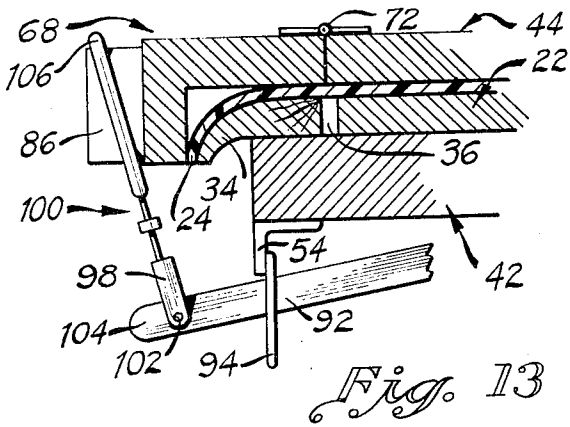


Fig. 13

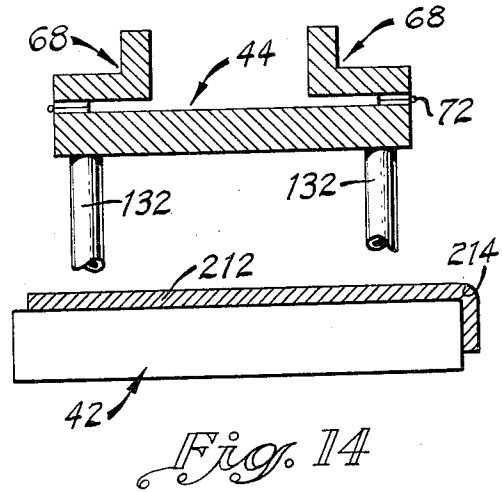


Fig. 14

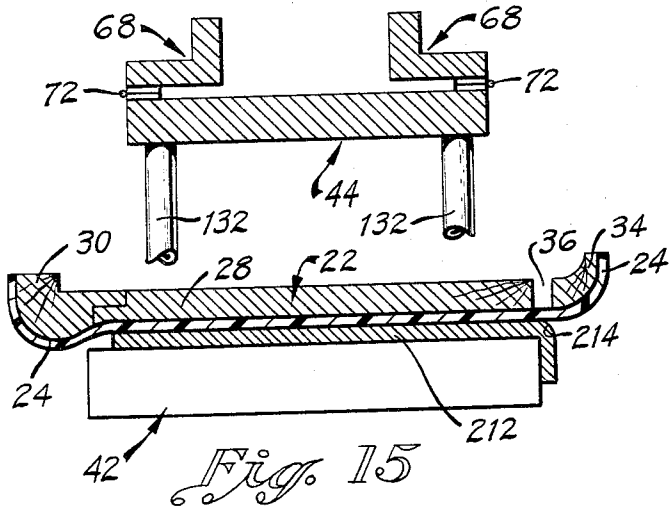


Fig. 15

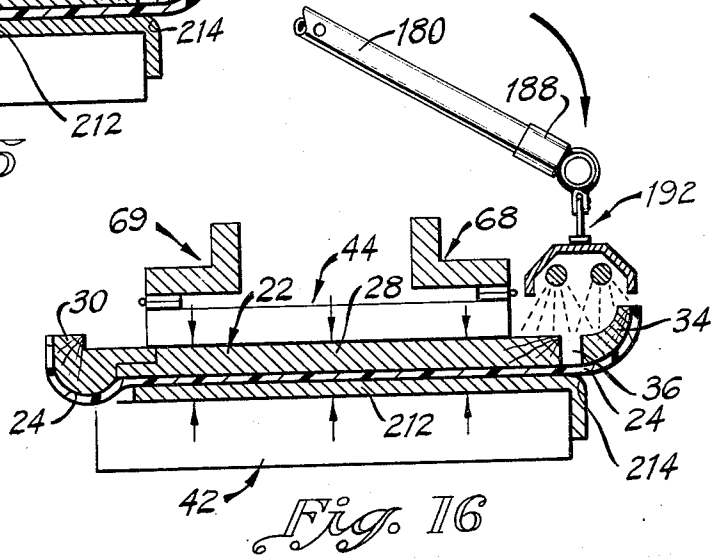


Fig. 16

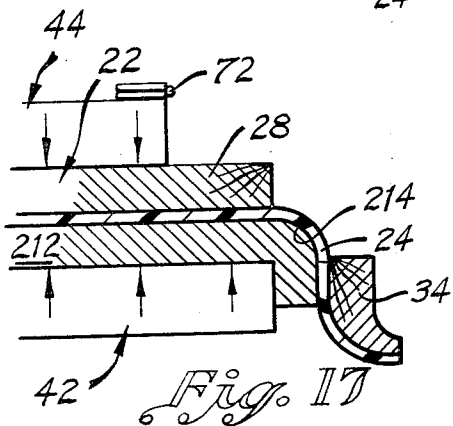


Fig. 17

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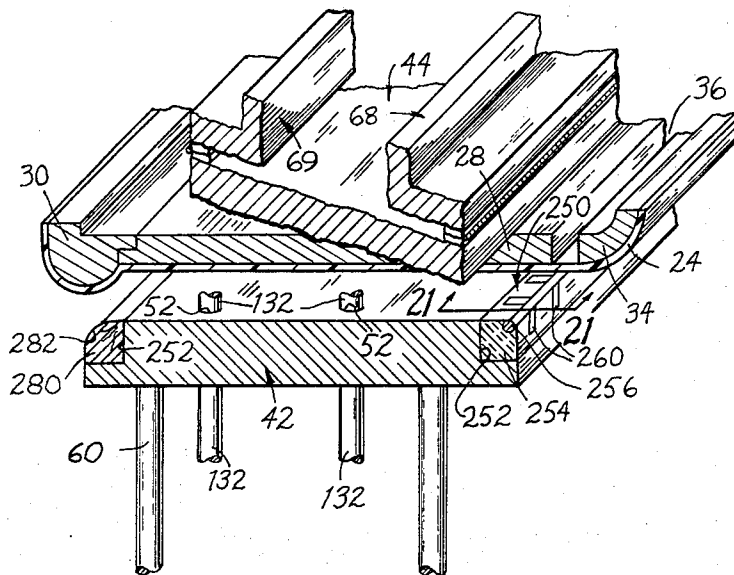
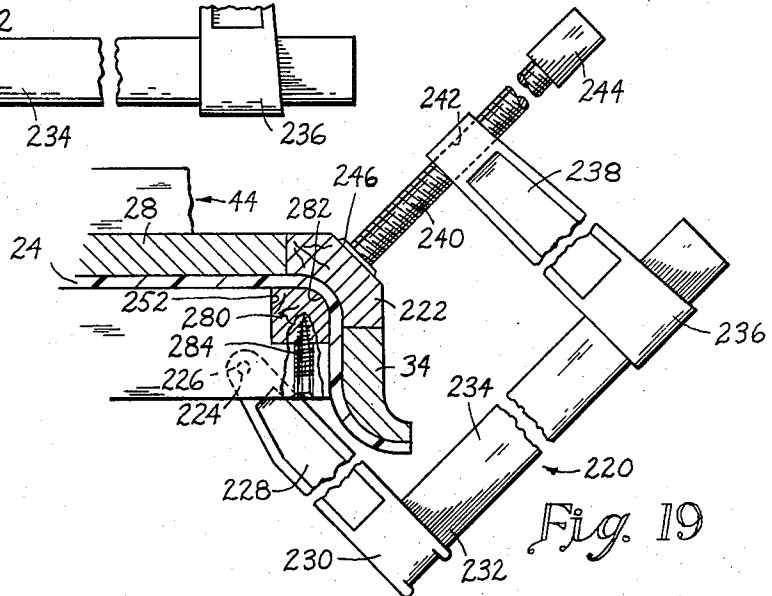
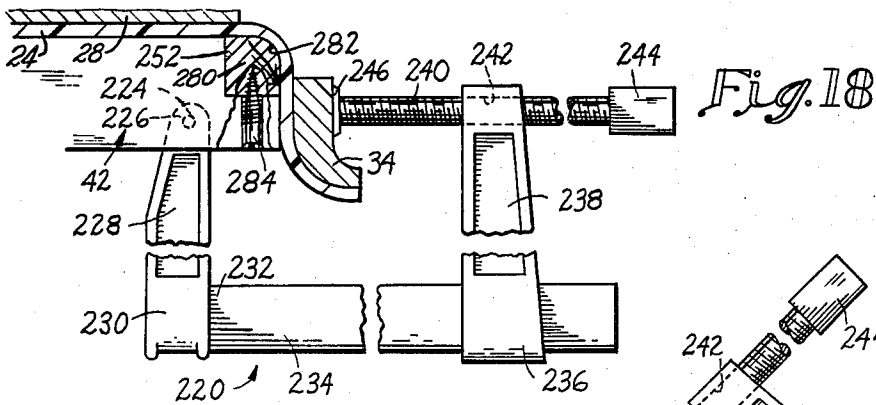


Fig. 20

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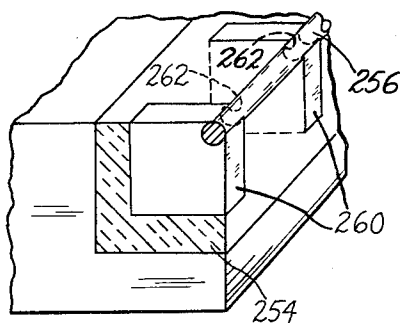


Fig. 21

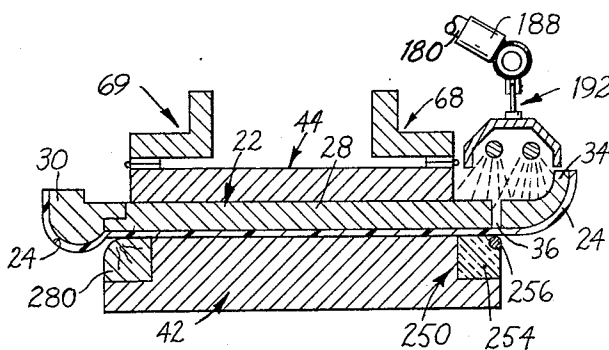


Fig. 22

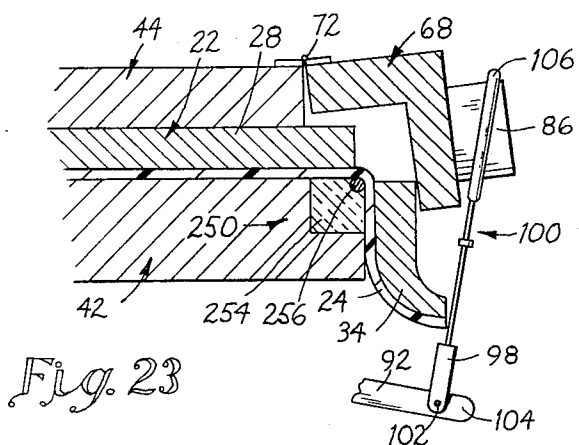


Fig. 23

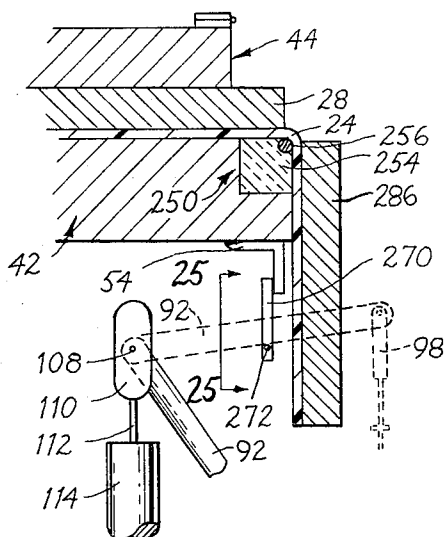


Fig. 24

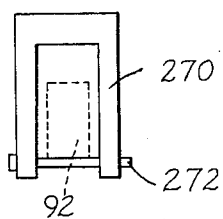


Fig. 25

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LAMINATING METHOD AND APPARATUS

This application is a continuation-in-part of U. S. Pat. Application Serial No. 510,597 filed Nov. 30, 1965 and now abandoned.

The present invention generally relates to the making of a laminated workpiece and more particularly to a unique method of and a novel apparatus for making a laminated workpiece comprising a base, such as wood, and an exposed covering of plastic veneer bonded to the base, the plastic being rigid at room temperature but pliable at elevated temperatures. The fabricated workpiece may be a preformed contoured countertop, such as those used in residential kitchens, and the plastic covering may be of decorative "Formica" or the like though this invention is not limited to such a configuration or to use of such covering material.

