Sept. 17, 1963 F. H. MILLIGAN 3,103,961

WOOD DEFECT REMOVING APPARATUS

Filed May 1, 1961 4 Sheets-Sheet 1

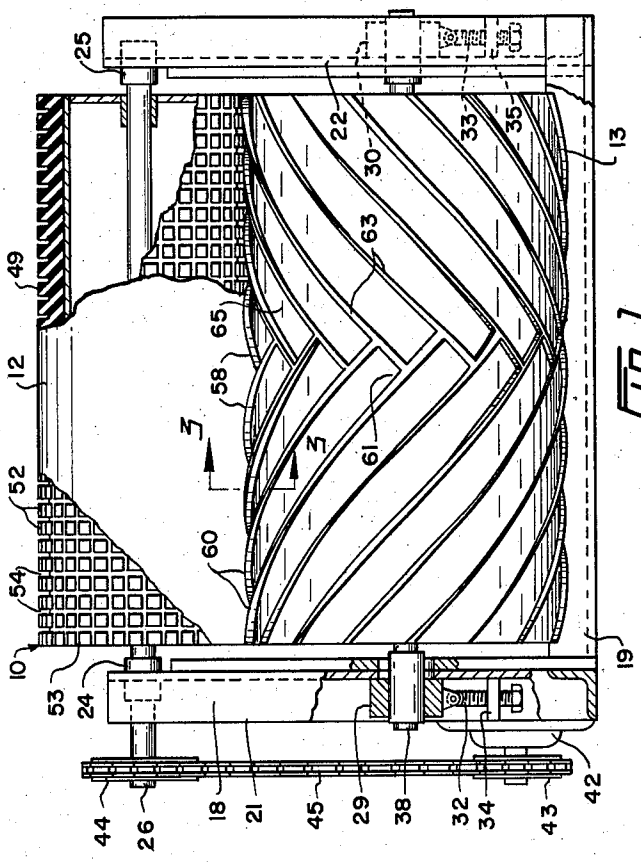


FIG. 1.

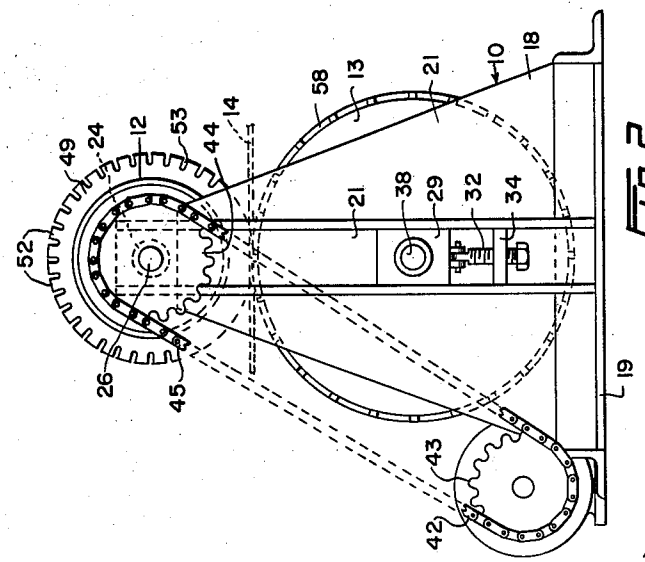


FIG. 2.

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Filed May 1, 1961 4 Sheets-Sheet 2

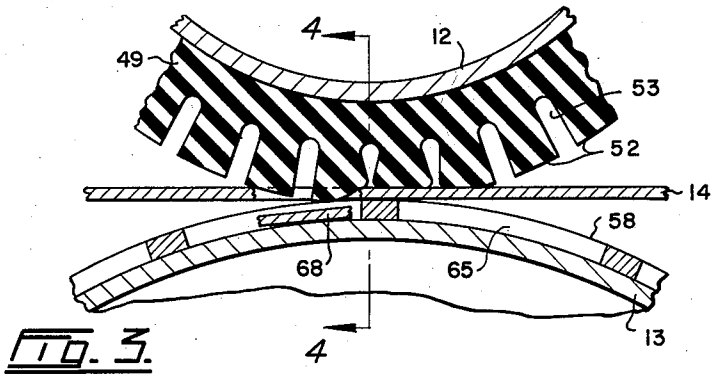


FIG. 3.

