United States Patent

Ehrensing et al.

[15] **3,678,890**

[45] **July 25, 1972**

[54] PANEL COATING APPARATUS

[72] Inventors: **Alvin T. Ehrensing,** Corona, Calif.; **Clement R. Taylor,** Boise, Idaho

[73] Assignee: **Boise Cascade Corporation,** Boise, Idaho

[22] Filed: **Dec. 9, 1970**

[21] Appl. No.: **82,904**

[52] **U.S. Cl.** **118/63**

[51] **Int. Cl.** **B05c 11/00**

[58] **Field of Search** ..... 117/102 L, 102 A; 118/62, 63, 118/324, DIG. 4

[56] **References Cited**

UNITED STATES PATENTS

1,283,155	10/1918	Goldhamer	118/63
2,279,553	4/1942	Bradt	118/63
2,988,459	6/1961	Buelow	118/63
3,205,089	9/1965	Kinzelman	118/324

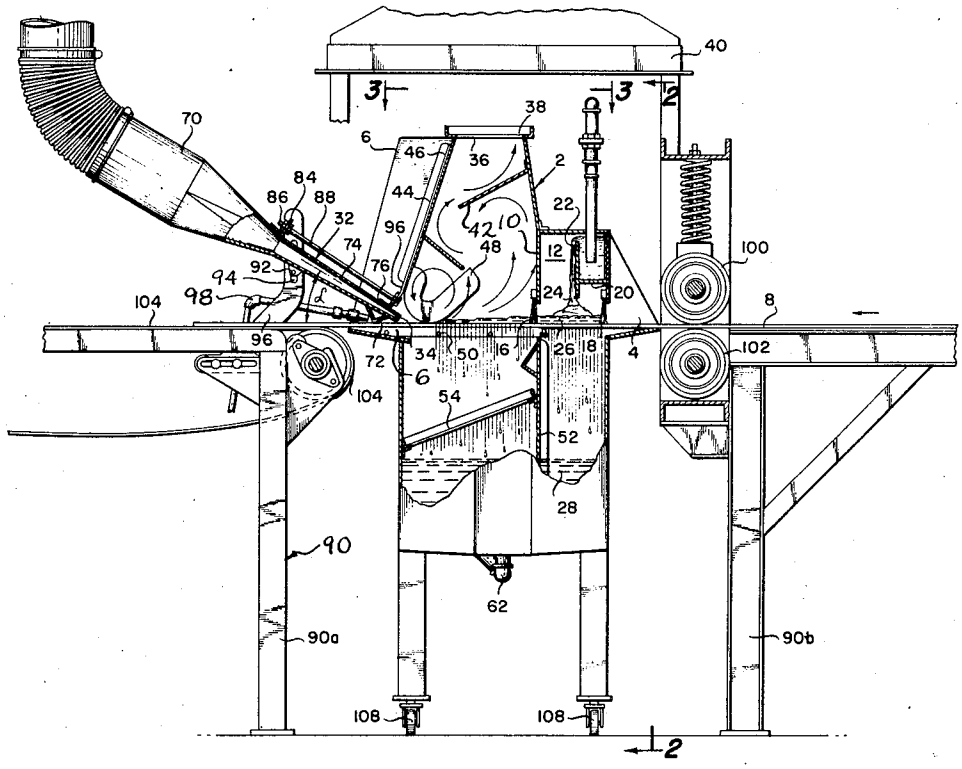
Primary Examiner—Henry S. Jaudon

Attorney—Lawrence E. Laubscher

[57] **ABSTRACT**

Apparatus for coating with a liquid a continuously travelling horizontal panel having a uniform or irregular surface, characterized by the provision of housing means including a flood coating compartment in which a massive quantity of liquid coating is deposited to a given depth upon the upper surface of the travelling panel, and an air doctoring compartment in which a large volume of high pressure air is angularly directed on the panel in a direction opposite to the direction of panel travel. The excess liquid coating in both compartments is directed laterally off the longitudinal edges of the panel and is collected by gravity in collector means arranged in the bottom of the housing beneath said compartments.