Previously, the manufacture of laminates having a plastic veneer covering has normally necessitated utilization of comparatively massive, often multiple station, pressure-applying and heat-applying equipment. Disadvantageously, such equipment is very costly to initially purchase and to thereafter maintain, occupies a substantial area of plant floor space, and lacks versatility of use. Commercial use of such equipment is fundamentally restricted to the automated manufacture of laminated patterns of standardized configuration where high production rates are essential. Use of such costly and bulky equipment for custom manufacturing or for varied types and quantities of production, where possible, is awkward and not economically feasible, especially with respect to relatively small business concerns engaged in specialized laminating work or operating on an irregular, limited production basis.

With the foregoing in mind, it is a primary object of the present invention to provide a novel laminating method and apparatus which substantially overcomes the above-identified prior art deficiencies.

An additional important object of the present invention is to provide a novel laminating apparatus which is versatile and compact, comparatively inexpensive to purchase and maintain and convenient to operate.

Another principal object of the present invention is the provision of a single station laminating apparatus wherein a heat-applying portion thereof is structurally separate from the pressure applying portion and can be readily displaced to either of two oppositely disposed effective positions during use and to remote positions during non-use.

A further significant object is the provision of a novel method of laminating plastic veneer to a base structure, which method uniquely accommodates heat-softening of select portions of the plastic veneer to enable permanent bonding and exact shape conformity between the base and the plastic veneer without cracking or creation of heat flaws.

Another paramount object of this invention is the provision of a novel system, including method and apparatus, for the fabrication of a very small radius of curvature between angularly related components of a laminated workpiece.

These and other objects and features of this invention will become more fully apparent from the following description and appended claims taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a schematic perspective view of the presently preferred laminating apparatus of this invention;

FIG. 2 is a cross-sectional view in elevation taken along line 2—2 of FIG. 1;

FIG. 3 is a fragmentary plan view taken along line 3—3 of FIG. 2;

FIG. 4 is a cross-sectional view in plan taken along line 4—4 of FIG. 1;

FIG. 5 is a fragmentary schematic cross-sectional view in elevation taken along line 5—5 of FIG. 1;

FIG. 6 is a fragmentary schematic elevational view taken along line 6—6 of FIG. 5; and

FIGS. 7 through 17 are fragmentary schematic cross-sectional representations of the sequential steps of a presently preferred method, according to this invention, for fabricating

a residential kitchen countertop having an exposed covering of plastic veneer.

FIGS. 18 and 19 are fragmentary schematic cross-sectional representations principally depicting a pivotable "C"-clamp assembly which may be used to fabricate or "cove" the backsplash portion of a workpiece;

FIG. 20 is a fragmentary perspective schematic representation of another presently preferred laminating apparatus used to fabricate a small radius of curvature in the plastic veneer at a location where the backsplash joins the main body of the workpiece;

FIG. 21 is a fragmentary cross section taken along line 21—21 of FIG. 20;

FIGS. 22 and 23 are fragmentary schematic cross-sectional representations depicting the preferred sequential steps to be followed when fabricating a short radius of curvature using the apparatus of FIG. 20;

FIG. 24 is a fragmentary schematic cross-sectional representation depicting the fabrication of a workpiece having a full or long backsplash and illustrating structure for releasing the adjacent arm of the locking mechanism from its normal position to a remote, inactive position; and

FIG. 25 is a cross-sectional view taken along line 25—25 of FIG. 24.

The Apparatus of FIGS. 1-6

Reference is now made in general to FIGS. 1 through 6 of the drawings which illustrate the presently preferred laminating apparatus of this invention, generally designated 20. The laminating apparatus 20 is extremely versatile and compact, and accommodates single station fabrication of a laminated workpiece comprising a base and a plastic veneer covering. The apparatus 20 comprises a pressure applying mechanism and a heat applying mechanism each of which is structurally separate from the other.

The workpiece, which is shown in partially fabricated condition in FIG. 7, is specifically a residential kitchen countertop in the illustrated example, generally designated 22.

Structurally, the workpiece or countertop 22 comprises an exposed covering of plastic veneer 24, which is rigid at room temperature but pliable when heated to elevated temperatures. The veneer 24 may be a plastic of the "Formica" type or the like, which provides a hard, though usually decorative, working surface which is highly wear-resistant.

When the workpiece 22 is fully fabricated, the veneer 24 is appropriately bonded, by a suitable bonding agent or adhesive, to an elongated base structure 26 of desired length and cross-sectional configuration. The base structure is fabricated from wood or other suitable material. The elongated base structure 26 comprises three components, i.e., a central, essentially planar section 28, a rounded front edge portion 30 which is lap joined at 32 to the central section 28, and a rear backsplash section 34 which is transversely spaced a predetermined distance 36 from the rear edge of the central section 28. In the finished configuration, the backsplash 34 will extend upwardly at approximately a 90° angle with respect to the center section 28, as is common practice in the art today.

It is to be appreciated that the countertop 22 is presented in this specification as exemplary only. Other laminated workpieces having a base and a bonded plastic veneer covering can also be suitably fashioned or formed by use of the instant method and apparatus.

The Press

Returning now to FIGS. 1 through 6, a forming press, generally designated 40, operates to apply pressure to the workpiece to restrain the same against displacement as the edges of the veneer are appropriately configured and bonded to the base. The press 40 comprises a lower stationary platen 42 and an upper reciprocable platen 44.

The parallel planar portions of the lower platen and the upper platen are composite in nature and comprise oppositely

disposed facing plates 46, which can be a high pressure plastic veneer, a suitable metal or the like. Two superimposed flat plywood or like strips 48 and 50 about each facing plate 46. The respective facing plates 46 and strips 48 and 50 are suitably secured one to another by bonding, bolts or the like so as to form the integral structure seen in FIG. 2.

As best visualized in FIG. 2, the lower platen 42 is fabricated to include four post-receiving apertures 52, two being alignedly disposed adjacent each end of the apparatus 20. The lower stationary platen 42 also comprises angle braces 54 disposed along the full periphery at the bottom of the lower strip 50, being rigidly attached thereto by bolts or other suitable means such that the respective legs of the angle braces project inwardly and downwardly.

Four guide sleeves 56 are respectively suitably secured to the lower platen, such as at the inwardly extending leg of the angle brace 54, by welding or the like, so as to project downwardly in essentially concentric relation with the adjacent post-receiving aperture 52 (see FIG. 2).