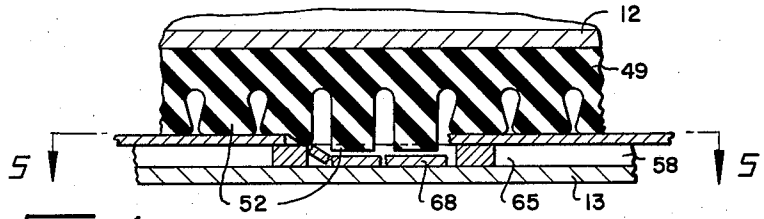


FIG. 4.

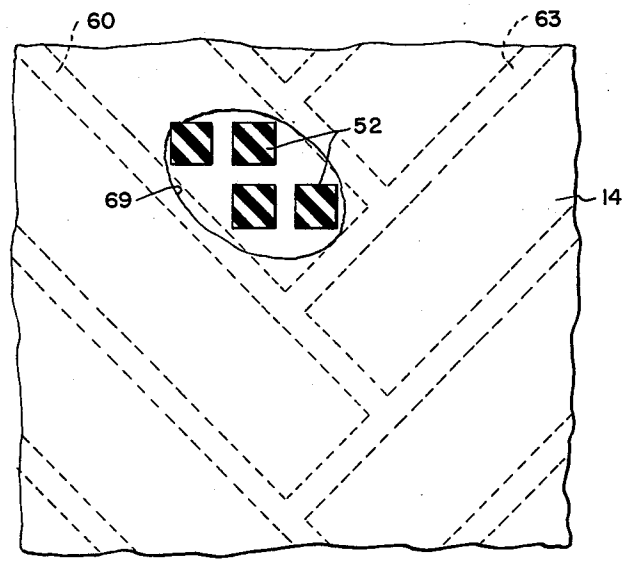


FIG. 5.

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Filed May 1, 1961 4 Sheets-Sheet 3

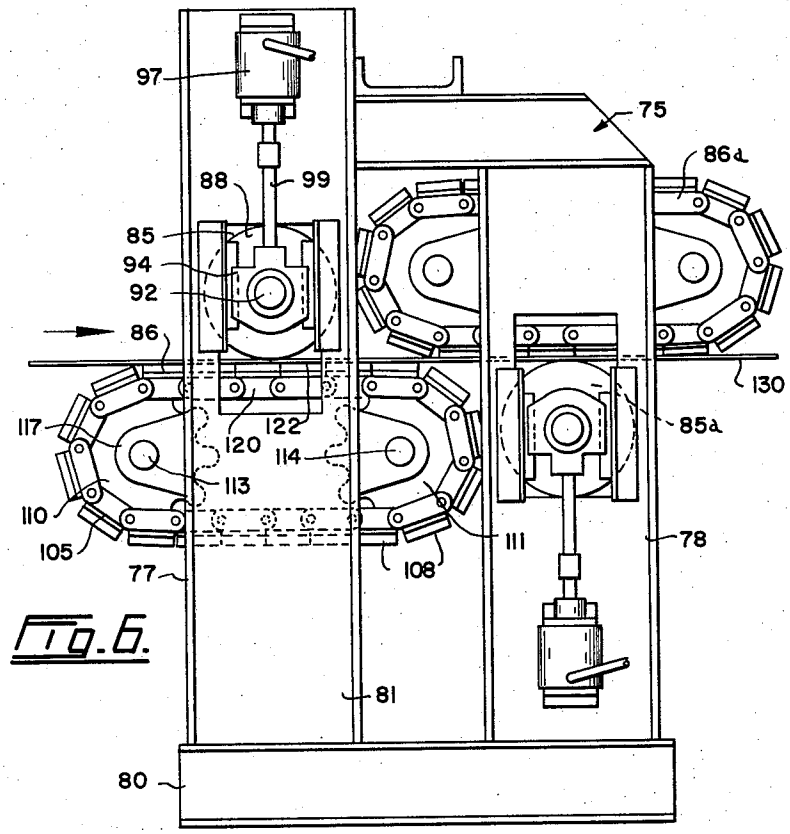


Fig. 6.

