

Nov. 5, 1968

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3,408,775

BELT SANDING AND POLISHING MACHINE

Filed Feb. 16, 1966

5 Sheets-Sheet 1

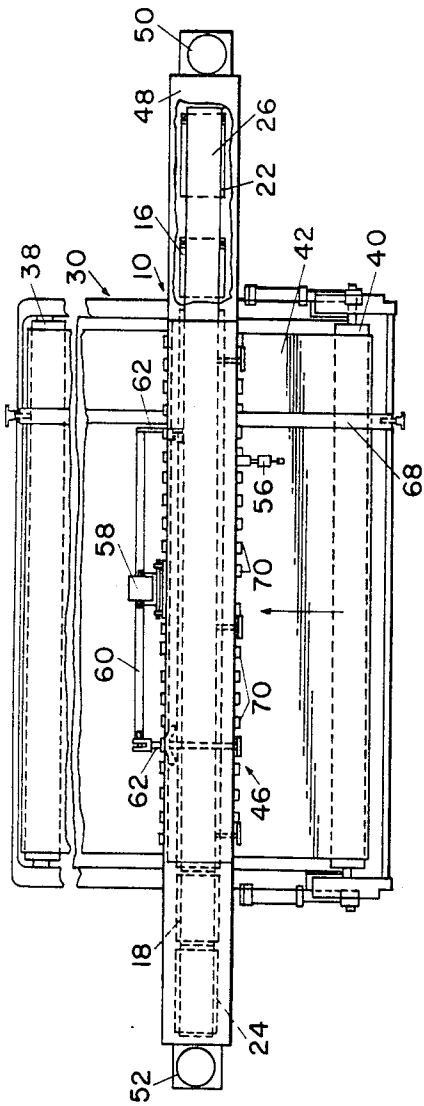


FIG. 1

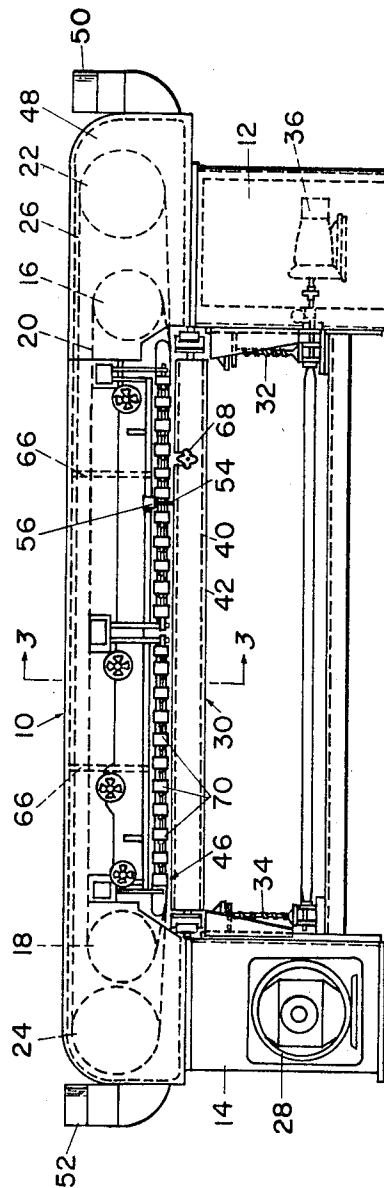


FIG. 2

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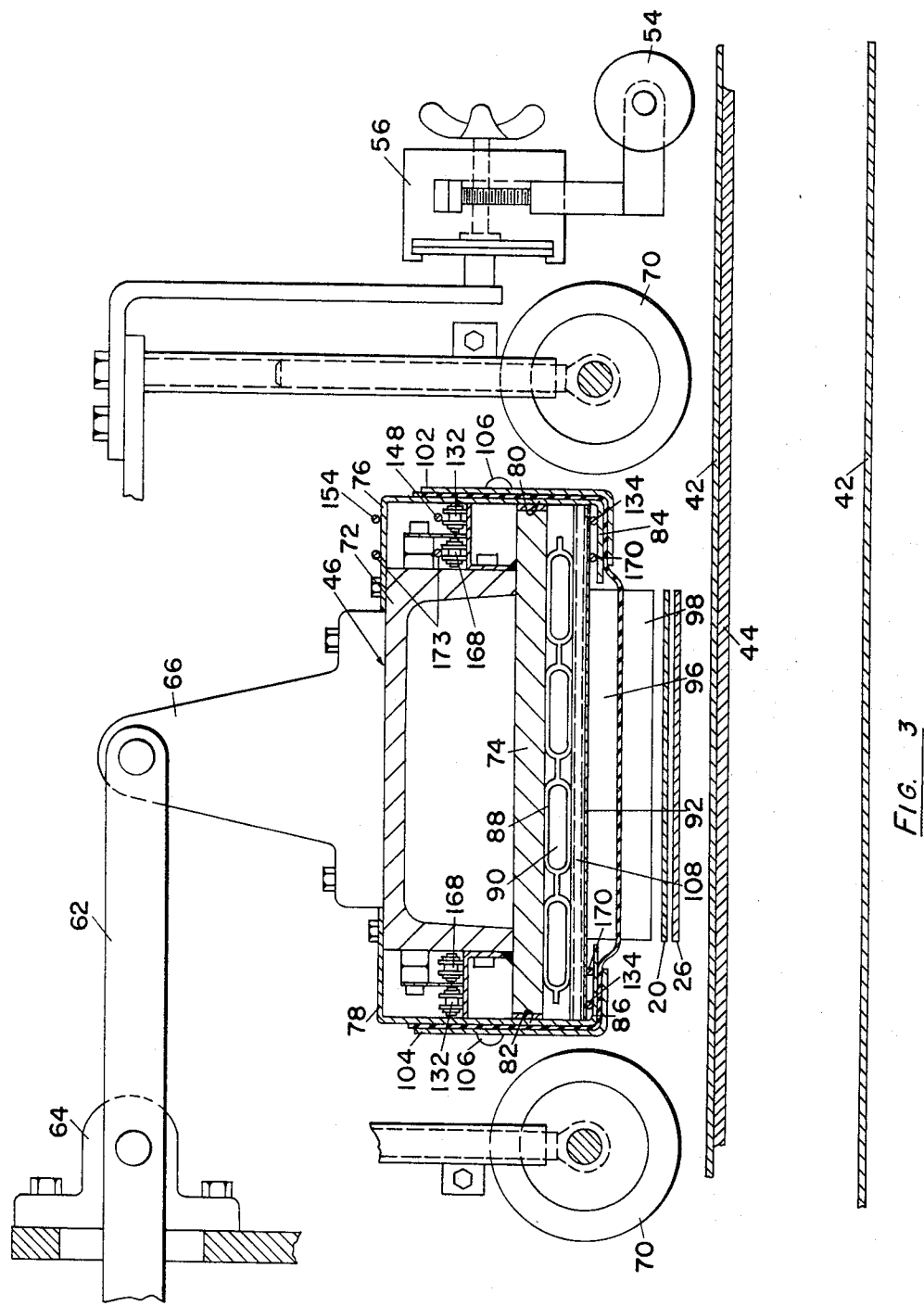