Leg-receiving sockets 58 are similarly integrally joined to the lower platen, i.e., at angle braces 54 in the illustrative example. Preferably, each of the sockets 58 is a hollow cylinder which is internally threaded. A hollow cylindrical leg 60, constituting part of the support frame of the laminating apparatus 20, is externally threaded and joined thereat to each socket 58. In this way, the illustrated eight legs each individually accommodate variance in the overall effective length of the leg by respectively threading the leg in or out of the socket the distance desired.

Note that each of the legs 60 are equipped with a ground-engaging adjustable support 61 which is threadedly attached to the base of the adjacent leg to accommodate leveling of the laminating apparatus 20.

The upper reciprocating platen 44 is rigidified by a pair of longitudinally extending oppositely disposed stiffeners 62 which, in the illustrated embodiment, are angular in cross-section.

The upper platen 44 is also provided with a movable edge member, generally designated 68, at each side edge of the platen 44. The edge members are best seen in FIGS. 1, 2, 3, and 5. Each movable edge member 68 is hinge-mounted at 70 by a suitable hinge 72 to the upper surface of the strip 50 of the upper platen 44 near the edge thereof. Carried at the opposite leg of each hinge 72 is an elongated spacer block 74, of suitable material, preferably having considerable weight for purposes yet to be explained. A longitudinally extending angularly shaped member 76 is integrally attached to the upper surface of the spacer block 74 in a suitable manner, as seen in FIG. 2.

Though not shown, the interior of the angle member 76 preferably contains suitable pressure points for forcing the edge of the veneer into conformity with the general configuration of the adjacent base of the workpiece to be fabricated. However, in the illustrated embodiment, with particular reference to FIG. 2, no insert is shown. Rather, a strip of rubber 78 with a superimposed narrower strip of wood 80 is attached to the horizontally extending leg of the angle 76 by means of a metal strip 82 secured in place by a suitable number of spaced screws. The same construction can be placed on the vertically extending leg of the angle 76. The exposed wood, or a like material, is desirable since it accommodates frictional displacement of the angle 76 across the surface of the plastic veneer during lamination as will subsequently become more fully apparent.

The upwardly extending leg of the angle 76, when viewed as in FIG. 2, integrally carries one or more U-shaped handles 84 (see FIGS. 2 and 3), suitably positioned, and one or more transverse latch plates 86 integrally joined to the upwardly extending leg of angle 76 (see FIGS. 2 and 3). Each latch plate 86 operates in conjunction with a latch mechanism, generally designated 90 (see FIGS. 1, 5 and 6).

The latch mechanism 90 comprises oppositely transversely extending arms 92 which are supported individually by an

anchor bracket 94 slotted at 96, the arm 92 passing through the slot 96. The anchor bracket 94 is integrally joined to the depending leg of the angle brace 54, as for example by welding.

A clevis 98 of an adjustable turnbuckle 100 is pivotally pin joined at 102 to the distal end 104 of each arm 92. Thus, the turnbuckle 100 is freely swingable about the pin 102. The end free of the turnbuckle comprises an elongated eye loop 106 suitably shaped to easily fit over the latch plate 86, as shown in dotted lines in FIG. 5.

The inwardly directed ends of the two arms 92 overlap and are pin joined one to the other at pin 108, which pin also joins the arms 92 to a clevis 110. The clevis 110 is in turn integrally joined to a piston rod 112 of a one-way hydraulic cylinder 114.

The hydraulic cylinder 114 functions to displace the arms 92 between the position shown in solid lines and that shown in dotted lines in FIG. 5. The cylinder 114 is supported at the bottom of the lower platen 42 by a bolt-secured, U-shaped bracket 116. The cylinder 114 is powered by utilization of a manually controlled hydraulic valve (not shown) constituting part of a hydraulic supply system (not shown) of any suitable known type.

During lamination, when the eye loop 106 is shifted from the solid to the dotted line position of FIG. 5 and the piston rod 112 of the cylinder 114 is extended to displace the arms 92 from the solid to the dotted position of FIG. 5, the eye loop 106 will exert a downward force of substantial magnitude on the latch plate 86 causing each movable edge member 68 to be pulled through its complete rotation of substantially 180° in the illustrated embodiment thereby firmly displacing and bonding the edge of the plastic veneer to the base of the countertop.

While only one latch mechanism 90 is illustrated in the Figures, it is to be appreciated that as many such mechanisms as desired may be utilized to accommodate precise lamination.

It is to be noted that the upper platen is reciprocated between an open position generally shown in FIGS. 1 and 2 and a closed position as seen in FIGS. 8 through 13 and 16 and 17. This reciprocating movement, which keeps the upper platen essentially parallel to a lower platen, is accomplished by means of the hydraulically actuated power mechanism shown in FIG. 2, which mechanism is generally designated 130.

The power mechanism 130, one being located at each end of the apparatus, comprises a pair of posts 132 disposed in aligned relation at each end of the laminating apparatus 20. Each post 132 is integrally secured by suitable means to a bridge member 134, which, in the illustrated configuration, is channel-shaped in cross section. Each post 132 upwardly extends through one guide sleeve 56 and the concentric aperture 52 in the lower platen 42 and is integrally secured to the upper platen 44, as for example by a threaded attachment. Each post 132 passes through the adjacent guide sleeve 56 and aperture 52 in spaced relation so that reciprocal movement of the post does not bind against the sleeve or the lower platen 42. By reason of this reciprocating motion, the operator of the laminating apparatus 20 has ready access to the press from either side thereof.

The piston rod 136 of each two-way cylinder 138 is pin joined to the bridge member 134 through anchor lugs 140. Thus, joint extension and retraction of the two piston rods 136 jointly displaces the two bridges 134 and the four posts 132, the aligned pairs of posts being joined to each bridge 134.

The upper end of the cylinder 138 includes a lug 142 which is pin joined at 146 to the angle brace 54 through a pair of spaced anchor lugs 144. While other types of connections may be used to join the two-way cylinder 138 to the lower platen 42 and to the bridge 134, the described pin joints offer the advantage of substantially eliminating any binding which might otherwise occur.

A manually controlled valve (not shown) is used to regulate the influent and effluent of hydraulic fluid between the two-way cylinder 138 and a suitable hydraulic system (not shown).