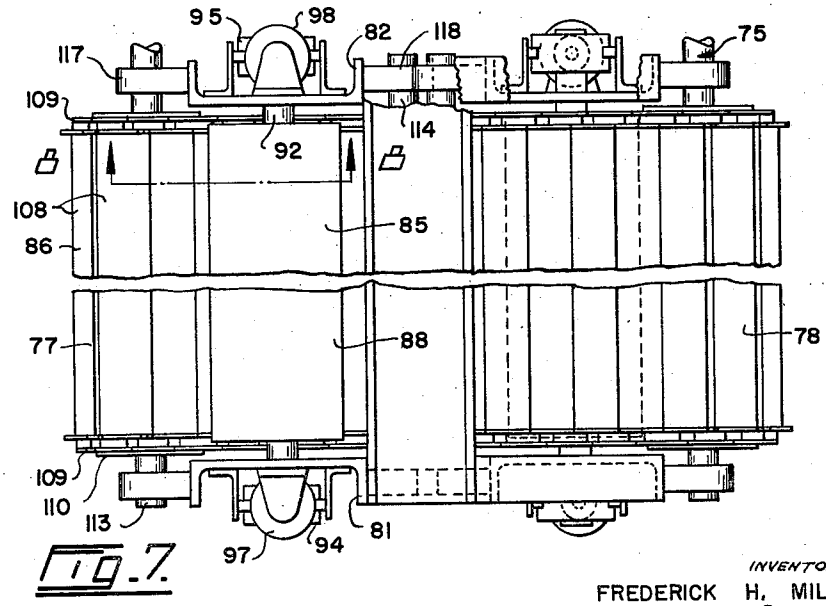


Fig. 7.

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Sept. 17, 1963 F. H. MILLIGAN 3,103,961

WOOD DEFECT REMOVING APPARATUS

Filed May 1, 1961 4 Sheets-Sheet 4

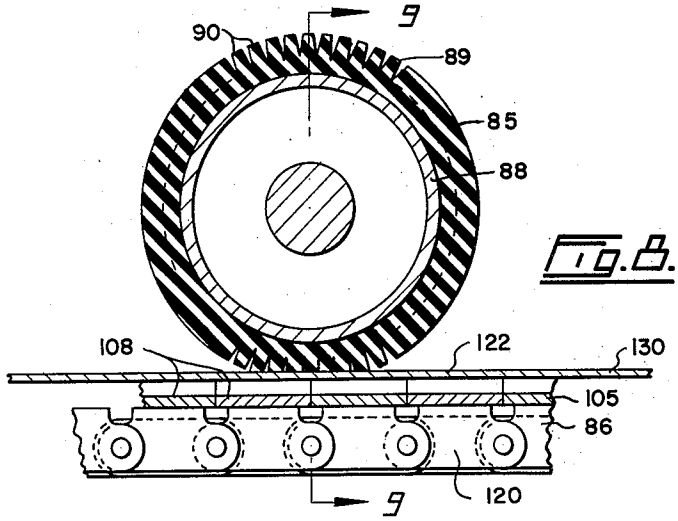


Fig. 8.

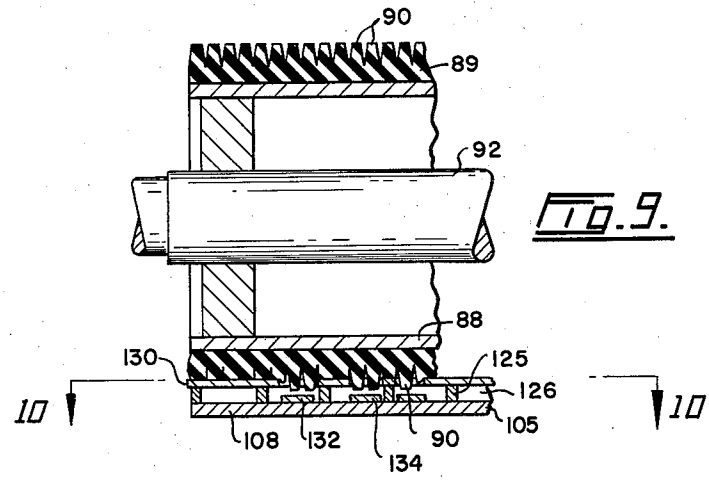


Fig. 9.