FIG. 3

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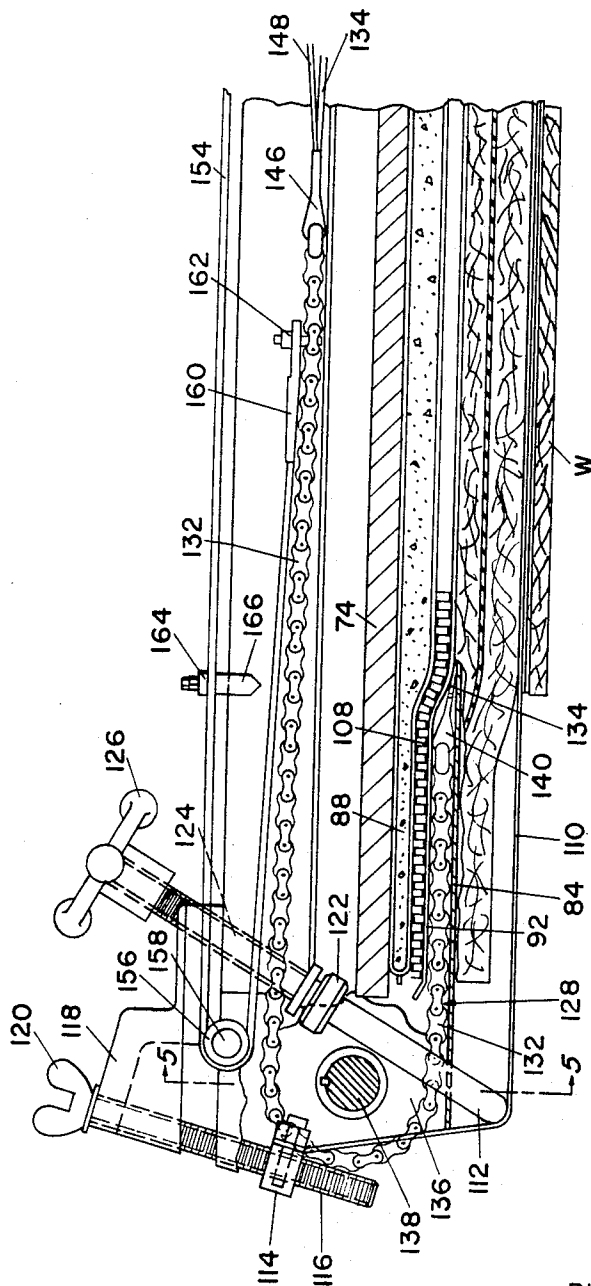
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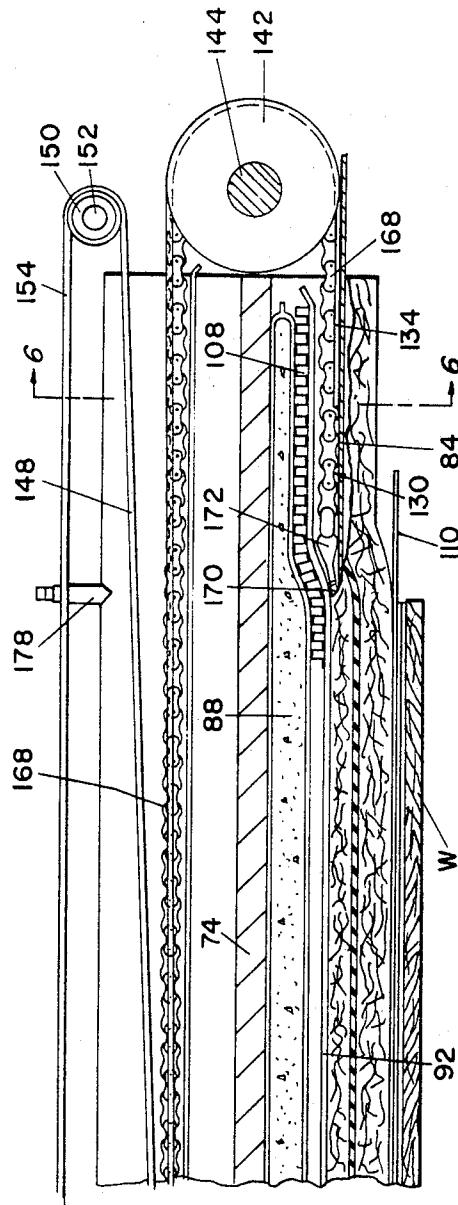