The Heater Assembly

The support frame of the laminating apparatus 20, in addition to the adjustable legs 60, includes at each end of the apparatus a triangular support, generally designated 150. Each triangular support 150 comprises integral members including a channel-shaped bottom 152, which integrally rests upon a cantilevered projection 154 of the upper platen 44 (FIG. 1), two channel-shaped sides 156 which converge upwardly to an apex and an upwardly extending rectangularly-shaped portion 158 disposed at the apex. While a triangularly-shaped support has been chosen, it is to be appreciated that other supports of different configuration could be suitably used.

A heater assembly, generally designated 160 and comprising a carrier frame or turnstile 162, is pivotally mounted to the apparatus frame at the opposite portions 158 of the triangular supports 150. With reference to FIGS. 1, 2 and especially 4, the pivot mounting is facilitated, in the illustrated embodiment, by use of a bolt or other suitable shaft 166 which is threaded at end 168 and has a head 170 at the opposite end. The bolt 166 rotatably passes through apertures (not seen) in the carrier frame or turnstile 162, being supported rotatably in said aperture by suitable antifriction bearing means if desired. The bolt 166 also passes through apertures in the support portion 158 being integrally secured to the portion 158 by use of opposed nuts 172 and 174. A spacer 176 is interposed between the carrier frame 162 and support portion 158.

Thus, the heater assembly 160 is structurally independent or separate from the pressure 40 (though additional heating means could be associated with either the upper or the lower platen or both to aid in forming and bonding). The assembly 160 is arcuately swingable through all or nearly all of the full 360°, in either direction. As will become more fully apparent subsequently, the heater apparatus 160 accommodates precise contoured bonding of the edges of the plastic veneer to the adjacent base portion of the workpiece, especially where the base is irregularly contoured at one or both edges.

Specifically, the carrier frame or turnstile 162 falls generally within a single plane and comprises a pair of transverse end members 180 and three longitudinal members 182, 184, and 186 respectively, which are integrally joined by suitable fittings 188 and 190 respectively. By way of example only, the transverse members and the longitudinal members 180, 182, 184 and 186 are tubular in configuration. The two longitudinal members 182 and 184 are eccentrically offset to one side of the pivot axis of the carrier frame as defined by the centerline axes of the aligned shafts 166. The other longitudinal member 186 is eccentrically offset to the other side of the carrier frame with respect to such pivot axis.

A suitable heat source, generally designated 192, is gravity suspended from the elongated member 186 upon spaced support brackets 194. The heat source 192 is conventional and comprises one or more heating elements 196 (FIG. 2), a reflective shield 198 and end plates 200. The heat source 192 is illustrated as being electric in the drawings, the electric conduit 202 being adapted to receive 220 volt potential. The conduit 202 is clipped-secured to the support brackets 194 in a suitable manner immediately adjacent each carrier clip 204, which clips suitably join the support brackets 194 to the exterior of the reflective shield 198.

Regardless of the orientation in which the carrier frame 162 is placed, the heat source 192, being gravity suspended, will hang downwardly from its eccentric support, at the longitudinal member 186. By way of example only, the heat source 192 may be radiant, one such suitable heater being the "Chromalax" Radiant Heater Catalog No. RAD. D7604X9A manufactured by Edwin L. Wiegand Company of Pittsburgh, Pennsylvania. Of course, if desired, a suitable conduction heater could be used in preference to a radiant heater.

One or both of the longitudinal members 182 and 184 contain counterbalancing weights (not shown) which offset the eccentrically-disposed weight of the heat source 192 such that the carrier frame 162 will retain any orientation in which it is placed. Yet free-swinging repositioning of the carrier frame is easily accommodated by the operator of the laminating apparatus 20. Functionally, the heater assembly 160 is unique in that it can be freely displaced arcuately in either direction. Thus, the heater assembly can be placed in either of two effective heat exchange positions adjacent the two respective side edges of the pressure applying apparatus 40. Consequently, the edges of the plastic veneer may be readily made pliable and brought into conforming configuration with the surface of the base of a workpiece, the heat source 192 being readily displaced to a remote position following heat-softening of the veneer so that bending, forming or displacement of the veneer may be accommodated without interference with the heater assembly 160.

Of course, a suitable conventional temperature control mechanism (not shown) can be provided to regulate the temperature of the heat radiating from the heat source 192.

The Structure of FIGS. 18 and 19

With reference to FIGS. 18 and 19, one or more serially aligned "C"-clamp assemblies, generally designated 220, may be used to assist in displacing the backplash to the full 90 degree position of FIG. 18, and/or to accommodate correct placement and bonding of the cove stick 222 to the plastic veneer 24 between the base section 28 and the base backplash 34, as shown in FIG. 19, once the backplash is displaced in the full 90 degree position.

Each "C"-clamp assembly 220 is suitably pivotally joined to the underside of the lower platen 42, schematically shown at pin 224 in FIGS. 18 and 19. The pin 224 is supported by the underframe of the platen 42 and passes through a properly shaped and sized aperture in end 226 of the arm 228. The other end 230 of the arm 228 receives, either rotatably or non-rotatably as desired, the lower end 232 of the yoke 234 as viewed in FIGS. 18 and 19.

The yoke 234 passes, either rotatably or non-rotatably, through the end 236 of a second arm 238. A threaded shaft 240 passes through a correspondingly threaded aperture 242 in the other end 244 of the arm 238. The relative position of the shaft 240 and the arm 238 may be altered manually by threadedly displacing the shaft 240 forward or back through the recess 242 using handle 244, which handle is integrally fastened to one end of the shaft 240. The other end of the shaft 240 carries an abutment fixture 246 for engaging the workpiece. Thus, the clamp 220 respectively positioned as shown in FIGS. 18 and 19, the threaded shaft 240 may be advanced to (a) force and/or retain the backplash in the full 90° position (FIG. 18) or (b) appropriately position the cove stick 222 while bonding of the cove stick 222 to the plastic veneer 24 is achieved (FIG. 19).

Where (a) the arm 238 is rotatably joined to the yoke 234 and (b) the pivot point 224 is essentially midway between the edges of the lower platen 42, the "C"-clamp can be quickly adjusted for use at either edge of the press.