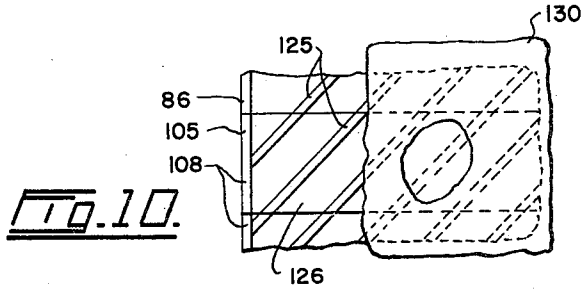


Fig. 10.

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3,103,961

WOOD DEFECT REMOVING APPARATUS

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Filed May 1, 1961, Ser. No. 106,815
5 Claims. (Cl. 144—2)

This invention relates to apparatus for removing knot and other defects from thin wood sections, such as plywood veneer, without removing surrounding or good wood.

A common and continuing problem in the manufacture of plywood, paper overlaid veneer and other products made from thin sections of wood is the presence of defects such as knots, pocket rot and the like which tend to fall out during manufacturing processes, and spoil the appearance and quality of the wood. These defects are characterized by being continuous between the plane surfaces of the thin sections of wood, such as veneer. When the material from these defects comes out of the wood it frequently is responsible for damage to equipment, or loss or degrading of material. For example, the rubber rolls of glue applicator machines can be damaged by hard pieces of knot; the glue in the applicator machine can be contaminated by knots, rot and other wood material; knots and other hard woody material can fall out and subsequently be pressed into and mar the surface of a plywood panel or the overlaid face of a composite panel or get between plies in plywood to prevent proper bonding, thereby causing total loss or at least reducing the value of the panel.

Wood veneer and plywood are overlaid with a variety of different materials, such as paper or cloth, to produce desired products. Open defects in the wood have to be patched, and knots present particularly poor surfaces for glue bonding, and it is desirable that all knots be removed so that they may be replaced by materials presenting a better surface for gluing, both in ordinary plywood and in overlaid wood.

Prior to the present invention, the only commercial way of attending to the knot and other defects in thin wood sections was to cut away the parts of the wood including the defects, and applying patches to the wood. This meant cutting out some of the good wood around the defect, and as the cutting out was done by machinery, the cut-outs had to be large enough to be sure to get the largest defects in the wood. As a result of this, a fairly large piece of wood was cut out even for a very small defect. In addition to this, only defects that were noticed were cut out. Some effort has been made in the past to punch out defects manually, but this was not a usual practice.

An object of the present invention is the provision of apparatus for the removal of knots and other defects from thin wood sections without recourse to manual labour, and either as a separate operation or in line with other manufacturing operations, such as during the production of plywood.

Another object is the provision of apparatus for removing knot and other defects which automatically removes only the defects and without affecting the good wood.

A further object is the provision of apparatus for automatically removing knot and wood defects, thereby eliminating the necessity of having someone watch for defects of this nature.

Yet another object is the provision of apparatus for removing knot and other defects from thin wood sections regardless of the grain direction of the wood with respect

to the direction of travel thereof through the apparatus, and regardless of whether the wood sections are in small pieces or in long continuous strips.

Apparatus according to the present invention for removing knot and other defects from thin wood sections without removing good wood, comprises means for supporting a thin wood section, and means for applying pressure to knot and other defects in a thin wood section on the supporting means to press said defects through and out of the section. The supporting means is preferably in the form of a grid including raised edges with spaced therebetween. The pressure applying means is preferably in the form of a resilient pad. When this pad is pressed against the face of the thin wood section, it presses out of the section any weakened or loose portions thereof. In other words, the good wood withstands the pressure, while a knot or other defect cannot resist and, therefore, is pressed out of the wood.

Examples of this invention are illustrated in the accompanying drawings, in which,

FIGURE 1 is an end elevation of one form of defect removing apparatus,

FIGURE 2 is a side view of the apparatus of FIGURE 1,

FIGURE 3 is an enlarged fragmentary sectional view taken substantially on the line 3—3 of FIGURE 1,

FIGURE 4 is a vertical section taken on the line 4—4 of FIGURE 3,

FIGURE 5 is a horizontal section taken on the line 5—5 of FIGURE 4,

FIGURE 6 is a side elevation of an alternative form of defect removing apparatus,

FIGURE 7 is a plan view of the apparatus of FIGURE 6,

FIGURE 8 is an enlarged section taken on the line 8—8 of FIGURE 7,

FIGURE 9 is a vertical section taken on the line 9—9 of FIGURE 8, and

FIGURE 10 is a horizontal section taken on the line 10—10 of FIGURE 8.