18 Claims, 5 Drawing Figures



Patented July 25, 1972 3,678,890

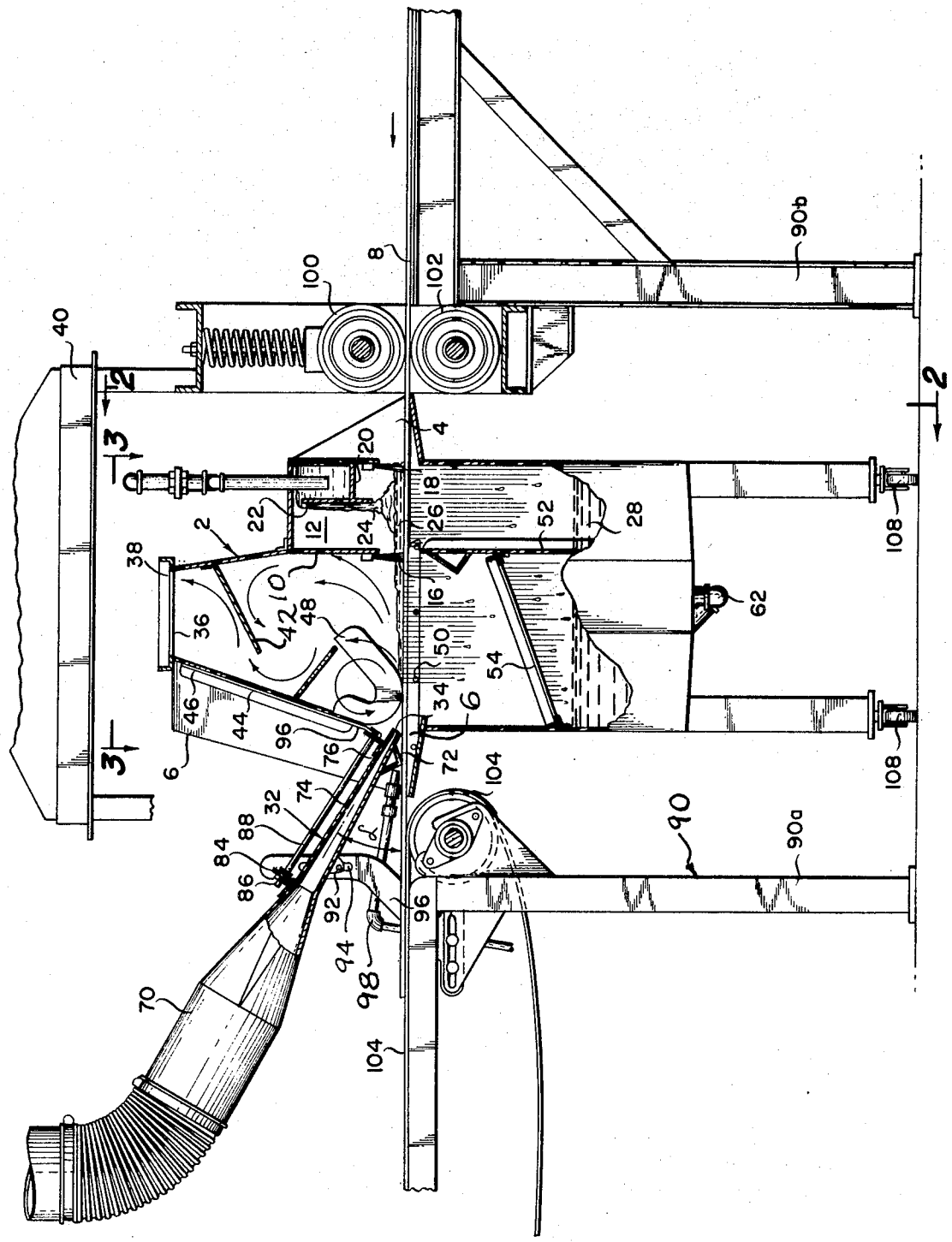
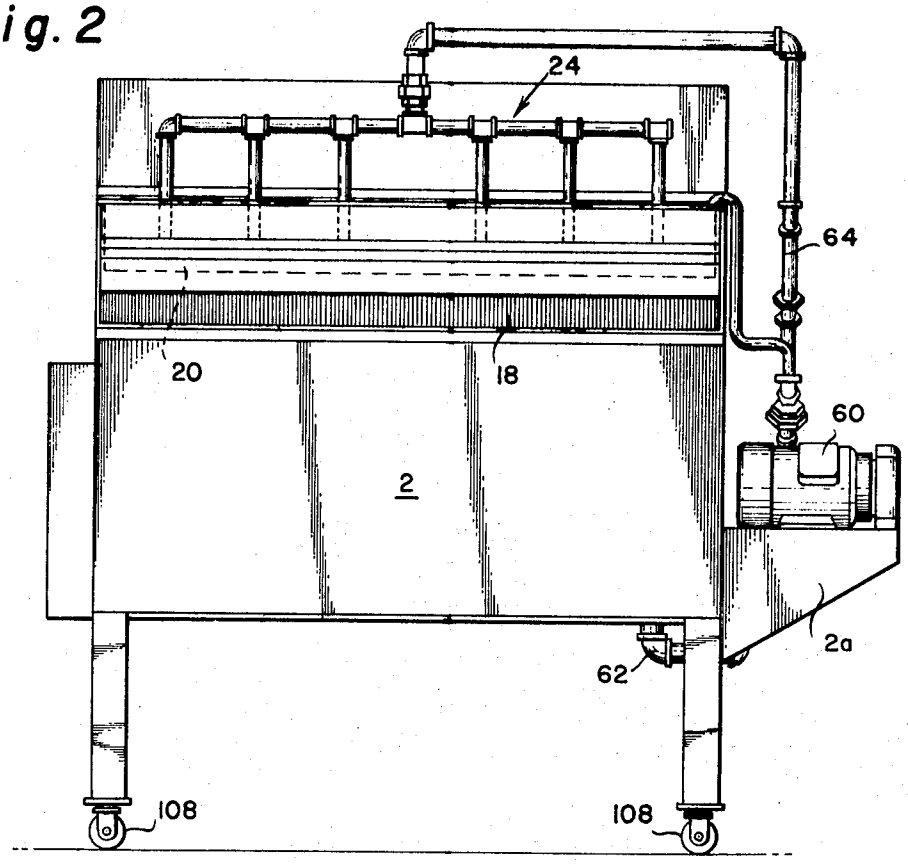