FIG. 4b

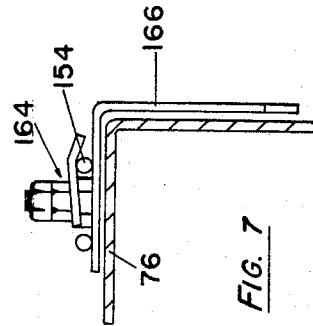


FIG. 7

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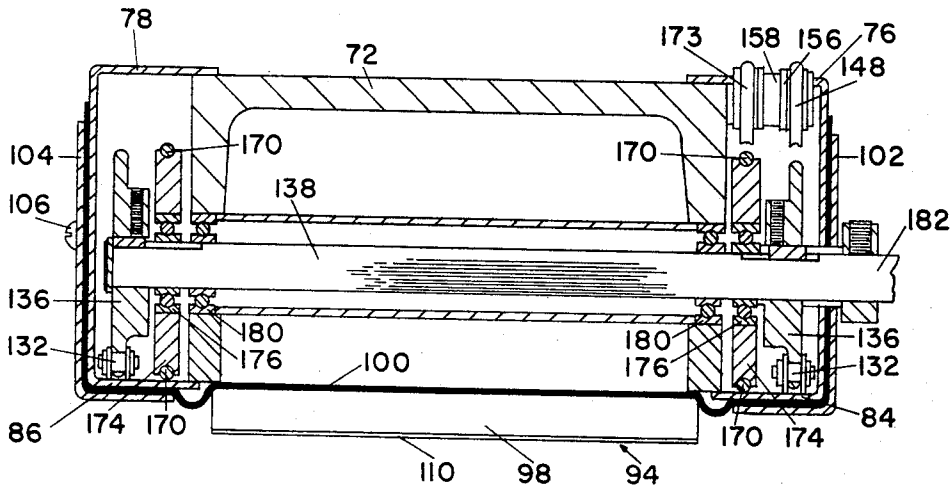


FIG. 5

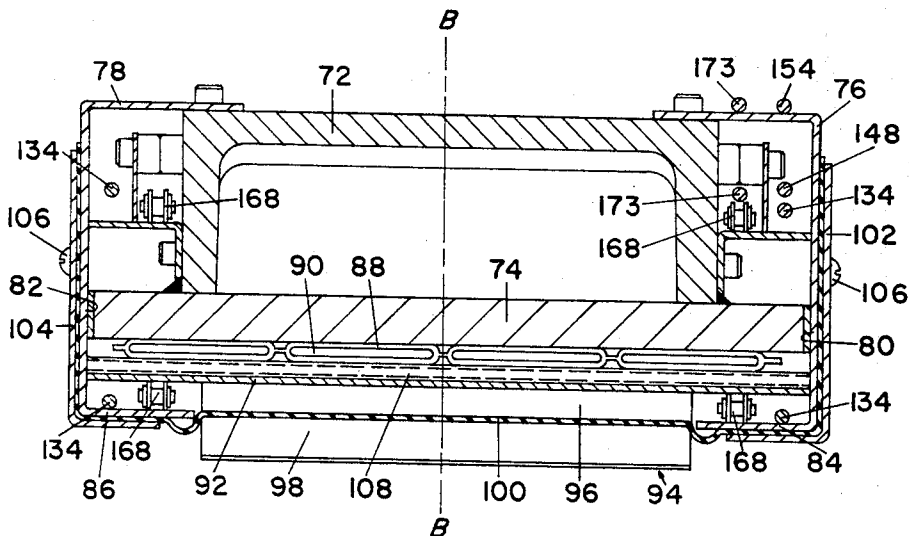


FIG. 6

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3,408,775

BELT SANDING AND POLISHING MACHINE
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10 Claims. (Cl. 51-146)

ABSTRACT OF THE DISCLOSURE

A sanding and polishing machine utilizing an abrasive belt in which the effective pressure pad length of a caul assembly is adjustable and strip-like means is incorporated in said assembly to permit flexibility of the pressure pad in the lengthwise direction while maintaining the pad rigid in a direction normal thereto so that uniform pressure will be applied across the full width of the abrasive belt.

This invention relates to belt sanding and polishing machines and, more particularly, to pressure cauls for sanding and polishing machines.

It is well-known in the furniture industry to adhesively bond a thin sheet of veneer of an expensive fine grade wood to a core composed of a less expensive wood to provide an attractive expensive-looking finished product. After the veneered panel is rough sanded to remove surface irregularities, it is further polished to provide a smooth, even surface. To accomplish the above result it is necessary to press a movable abrasive belt against the surface of a veneered panel or workpiece and, for this purpose, a resilient pad is usually mounted on a sanding and polishing machine for urging the belt against the surface of the workpiece with a uniform pressure.

Since the abrasive belt has an active run longer than the length of the veneered panels or workpieces, concentrated abrasive forces are applied along the ends of the workpiece and often cause the veneer to be sanded through adjacent said ends so that the core is exposed. In order to obviate these deficiencies, a sanding and polishing machine has been developed in which the effective pad length is adjustable by raising selected portions of the pad from the abrasive belt immediately adjacent the ends of the workpiece to prevent the thin veneer thereon adjacent such ends from being sanded through.