Apparatus according to the present invention includes mainly a first surface comprising a thick resilient pad, and a second surface against which a thin wood section is pressed by the first surface. It is preferable to make either or both of these surfaces curved so that in effect one surface extends towards and away from the other. One surface may be moved towards and away from the other, or both surfaces may be moved towards and away from each other, as desired. It is preferred to make both surfaces continuous either in the form of cylinders and/or endless belts, in which case the surfaces move in the same direction, but it will be understood that one surface may be moved towards the other somewhat in the same manner as a platen of a press.

Referring to FIGURES 1 to 6 of the drawings, **10** is one form of wood defect removing apparatus including an upper cylinder or roll **12** and a lower cylinder or roll **13** between which a thin wood section or veneer **14** may be moved. These rolls may be mounted in any desired manner as long as they apply considerable pressure to the wood section as it moves between them.

The apparatus includes a frame **18** including a base **19** with laterally spaced supports **21** and **22** projecting upwardly therefrom. Supports **21** and **22** have bearings **24** and **25** at the upper end thereof in which the shaft **26** is journalled, upon which roll **12** is fixedly mounted. As it is desirable to be able to adjust one roll relative to the other, bearings **29** and **30** are slidably mounted in supports **21** and **22**, and are adjustable vertically by means of screws **32** and **33** threaded through brackets **34** and **35** carried by said supports. These bearings may be

vertically adjustable by other means, such as air cylinders, lever arms and the like. A shaft 38 is journalled in bearings 29 and 30, and roll 13 is fixedly mounted on said shaft between the upright supports.

Although wood section 14 may be moved between rolls 12 and 13 in any desired manner, it is preferable to rotate either or both of these rolls. In this example, roll 12 is driven by a suitable source of power, such as an electric motor 42 through any suitable driving connection, such as a sprocket 43 mounted on the drive shaft of the motor, a sprocket 44 fixed to shaft 26, and a chain 45 extending around said sprocket.

Roll 10 is provided with a surface in the form of a fixed resilient pad 49. This pad is formed of any suitable material, such as rubber, plastic or the like. Pad 49 may have an unbroken outer surface, but it is preferable to divide it into a plurality of pressure blocks 52 formed by grooves cut fairly deeply into the pad surfaces. In the preferred form of the invention, blocks 52 are formed by longitudinal grooves 53 and transverse grooves 54.

Roll 13 is formed with a non-resilient surface in order to provide a stiff backing or support for veneer 14 as it moves between the rolls. The surface of roll 13 preferably has a raised design thereon in the form of hard projections with openings therebetween. The raised projections may be of any desired design or configuration, such as spaced bars, a pattern of squares, circles, semi-circles, triangles, crosses, or other configurations. The preferred form of surface includes spaced bars 58 angularly disposed relative to the path of travel of the veneer 14. The illustrated roll 13 has a herringbone design on the surface thereof, and bars 58 are divided into a plurality of spaced bars 60 spiralling outwardly from the circumferential centre 61 of roll 13, and another group of bars 63 spiralling outwardly in the opposite direction from said centre, as clearly shown in FIGURE 1. The spacing of bars 58 forms spaces or openings 65 therebetween.

Apparatus 10 operates in a very simple manner. The thin wood section 14 is fed between rolls 12 and 13, and the rotation of roll 12 moves the section forwardly between said rolls. FIGURES 3 to 5 illustrate the operation of the apparatus. The wood section 14 is pressed firmly against bars 58 of roll 13 by pad 49 of roll 12. Blocks 52 of this pad are compressed against the surface of veneer 14, and the latter is moving over openings 65 of the lower roll, but good wood is capable of withstanding the pressure of the blocks and so nothing happens. However, a defect in the form of a knot or weak area is not able to withstand this pressure. Therefore, a pressure block or blocks bearing against a defective section reassert themselves when said defective section moves over a space 65 of roll 13 or, in other words, is not supported by the latter roll. For example, FIGURES 3 and 4 show a plurality of blocks 52 pressing a defective piece 68 out of veneer 14. FIGURE 5 shows a hole 69 in the veneer 14 as a result of pressure by a plurality of blocks 52, some of which are shown in section in this view.