To overcome the inconvenience and sometimes time-consuming task of placing and removing the backplash adapter 212 (FIG. 17), the lower platen edge construction of FIGS. 18 and 19 may be used to form a cove in the workpiece. This construction comprises a hardwood or like strip 280, which fills to the square an open recess 252, suitably routed or otherwise formed at one or both longitudinally-extending edges of the lower platen 42 at the top surface thereof. The hardwood strip 280 has a longitudinally-exposed, arcuate surface 282 of satisfactory radius and is held in position by spaced screws 284 or the like. Where cove fabrication comprises bending plastic veneer trough different sized radii, a variety of such hardwood strips may be made available and, when the installed strip is no longer satisfactory, it may be removed by backing off screws

284 and replaced by a suitable strip, held in place by tightening of the screws.

The Structure of FIGS. 20 and 21

Reference is now made to the embodiment of the invention shown in FIGS. 20 and 21. Unless otherwise indicated in the following description, the structure of the embodiment of FIGS. 20 and 21 is identical to that of apparatus 20, previously described, and such structural components are so numbered in FIGS. 20 and 21.

The major structural difference between apparatus 20 and the embodiment of FIGS. 20 and 21, apart from the hardwood or like strip 280 explained above, comprises an auxiliary heater assembly, generally designated 250, used to fabricate a very small, $\frac{1}{8}$ inch or less, radius, 90° bend between the main portion and the backsplash of the workpiece or countertop.

The auxiliary heater assembly 250 is situated in the open recess 252. The open recess is essentially filled to the square with a mat 254 of asbestos or other suitable insulating material, which comprises part of the auxiliary heater assembly 250. The assembly 250 further comprises an elongated small radius heater element or rod 256 substantially embedded in the asbestos 254 but partially exposed only at the upper right corner of the asbestos, as viewed in the Figures. The heater element 256 is preferably energized by a 110 volt electrical power system (not shown), the temperature thereof being regulated by a suitable regulator (not shown). The heater element 256 is supported in the illustrated position by use of spaced thermosetting plastic blocks 260, preferably formed of phenolic or like resin. The blocks are arcuately recessed at 262 to snugly receive the heater element and are sized so as to distribute through the asbestos mat 254 any weight load or other force imposed on the heater element without appreciable deformation or displacement. Nevertheless, the relatively high temperatures to which the element 256 is elevated do not reach the lower platen 42, due to the insulating effect of the mat 254.

The Structure of FIGS. 24 and 25

With reference to FIGS. 24 and 25, the apparatus 20 may be modified by replacing the bracket 94 of FIGS. 5 and 6 with a bracket 270. The bracket 270 is in the shape of an inverted "U." Normally, the arm 92 will rest by force of gravity upon the pin 272 as shown in dotted lines in FIG. 24. However, the pin 272 may be pulled from its illustrated position enabling the arm 92 to fall into the position shown in solid lines in FIG. 24. Thus, when a workpiece, having a "full" or relatively long backsplash, is being fabricated the arm 92 can be "dropped" down to avoid any problem of interference between the backsplash and the turnbuckle 110.

The Method of FIGS. 7-19

The steps of one presently preferred method of this invention are consecutively illustrated in FIGS. 7 through 19 which steps comprise a single station laminating process whereby a finished laminated workpiece is fabricated from a plastic veneer covering, e.g., 24, and a base, e.g., 26. For ease of description only, the illustrated embodiment depicts and describes the fabrication of a residential kitchen countertop 22.

Procedurally, with the two cylinders 138 retracted and the press 40 in the open position, a suitable bonding agent is used to bond the plastic veneer 24 to the co-extensive matched flat surfaces of the base sections 28 and 34. This is done either prior to or after insertion of the countertop components between the upper and lower platens 42 and 44 or after the base components have been properly positioned upon the lower platen 42. In either event, the countertop 22 will be configured and positioned as generally depicted in FIG. 7 at this point in time.

With the partially fabricated countertop 22 appropriately oriented in the open press 40 so that the front edge of the

countertop is aligned with one side edge of the press, (see FIG. 7), the hydraulic cylinders 138 are jointly extended (preferably by actuation of a control valve). This displaces the upper platen 44 into engagement with the top of the veneer 24 and places the entire countertop under a compressive force of restraining pressure directed essentially transverse of the bonded interface between the veneer and the base. Hence, no displacement of the countertop relative to the press may occur.

At this point in time, the heater assembly 160 is arcuately displaced (normally clockwise as viewed in FIGS. 7 through 17) from the position of FIGS. 7 to the heat exchange position of FIG. 8. Thereafter, the heat source 192, being energized at a suitable point in time, softens the front edge of the plastic veneer opposite the adjacent surface of the base non-drip component or bull-nose piece 30 until the plastic edge is pliable. Some bonding agents tend to be reactivated, when partially cured, by such heating and this helps facilitate achievement of a strong permanent bond.

When the front edge of the plastic veneer 24 is sufficiently pliable due to the heat-softening, the carrier frame 162 is then arcuately displaced until the heating element of the heat source 192 is located remote from the front edge of the veneer. Immediately thereafter the right hand movable edge member 68 is rotated about the hinge 172 through most or all of the permissible, essentially 180 arcuate degrees from the position of FIG. 8 to that of FIG. 9 or FIG. 10. This action bends or forms the pliable veneer edge so that it generally contiguously conforms in configuration with the surface of the front edge of the base component 30 and aids in bonding the edge of the veneer in that position.

In situations where the weight of the edge member 68, along with any force exerted by the operator of the apparatus 20, is insufficient to fully rotate the right edge member through the permissible, essentially 180 arcuate degrees, the latch mechanism 90, previously described, may be used to pull the edge member through full rotation from the general position of FIG. 9 to that of FIG. 10. This is accomplished, as previously described, by placing each eye loop 106 over the adjacent latch plate 86 (FIG. 5) and by thereafter hydraulically extending cylinder 114 (normally by activation of a hydraulic control valve) so that the arms 92 are displaced from the solid to the dotted position of FIG. 5. This exerts a sufficient pulling force in a downward direction, indicated by arrow 210 (FIG. 10), to displace the entirety of the front edge of the plastic veneer into bonded contact with the surface of the base component 30.

When the width of the workpiece being fabricated is either greater or less than the width of the press, as is usually the situation, the press must now be opened and the back edge of the workpiece must thereafter be aligned with one or the other edge of the press. With a workpiece of substantial width, such as countertop 22, the alignment can more easily be achieved at the edge of the press shown on the left in FIGS. 7 through 19. However, when the workpiece is relatively narrow, as for example a window sill, once the press is open the workpiece is more easily reversed edge-for-edge bringing the yet to be contoured workpiece edge into alignment with the edge of the press shown on the right in FIGS. 7 through 19. Thus, advantageously, neither the apparatus or method of this invention is restricted to a workpiece of standardized or fixed dimensions.