Fig. 1

Inventors
Alvin T. Ehrensing
Clement R. Taylor
By
Lawrence E. Kubzcher
Attorney

Fig. 2



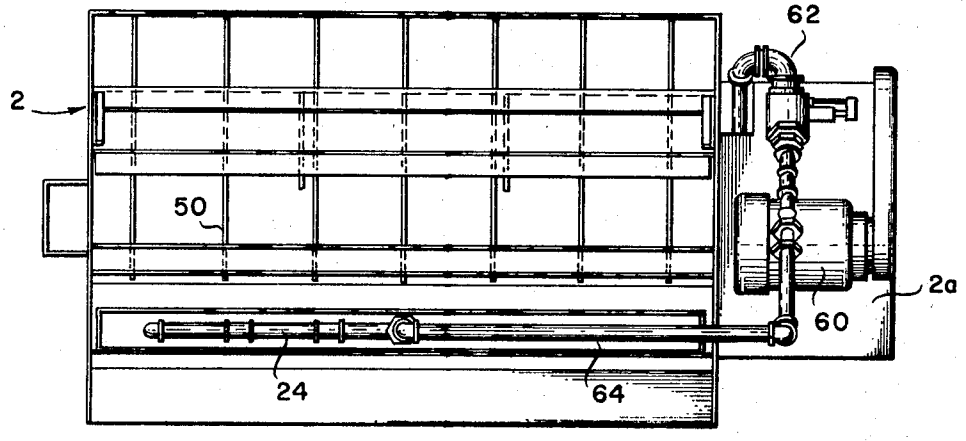


Fig. 3

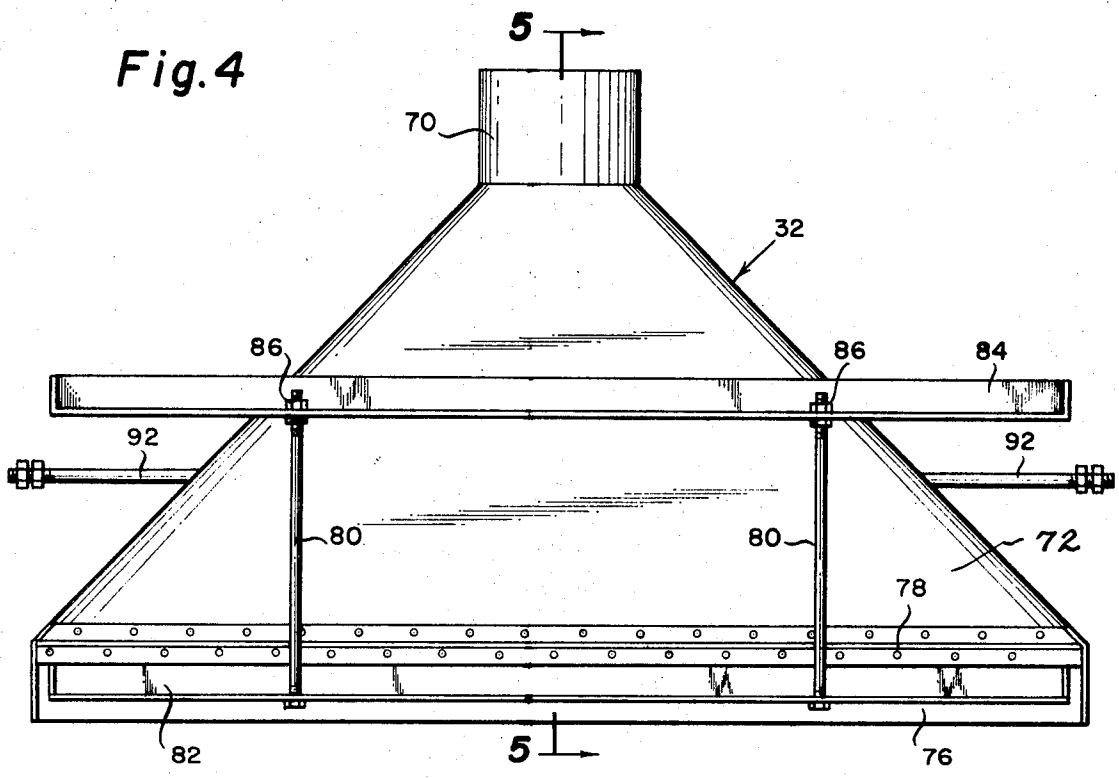
Inventors
Alvin T. Ehrensing
Clement R. Taylor

By
Lawrence E. Laubscher
Attorney

Patented July 25, 1972 3,678,890

3 Sheets-Sheet 3

Fig. 4



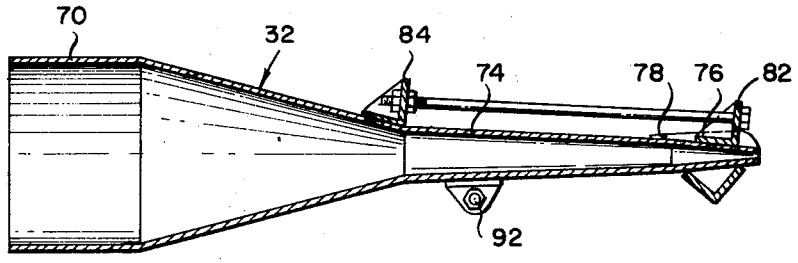


Fig. 5

Inventors
Alvin T. Ehrensing
Clement R. Taylor

By
Lawrence E. Laubscher
Attorney

PANEL COATING APPARATUS

It is well known in the coating art to paint or stain plywood panels or the like by conventional coating techniques, such as bushing (manual or mechanical), spraying, roll coating, flooding, curtain coating, electrostatic spraying, and dipping. As evidenced by the U.S. Pats. to Williams No. 773,840, Hofmann U.S. Pat. No. 1,604,941, Lauring U.S. Pat. No. 2,332,385, and Jones U.S. Pat. No. 2,598,391, it is further known to remove excess coating material from the panel by means of air jet or air knife doctoring means. While the above and other known coating apparatus are generally suitable for use with panels or sheets having uniform, relatively smooth surfaces, it has been found that they are generally unsatisfactory for use in applying decorative or protective coatings to plywood panels having rough-sawn, grooved, smooth-sanded or other irregularly textured surface. Thus, in order to obtain thorough penetration of the coating into all the voids and crevices contained in the surface of the panel, it is necessary to carefully apply the coating in a time-consuming, often wasteful manner.