Knots in veneer 14 are punched out of it in this manner. As some knots have a slight taper, they can be punched out from one side only of the veneer. In this case, it is necessary to turn the veneer over and run it between rolls 12 and 13 a second time. Alternatively, a second set of rolls may be provided in a position to receive the veneer from the above described set, in which case the positions of the rolls would be reversed, that is, the roll with the pad surface would be at the bottom, and the roll with the stiff surface at the top.

FIGURES 6 to 10 illustrate an alternative defect removing apparatus 75. This apparatus includes two sections 77 and 78 which consecutively work on a sheet of veneer, one pressing defects downwardly, and the other pressing defects upwardly. For the sake of clarity, the description will be directed mainly to one of the sections, namely, section 77.

Apparatus 75 includes a frame made up of a base 80 with spaced supports 81 and 82 projecting upwardly therefrom. A pad element 85 is mounted above and urged towards a support element 86. Pad element 85 is in the form of a cylinder or roll 88 having a thick resilient pad surface 89 similar to pad 49 of roll 12. Pad 89 is preferably divided into pressure blocks 90.

Roll 88 is mounted on a shaft 92 which, in turn, is mounted in any desired manner on vertical supports 81 and 82. In this example, the shaft is journalled in bearings 94 and 95 slidably mounted for vertical movement in supports 81 and 82. These bearings are preferably resiliently urged downwardly, and this is done in this example by means of air cylinders 97 and 98 having pistons therein that are connected to bearings 94 and 95 by connectors, one of which is shown at 99 in FIGURE 6.

Supporting element 86 is the equivalent of roll 13 of apparatus 10. This supporting element is in the form of an endless conveyor 105 having a hard surface preferably with a raised design thereon. This surface may be in the form of a continuous strip of flexible metal with the design on its outer surface, but it is preferable to make the surface of a plurality of narrow strips 108 mounted on a plurality of laterally spaced chains 109 which extend around sprockets 110 and 111 fixedly mounted on shafts 113 and 114 extending across the apparatus and carried by horizontal frames 117 and 118 mounted on vertical supports 81 and 82. Conveyor 105 has an upper horizontal run 120 extending beneath roll 88. The cross strips 108 are so mounted on chains 109 that when they move along the upper horizontal run 120, they abut each other to present a substantially continuous upper surface 122 to pad 89 of roll 88, see FIGURE 8. The outer surface of each strip 108 preferably has a raised design thereon with spaces or openings therebetween. The preferred form of design consists of a plurality of bars or ribs 125, see FIGURES 9 and 10, projecting outwardly from the strip surface and forming spaces or openings 126 therebetween. These bars are preferably angularly arranged with reference to the direction of travel of a thin wood section or veneer 130 carried by conveyor 105 through the apparatus. If desired, bars 125 may be in a herringbone design similar to that of bars 58 of roll 13 in apparatus 10.

When veneer 130 is moved through the apparatus between the raised bars 125 of conveyor 105 and the pressure blocks 90 of pad 89 on roll 88, the apparatus functions in the same manner as apparatus 10. FIGURE 9 illustrates how the pressure blocks 90 press knot and other defects 132 and 134 downwardly into openings 126 between bars 125. The wood is carried by said bars and bridges openings 126. The good wood withstands the pressure of blocks 90, whereas the weaker defects give way under such pressure. Thus, only defective wood is punched out of veneer 130.

As some knots can be punched out from one side only of a veneer sheet, it is desirable to apply punching pressure to opposite faces of the sheets. Apparatus 75 is designed to do this without the necessity of turning the veneer over. Section 78 of the apparatus includes a pad element 85*a* below the path of travel of the veneer through the apparatus, and a support element 86*a* above said path of travel. Thus, the pressure blocks of element 85*a* work against the opposite face of the sheet from the pressure block of element 85.

From the above it will be obvious the pad element may be in the form of an endless conveyor, and the support element in the form of a roll, similar to roll 13 of apparatus 10. In order to accomplish this, it would only be necessary to place pads similar to pad 89 on the outer surfaces of strips 108, or on a continuous supporting strip if such were used. The basic idea of this invention may also be utilized in two endless belt arrangements

with horizontal runs pressed together to move a wood section or veneer sheet therebetween. In this case, one endless belt would have the rigid supporting bars and the other the pressure pad, and the pad would be compressed when it engaged the surface of the veneer. Any portion of the pad over a weak or loose spot in the veneer would reassert itself to press or punch said weak spot or loose spot out of the sheet. However, it is preferable to arrange the pad and support elements so that the surface of one moves towards the surface of the other when approaching the veneer being acted upon.