Next, with the press closed and the countertop situated as shown in FIG. 11, the carrier frame 162 of the heater assembly is arcuately displaced to the heat exchange position of FIG. 11 and the heat source 192, being energized, softens the back edge of the plastic veneer.

When the back edge of the plastic veneer is sufficiently pliable due to the mentioned heat-softening, the carrier frame 62 is displaced swinging the heat source 192 from the effective position of FIG. 11 to a position remote from the back edge. Immediately thereafter the left movable edge member 68 is arcuately pivoted from the position of FIG. 11 to that of FIG. 12

or FIG. 13 substantially displacing or bending the rear edge of the veneer into contiguous conformity and bonded relation with the backsplash base member 34.

In a situation where the weight of the edge member 68, along with any force exerted by the operator of the apparatus 20, is insufficient to fully rotate the edge member, the latch mechanism 90 may be used. After the cylinder 114 is retracted and, if desired, the right eye loop 106 is dropped to the solid position of FIG. 5, the left eye loop 106 is then positioned as shown in dotted lines in FIG. 5 followed by hydraulic extension of the cylinder 114. This will pull the left edge member 68 through its full permissible rotation of essentially 180 arcuate degrees to the position of FIG. 13.

Once the plastic veneer at the back edge has been shaped to conform with the base component 26 and is bonded thereto, two techniques may be employed to cove the workpiece. Using the first technique, the press 40 is hydraulically opened and the countertop 22 is removed from the press. An auxiliary piece or backsplash adapter 212 (FIG. 14) is appropriately placed over top of the lower platen 42. The auxiliary piece 212 may either be "L"-shaped as depicted in FIG. 14 or generally "U"-shaped (not shown) with, respectively, one or two curvilinear surfaces 214 of suitable shape and size. The second technique comprises use of the already described hardwood strip 280 having a suitable radius 282 for cove fabrication.

Using either technique and with press 40 in open position, the countertop is again positioned in the press 40 but in inverted position and upon either the auxiliary piece 212 with the plastic at space 36 disposed above the curved portion 214, as shown in FIG. 15 or directly upon the upper surface of the lower platen 42 with the plastic veneer at space 36 disposed above the curved portion 282. The countertop 22 is then restrained in such inverted position by closing of the press, which exerts lateral pressure upon the countertop.

Next, the carrier frame 162 is arcuately displaced to the heat exchange position shown in FIG. 16, following which the heat source 192, being energized, heat-softens the portion of the plastic veneer exposed at the space 36 between the base portions 28 and 34.

When the exposed veneer at space 36 is sufficiently pliable, it is bent around the curved surface 214 on the curved surface 282, as the case may be from the position generally illustrated in FIG. 16 to that of either FIG. 17 or FIG. 18. This bending step may be achieved manually, by use of the adjacent edge member 68, by use of the "C"-clamp assembly 220 as shown in FIG. 18, or by a combination of the three. At this point in time the cove stick 222 (FIG. 19) is integrally interposed at the space 36 between the base portions 28 and 34 in a conventional way, such as by bonding preferably using the "C"-clamp assembly 220. Thus, the countertop will now be fully prefabricated and ready for installation in a residential kitchen or the like. Thereafter, the countertop 22 is removed from the press, after the press is opened.

The Method of FIGS. 22 and 23

When it is desired to fabricate a very small radius, e.g., $\frac{1}{8}$ inch or less, between backsplash and main portions of a countertop or like workpiece, usually after the plastic veneer 24 has been contoured and fully bonded to the base, the method steps depicted in FIGS. 22 and 23 may be practiced upon the workpiece using apparatus of the type described in conjunction with FIGS. 20 and 21.

Initially, with the press open, the workpiece is placed in inverted relation upon the bottom platen 42 so that the veneer at space 36 is aligned with and is immediately above the heater element 256. The back cove adapted 212 and the strip 28 are not used. The press is then closed and the heater assembly 160 rotated to bring the heat source 192, properly energized, into correct heat exchange relation with the back side of the veneer at space 36, as shown in FIG. 22.

The heater element 256 is also properly energized so that the plastic veneer at space 36 is heat softened from both sides. When the plastic veneer is sufficiently pliable and with the heat source 192 rotated to a remote position, the backsplash is bent through the tiny radius to the full 90° position as illustrated in FIG. 23, manually, by use of the "C"-clamp assembly 220 of FIG. 18, by use of the edge member 68 and locking mechanism 90, or by any combination of the three. A coved stick such as 222 is thereafter appropriately placed and bonded to the veneer between the base portions 28 and 34 as shown in FIG. 19. Alternatively or concurrently, screws, nails, or the like may be used to hold the cove stick in place.

Experience has shown that an inside radius of $\frac{1}{8}$ inch or smaller can be readily formed at the exposed surface of the veneer at the space 36 using the novel method just described. Moreover, the comparatively high level of stress induced in the veneer consequential of such small radius fabrication tends to pull the veneer away from the base portions 28 and 34 immediately adjacent the space 36. However, testing has verified that the residual or added heat imparted to the veneer by the heater element 256 tends to reactivate the bonding agent, such as contact cement, and cure or heal the damage, if any. Thus, the veneer is reinstated to its fully bonded relation with the base portions.

Where a cove radius of curvature larger than the exposed surface of the heater rod 256 is desired, a back cove adapter of the type identified as 212 may be used over the top of the bottom platen 42.