Accordingly, a primary object of the present invention is to provide an improved coating apparatus for applying a decorative or protective coating to the upper surface of a panel during longitudinal transport at a relatively high linear velocity. The invention is characterized by the provision of a housing containing coating and air doctoring compartments through which the panel is successively passed. In order to effect complete penetration of the liquid coating into all the surface crevices of the panel, a horizontal trough is arranged in the upper portion of the coating chamber, said trough extending transversely across the panel. The trough includes a weir wall that is operable, when an excess of the coating material is supplied to the trough, to form a massive curtain or blanket through which the panel is conducted. The coating curtain is deposited to a substantial depth on the upper surface of the panel during longitudinal transport through the coating chamber, thereby effecting complete penetration of the coating into the voids contained in the irregularly textured panel surface.

According to a more specific object of the invention, air nozzle means are provided for directing across said air doctoring compartment a jet of air longitudinally of the panel in the direction of the coating compartment, whereby the excess coating material is blown laterally across the panel for removal at the longitudinal edges thereof. Collector means are arranged beneath the coating and air doctoring compartments for receiving by gravity the excess coating that is deposited over the longitudinal edges of the panel.

A more specific object of the invention is to provide first seal means for sealing the coating compartment from the air doctoring compartment, and second seal means at the inlet opening of the housing for sealing the coating compartment from the atmosphere. In the preferred embodiment, the seal means comprise downwardly depending brushes that engage the upper surface of the panel and define wall portions of the coating chamber against which the coating flood bath is contained.

A further object of the invention is to provide means for exhausting vapors from the air doctoring compartment via an opening contained in the top of the coating apparatus. The air doctoring compartment preferably includes baffle means for contributing to the cleanliness of the coating operation by causing the exiting air to travel a longer tortuous path, thereby removing the smaller entrained droplets of coating material from the vapor.

Another object of the invention resides in the provision of means for angularly adjusting the position of the nozzle means relative to the panel, whereby the excess coating is effectively blown off the panel during transport through the air doctoring chamber. Preferably the nozzle is adapted for adjustment between acute angles of from 45° to 75° relative to the panel.

According to a further object of the invention, means are provided for adjusting the width of the nozzle discharge slit as a function of the speed of transport of the panel, the degree of irregularity of the panel surface, the physical nature (i.e., viscosity, temperature and composition) of the coating material, and the thickness of the flood bath. The nozzle slit is arranged adjacent the panel discharge opening of the air doctoring compartment, whereby the pressure air serves as a seal for the housing. According to an important advantage of the invention, the bottom of the panel is kept free from the coating material, thereby eliminating unnecessary waste.

Other objects and advantage of the invention will become apparent from a study of the following specification when viewed in the light of the accompanying drawing, in which:

FIG. 1 is a longitudinal sectional view of the coating apparatus as connected in the plywood panel conveyor system;

FIGS. 2 and 3 are detailed views of the coating apparatus taken along lines 2—2 and 3—3 of FIG. 1, respectively, the panel being moved;

FIG. 4 is a detailed top plan view of the air nozzle means; and

FIG. 5 is a sectional view taken along line 5—5 of FIG. 4.