What I claim as my invention is:

1. Apparatus for removing knot or other defects from thin wood sheets, comprising, a support element including support members with unsupported areas therebetween, a resilient pad to apply pressure in the direction of said support element to and throughout a portion of one surface of a sheet interposed between said pad and said element and supported on said element, said surface portion encompassing an area larger than a major portion of the area of the average size of knots usually found in thin wood sheets, said pad, when brought into pressure contact with said sheet, presenting a relatively flat surface in direct pressure contact with at least a major part of said sheet surface portion and exerting pressure throughout said sheet surface portion, and means to bring said pad into pressure contact with said sheet on said support element, whereby, knots or weakening defects in said portion of the sheet are directly subjected to said pressure over at least a major portion of their surfaces and are thereby pressed out of said sheet by said pad.

2. Apparatus for removing knot or other defects from thin wood sheets, comprising, a movable support element including support members with unsupported areas therebetween, a resilient pad at and opposed to said support element and compressible by said support element to apply pressure in the direction of said support element to and throughout a portion of one surface of a sheet interposed between said pad and said element and supported on said element, the pressure applying surface of said pad comprising a plurality of closely arranged, relatively short, discrete pressure blocks, said surface portion encompassing an area larger than a major portion of the area of the average size of knots usually found in thin wood sheets, said pad being movable with and in the same direction as said support element and, said pad, when brought into pressure contact with said sheet, presenting a relatively flat surface in direct pressure contact with at least a major part of said sheet surface portion and exerting pressure throughout said sheet surface portion, and means to bring said pad into pressure contact with said sheet on said support element, whereby, knots or weakening defects in said portion of the sheet are directly subjected to said pressure over at least a major portion of their surfaces and are thereby pressed out of said sheet by said pad.

3. Apparatus for removing knot or other defects from thin wood sheets fed therethrough in a path of travel, comprising, a grid including inflexible support members having unsupported areas therebetween, said members being spaced closely enough together to support a portion of a thin wood sheet against damage when said portion is received on the grid and pressure is applied to the opposite surface of the supported portion of said sheet and being distributed to provide a supporting surface extending both across and in the direction of said path, said supporting surface being considerably smaller than the unsupported areas therebetween, whereby a major part of substantially all knots and weakening defects in the supported portion of said sheet overlie unsupported areas of said grid, a resilient pad to apply pressure to and throughout the surface of said supported portion of said sheet in the direction of said grid and substantially normal to the sheet surface, and means to bring said pad into pressure contact with the opposite surface of said supported portion, whereby knots or weakening defects in said portion of the sheet are subjected to said pressure and thereby pressed out of said sheet by the pad into said unsupported areas of the grid.

4. Apparatus as in claim 3 and wherein said support members comprise narrow bars arranged in a herringbone design, said bars extending angularly across the path of travel of said sheets.

5. Apparatus for removing knots or other defects from thin wood sheets fed therethrough in a path of travel, comprising, a movable grid including inflexible support members having unsupported areas therebetween, said members being spaced closely enough together to support a portion of a thin wood sheet against damage when said portion is received on the supported portion of said sheet and being distributed to provide a supporting surface extending both across and in the direction of said path, said supporting surface being considerably smaller than the unsupported areas therebetween, whereby a major portion of substantially all knots and weakening defects in the supported portion of said sheet overlie unsupported areas of said grid, a resilient pad at and opposed to said grid and compressible by said grid to apply pressure in the direction of said support element to and throughout a portion of one surface of a sheet interposed between said pad and said grid and supported on said grid, said surface portion encompassing an area larger than a major portion of the area of the average size of knots usually found in thin wood sheets, said pad being movable with and in the same direction as said support element and, said pad, when brought into pressure contact with said sheet, presenting a relatively flat surface in direct pressure contact with at least a major part of said sheet surface portion and exerting pressure throughout said sheet surface portion, and means to bring said pad into pressure contact with said sheet on said grid, whereby, knot weakening defects in said portion of the sheet are directly subjected to said pressure over at least a major portion of their surfaces and are thereby pressed out of said sheet by said pad into said unsupported areas of the grid.

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