From the foregoing specification, it is to be appreciated that the present novel laminating processes and apparatus accommodate complete fabrication of a finished workpiece, all steps being performed at a single station. Structurally, the press and more particularly the unique heater concepts facilitates convenient fabrication of the workpiece and are not restricted by the dimensions of the workpiece. The present invention possesses the advantages of small floor space requirements, mobility, comparatively low capital investment and operating costs. The apparatus and methods are extremely versatile so that any width workpiece can be fabricated without requiring adjustment to the machine, and, moreover, radii as small as on the order of about $\frac{1}{8}$ inch may be fabricated in the plastic veneer at the back cove, when desired.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and range of equivalency of the claims are therefore to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In a laminating apparatus for post forming a workpiece of a base and plastic veneer: a reciprocable press comprising a support frame, lower press means for optionally engaging the base and the plastic veneer to hold the workpiece during lamination, upper press means for optionally engaging the plastic veneer and the base to hold the workpiece during lamination, power means for reciprocating the press between open and closed positions, and heater means comprising longitudinally-extending revolving structure, elongated heating means eccentrically carried by the revolving structure, counterbalance means carried by the revolving structure to compensate for the eccentricity of the elongated heating means, said revolving structure being mechanically related to the upper press means so as to be revolvable clockwise and counter-clockwise about a longitudinal axis above the upper press means solely in response to selective manual manipulation independent of press action to dispose and self-retain the heating means adjacent either of the opposed edges of the press at any one of several distances therefrom as selected by the operator and in any location in between the press edges also as desired by the operator whereby each edge of the

veneer may selectively be made pliable without mechanical alteration to the apparatus to accommodate permanent contoured post-forming lamination between said veneer edges and the adjacent portions of the base.

2. An apparatus as defined in claim 1 further comprising movable edge forming means for forcibly displacing the plastic veneer along edges thereof into contiguous bonded conformity with the adjacent portions of the base.

3. An apparatus as defined in claim 2 further including latch means responsive to power means for exerting a closing force upon the movable edge forming means to insure full displacement of said veneer edges against said base portions during lamination.

4. In a laminating apparatus of the type defined in claim 1 further comprising clamp means associated with the press for curvilinear displacement to accommodate (a) permanent interposing of a cove stick and the like between base components at the underside of the plastic veneer and (b) angularly bending the workpiece along a heat-softened region of the veneer.

5. An apparatus as defined in claim 1 wherein at least one of said press means includes a heat resistant cove-forming means disposed at one edge corner of the press means and having an exposed surface across which heat-softened plastic veneer may be bent to form a cove.

6. In a laminating apparatus for post-forming plastic veneer into bonded relation with a base to form a countertop and the like, a press comprising top and bottom platens having oppositely disposed flat surfaces, one said platen including cove-forming force-resisting heater means disposed at one exposed edge corner of the associated platen and comprising an elongated heat source substantially concealed in insulation but peripherally exposed only longitudinally along one quadrant thereof when viewed in cross-section, said cove-forming heater means further comprising serially spaced heat-resisting load-transferring means holding the heat source in the described disposition against horizontal and vertical force, the insulation being disposed both between successive load-transferring means and between each load-transferring means and the associated platen whereby correct placing of the plastic veneer adjacent the heat source and energizing of the heat source accommodate localized heat softening and subsequent bending of the veneer across the elongated heat source will produce a curvature in veneer of relatively small radius without appreciable deflection of the elongated heat source.

7. In a method of fabricating a workpiece including laminating plastic veneer to the surface of a base, the steps of:

bonding co-extensive adjacent surfaces of the veneer and the base one to the other,

forcibly holding substantially the entire area of said bonded portion of the workpiece in a selected stationary position between the jaws of a press against any movement relative to the jaws,

arcuately displacing a heat source into heat exchange relation essentially with one entire peripheral portion of the veneer while continuing to so hold the workpiece stationary between the jaws of the press,

softening said peripheral portion of the veneer by use of heat from said heat source until the peripheral portion is pliable, and

arcuately displacing said heat source to a position remote from said peripheral portion while continuing to so hold the workpiece stationary between the jaws of the press and immediately thereafter essentially symmetrically displacing the entire peripheral portion into contiguous bonded association with the base.

8. In a method as defined in claim 7 further including the steps of:

arcuately displacing the heat source from said remote position into heat exchange relation with a second entire

peripheral portion of the veneer while continuing to hold the workpiece stationary between the jaws of the press, softening said second peripheral portion of the veneer by use of heat from said heat source until the same is pliable, arcuately displacing said heat source to a position remote from said second peripheral portion and immediately thereafter essentially symmetrically displacing the entire second peripheral portion into contiguous bonded association with the base, all with the workpiece continuing to be so held stationary between the press jaws.

9. A method as defined in claim 8 further including the step of bending one edge of the workpiece into a position generally extending normal to the adjacent portion of the workpiece.

10. A method as defined in claim 7 wherein said workpiece is a countertop and further including the steps of:

inverting said workpiece with the press open, exerting pressure upon the veneer and the base to generally hold the workpiece in a stationary position between the press jaws,

displacing the heat source into heat exchange relation with an intermediate portion of the veneer while continuing to hold the workpiece stationary between the press jaws,

softening said intermediate portion of the veneer by use of said heat source until the same is pliable,

displacing said heat source to a position remote from said intermediate portion of the veneer and immediately thereafter essentially symmetrically bending said intermediate portion about a radius of predetermined size, all with the workpiece so held stationary between the press jaws.

11. In a semi-manual laminating apparatus, the improvement comprising a heater assembly comprising a manually revolvable frame rotatably held above the remainder of the apparatus and an elongated heating means eccentrically gravity-suspended from the revolvable frame so that clockwise and counter-clockwise manual revolving of the revolvable frame about an axis situated above the remainder of the apparatus accommodates displacement of the heater means between a pair of effective positions at opposite peripheral edge portions of a pressure means when the pressure means are closed and a series of incremental remote positions situated between the effective positions, to accommodate convenient (a) manual placement of the heating means into localized heat exchange relation with the plastic at one peripheral edge portion of the pressure means and (b) thereafter manual displacing of the heating means away from the softened veneer to enable prompt bending of the veneer into final configuration without interference with the heater assembly and without actuation of the pressure means.

12. In a method of fabricating a cove in a laminated workpiece having a plastic veneer bonded to a base, the steps of:

a. placing the workpiece within a press so that the veneer to be coved rests adjacent an elongated cove-forming heat source exposed at one edge corner of the lower platen of the press,

b. closing the press to hold the workpiece in position,

c. softening the lower side of the veneer to be coved by use of heat from said cove-forming heat source while insulating said heat from the adjacent portions of the press and concurrently softening the opposite upper side of the veneer to be coved by a different heat source directed from an elevated revolvable heater assembly until said veneer to be coved is locally pliable,

d. manually revolving the elevated heater assembly to a location remote from the heating site and generally arcuately bending the veneer through the cove angle desired by forcibly wrapping the pliable veneer around the cove-forming heat source to form the cove,

e. retaining the workpiece between the closed press during steps (b), (c) and (d).

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