Referring first more particularly to FIGS. 1—3, the coating apparatus includes a housing 2 that contains a chamber and includes an inlet 4 and an outlet 6, respectively, through which is fed a horizontal longitudinally-travelling panel 8 of plywood or similar material. The upper portion of the housing is divided by the transverse vertical partition 10 into a coating compartment 12 adjacent the inlet 4, and an air doctoring compartment 14 adjacent the outlet 6. A pair of bushes 16, 18 are connected with the lower end of the partition 10 and the portion of the housing 2 adjacent the inlet 4, respectively, for cooperation with the upper surface of the panel to seal the coating compartment 12 from the air doctoring compartment 14 and the atmosphere, respectively. Mounted in the upper portion of the coating compartment 12 is a horizontal trough 20 that extends transversely across the panel and includes a vertical weir wall 22. Normally a large excessive quantity of coating liquid is continuously supplied to the trough via the supply manifold 24, which liquid runs over and down the weir wall 10 to define a massive curtain or blanket 24 that is collected on the upper surface of the plywood panel to define the flood bath 26 that is contained between the brushes 16 and 18. At the lateral edges of the panel the flood bath flows downwardly by gravity over the edges of the panel and is collected in the bottom of the housing 2 in the form of a reservoir pool 28. Owing to the thickness of the flood bath and the time the bath is supported on the panel surface during high-speed transport, the liquid coating completely penetrates all of the surface voids and crevices contained in the panel.

Adjacent the housing outlet 6 is provided an air nozzle 32 having a discharge orifice slit 34 through which high pressure air is discharged for blowing excess coating liquid from the panel surface as the panel is discharged from the coating chamber 12. More particularly, the nozzle 32 is mounted for adjustment at an acute angle α of from about 45° to 75° relative to the panel, the air jet being directed against the partition 10 and the brush 16. The excess liquid is blown by the air jet laterally toward the edges of the panel for gravity discharge into the reservoir pool 28. In order to permit removal of the vapors from the air doctoring compartments 14, the upper end of the compartment contains a vent opening 36 in which is removably mounted a vapor filter 38, a suction hood 40 being arranged thereabove for exhausting the vapors to atmosphere. In order to establish a tortuous vapor path to effectively separate the larger liquid particles from the vapor, the inner surfaces of the front and rear walls of the housing are provided with baffle plates 42. The rear wall 44 of the air doctoring compartment is pivotally connected at its upper end for pivotal movement about the horizontal transverse pivot axis 46, the inner surface of said wall being provided with a plurality of spaced cam plates 48 that are adapted to hold down the panel during passage through the air doctoring compartment. A panel support grid 50 is removably supported beneath the panel and the air doctoring compartment, said grid being sup-

ported at its rear edge by the housing adjacent the outlet opening **6**, and at its front edge by the removable transverse divider **52**. Moreover, a debris screen **54** is removably supported between the panel support grid **50** and the reservoir pool **28**.

Referring now more particularly to FIG. **3**, the coating liquid contained in the reservoir pool **28** is pumped to the overflow trough **20** by high volume pump means **60** via reservoir connection **62**, pump **60**, supply conduit **64** and the manifold means **24**. The pump is supported on housing portion **2***a* for integral movement therewith as will be described below.

As shown in FIGS. **1**, **4** and **5**, the nozzle means **32** has at one end a cylindrical inlet **70** that is adapted for connection with a source of pressure air, and at the other end a flat laterally-extended sheet metal portion that terminates at the discharge slit **34**. The lower wall of the nozzle is stiffened by the L-shaped channel member **72**, while the upper nozzle wall comprises a pair of pivotally connected sections **74**, **76** that are joined by the horizontal transversely extending pivot **78**. In accordance with an important feature of the present invention, control means are provided for pivoting wall section **76** relative to wall section **74** to adjust the opening of the nozzle discharge slit, said control means including a pair of rods **80** that are connected at one end with the stiffener bar **82** on the section **76**, and are adjustably connected at the other end with the transverse support bar **84** on the nozzle wall **74** by the nut means **86**. Accordingly, tightening or loosening of the nut means **86** will longitudinally displace the rods **80** to increase or decrease the nozzle orifice.

Referring to FIG. **1**, the nozzle means **32** is connected with the stationary frame **90** of the panel transport means by means of a transverse support rod **92** that is connected with the lower surface of the nozzle and extends at each end through vertical slots **94** contained in vertical extensions **96** of the frame **90**. At its discharge end, the nozzle abuts the flexible belting seal member **96** carried by the lower external surface of the housing rear wall **44**. Owing to the cooperation between the support rod **92** and the slot means **94**, the nozzle means is vertically and angularly adjustable relative to the panel. Auxiliary nozzle means **98** are connected with frame **90** to blow excessive coating from the longitudinal edges of the panel.

The panel support means includes adjacent the housing inlet **4** a pair of feed rollers **100**, **102** that feed the panel into the housing, and adjacent the outlet are provided slightly elevated endless belt means **104** that remove the coated panels from the housing outlet. According to an important feature of the invention, the housing **2** is provided with rollers **108** that permit lateral removal of the coating apparatus from the opening between the transport frame portions **90**a, **90**b, whereby the housing may be readily replaced or serviced without complete disruption of the panel conveying system.

OPERATION

In operation, a series of horizontal plywood panels **8** are conveyed continuously in an end-butted manner through the coating housing **2** at a relative high velocity (on the order of about 100 lineal feet per minute). As each panel passes through the coating compartment, the flood bath **26** is formed on its upper surface to such a depth as to insure complete penetration of the coating into the surface voids and crevices during the time the panel passes through the coating compartment. The excess liquid flows laterally over the edges of the panel and is collected in the bottom of the housing in the reservoir pool **28**. As the panel is transported through the air doctoring chamber, excessive coating liquid is blown by the air jet emitted from nozzle means **32** against the rear surface of the brush **16** and laterally outwardly toward the longitudinal edges of the panel, whereupon the excess coating material is deposited by gravity into the reservoir pool **28**. Owing to the turbulence of the vapors in the air doctoring chamber, together with the tortuous vapor withdrawal path defined by the baffle plates **42**, the large and small coating particles are effectively removed from the exiting air, thereby improving the cleanliness of the coating operation. The auxiliary nozzle means **98** removes the excess coating liquid from the longitudinal edges of the panel as it exits from the housing outlet opening **6**. The panel engages the slightly elevated discharge transport means **104** which conveys the panel away from the housing.

Depending on the physical characteristics of the coating material (i.e., composition, viscosity, temperature and the like) the degree of coating of the textured panel surface can be controlled by such factors as the angle of the nozzle means relative to the panel, the degree of opening of the air nozzle means, the pressure of the air supplied to the nozzle means, and the transport velocity of the panels. Waste is maintained to a minimum since the lower surface of the panel is never engaged by support rollers or the like during transport through the coating apparatus, whereby the lower surface of the panel is desirably maintained free of the coating liquid. According to another advantage, the leading and trailing edges of the panels are coated as a consequence of the filling of the voids and crevices by the flood bath during passage through the coating compartment. Owing to the massive continuous blanket of coating material deposited from the trough, the entire width dimension of the panel, including all grooves and voids, is instantly covered with an excess of coating. In one working embodiment, the coating material was applied to the panel at a rate as high as 50 gallon/MSF, a residence time of almost a second and a half being effected during passage through the coating compartment. Panel speeds on the order of 100 lineal feet per minute have been achieved with the improved apparatus of the present invention.

Owing to the design of the coating apparatus as a self-contained unit, it is readily replaceable in a high production facility where a second machine can easily be placed in the panel conveyor line to facilitate a more rapid color change-over.

The lower edge of the weir wall **22** is normally spaced about 2 inches from the panel surface to limit the free fall distance, whereby necking, parting and splashing of the liquid curtain is avoided. Owing to the controlled removal of the coating by the air doctoring means, the mud cracking commonly formed in the bottom of grooves due to puddling is eliminated. Since use of the rotary brushes normally employed in similar staining apparatus is avoided, difficult and time-consuming clean-up of the apparatus, together with replacement or dressing of the rotary brushes due to wear in of the groove pattern, are obviated.

While in accordance with the provisions of the Patent Statutes the preferred form and embodiments of the invention have been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made in the described apparatus.

What is claimed is:

1. Apparatus for applying a liquid coating to the upper surface of a horizontal plywood panel during longitudinal transport at a relatively high linear velocity, comprising

a housing containing a chamber, said housing including inlet and outlet openings arranged to receive said panel during passage through said chamber;

means adapted to cooperate with the upper surface of said panel to define in the upper portion of said housing chamber a coating compartment adjacent said inlet opening and an air doctoring compartment adjacent said outlet opening;

a horizontal flood trough arranged in the upper portion of said coating chamber, said flood trough including a weir wall that terminates at its lower end immediately adjacent but spaced from the upper surface of the panel;

means for supplying a large excess quantity of liquid coating to said trough, whereby said liquid coating overflows and runs down said weir wall to define a massive continous liquid curtain that is collected to an appreciable flood depth upon the upper surface of the panel during passage of the panel through said coating compartment;

blower means for directing an air jet longitudinally across the upper surface of the panel in the direction from said outlet opening to said coating chamber, said blower means including a nozzle having a horizontal discharge slit that extends transversely completely across and immediately adjacent the upper surface of the panel; and collector means arranged in the bottom of said chamber beneath said compartments for receiving by gravity the excess coating liquid that passes laterally over the longitudinal edges of said panel.

2. Apparatus as defined in claim 1, wherein said compartment defining means includes a vertical partition, and first seal means carried by the lower portion of said partition for engagement with the upper surface of the panel to seal the coating compartment from the air doctoring compartment.

3. Apparatus as defined in claim 2, wherein said compartment defining means further includes second seal means connected with said housing adjacent said inlet opening for cooperation with the upper surface of said panel for sealing said coating chamber from atmosphere.

4. Apparatus as defined in claim 3, wherein said first and second seal means comprise downwardly depending brushes.

5. Apparatus as defined in claim 1, and further including pump means for pumping the liquid coating from said collector means to said overflow trough.

6. Apparatus as defined in claim 1, wherein said housing contains a vent opening in communication with the upper end of said air doctoring compartment, and further including means for removing vapors from said air doctoring chamber via said vent opening.

7. Apparatus as defined in claim 6, and further including baffle means arranged in said air doctoring compartment for defining a tortuous vertical passage in the direction of said housing opening.

8. Apparatus as defined in claim 1, wherein said nozzle means is arranged at an acute angle relative to the panel during discharge of the panel through the outlet opening.

9. Apparatus as defined in claim 8, and further including means for adjusting the angular relationship of said nozzle means in the vertical plane relative to the housing, thereby to adjust the angular relationship of said nozzle means relative to the panel.

10. Apparatus as defined in claim 9, wherein the rear wall of said air doctoring compartment is pivotally connected with the housing for pivotal movement about a horizontal pivot axis extending transversely of the panel, and further including flexible seal means connecting said nozzle means with the lower portion of said rear wall.

11. Apparatus as defined in claim 10, and further including cam plate means connected with the bottom portion of said rear wall and extending longitudinally of the panel in the direction of said coating chamber, said cam plate means having curved lower surfaces for holding down the panel during passage through said air doctoring compartment.

12. Apparatus as defined in claim 1, and further wherein said nozzle means is adjustable to vary the width of the nozzle opening.

13. Apparatus as defined in claim 12, wherein at least one of the top and bottom walls of said nozzle means is formed of sheet material and includes a pair of sections pivotally connected by a pivot axis extending transversely of the panel, one of said sections defining at its free edge the slit opening of said nozzle means, and further including means for pivoting said one section relative to the other to vary the nozzle opening.

14. Apparatus as defined in claim 1, and further including a panel support grid extending completely horizontally across the upper end of said collector means immediately adjacent the lower surface of the panel.

15. Apparatus as defined in claim 1, wherein said board has a four foot width and a linear velocity of about 100 lineal feet per minute, wherein said liquid coating comprises a stain supplied to said trough at a rate of at least 20 gallons per minute, wherein the blower air is supplied at a rate of at least 1,000 cubic feet per minute, and wherein said nozzle means is arranged at an angle of from between 45° to 75° relative to the panel.

16. Apparatus as defined in claim 15, wherein the angle of said nozzle means is approximately 60°, and further wherein the length and width dimensions of the discharge slit of said nozzle means are 56 inches and three-sixteenths inches, respectively.

17. Apparatus as defined in claim 1, and further including means for transporting said panel continuously at a uniform velocity through said housing.

18. Apparatus as defined in claim 1, and further including auxiliary air nozzle means adjacent said housing outlet for blowing excess coating material from the longitudinal edges of said panel.

* * * * *