Application Ser. No. 389,090, filed Aug. 12, 1964, now Patent No. 3,364,626, assigned to the same assignee as the instant application, may be referred to for a disclosure of an apparatus for changing the effective length of a pressure pad. Although the above-referred-to apparatus has served the purpose for which it was designed, it has been found that the flexibility required of certain elements adjacent the pressure pad for changing the effective length thereof effects a concentration of pressure and thereby excessive wear along the longitudinal center of the abrasive belt.

The general purpose of the present invention, which constitutes an improvement over the hereinbefore mentioned application, is to obviate the above disadvantage by providing a means for applying uniform pressure across the full width of the abrasive belt, thus increasing the efficiency and abrading life of such belt.

It is, therefore, an object of the present invention to provide a new and improved belt sanding and polishing machine.

It is another object of the present invention to provide a new and improved belt sanding and polishing machine having novel means for maintaining uniform pressure across the full width of an abrasive belt.

It is still another object of the present invention to provide a new and improved belt sanding and polishing ma-

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chine in which the effective pad length is adjustable for workpieces of various lengths, said machine having novel means for maintaining uniform pressure across the full width of an abrasive belt.

It is a specific object of the present invention to provide a new and improved belt sanding and polishing machine having novel means incorporated in the caul assembly thereof for permitting flexibility of a pressure pad in a first direction while maintaining substantial rigidity thereof in a direction normal to said first direction.

These and other objects of the present invention will become more apparent when taken in conjunction with the following detailed description and drawings, in which:

FIG. 1 is a top plan view, with parts broken away, of a sanding and polishing machine in which a preferred illustrative embodiment of the invention is incorporated;

FIG. 2 is a front elevational view of the sanding and polishing machine of FIG. 1;

FIG. 3 is a cross sectional view, partially schematic, of the sanding and polishing machine of FIG. 1, taken along the line 3-3 of FIG. 2;

FIGS. 4a and 4b, taken together, constitute an enlarged front elevational view, partially schematic and in section with the front cover removed, of the caul assembly, constructed in accordance with the principles of this invention;

FIG. 5 is a cross sectional view of the caul assembly taken along the line 5-5 of FIG. 4a, with the front cover plate added thereon and with certain elements deleted for purposes of clarity;

FIG. 6 is a cross sectional view of the caul assembly taken along the line 6-6 of FIG. 4b with the front cover plate added thereon; and

FIG. 7 is a fragmentary side view illustrating the disposition of a pointer element with respect to the caul assembly.

With reference to FIGS. 1 and 2 of the drawings, it will be seen that a sanding and polishing machine constructed in accordance with the principles of this invention comprises a suitable elongated horizontal frame, generally designated 10, suitably supported by vertically extending pedestals 12 and 14. Journaled for rotation in suitable bearings on frame 10 are a pair of back-up belt pulleys 16 and 18 around which an endless back-up belt 20 is trained for movement in an orbital path. Also journaled for rotation in suitable bearings on frame 10 are a pair of abrasive belt pulleys 22 and 24 around which an endless abrasive belt 26 is trained for movement in an orbital path. A suitable motor 28, mounted in pedestal 14, drives pulleys 18 and 24 in the same direction through suitable gear reduction and drive connections, not shown, but well-known in the art.

A conveyor frame, generally designated 30, disposed beneath frame 10 is supported by a pair of screw jacks 32 and 34 located on the pedestals 12 and 14, respectively, and which may be selectively raised or lowered through a suitable gear reduction means by motor 36 mounted in pedestal 12. Conveyor frame 30 is provided with rollers 38 and 40 journaled for rotation in suitable bearings at opposite ends of frame 30 and an endless conveyor belt 42 is trained about such rollers for the purpose of advancing workpieces beneath abrasive belt 26 in the direction of the arrow shown in FIG. 1. A base plate 44 (FIG. 3) is suitably mounted on frame 30 and provides a flat rigid support for the active or upper run of conveyor belt 42. The conveyor belt is driven by any suitable means, such as an electric motor by way of example, at a selected speed.

A pressure means or caul assembly, generally indicated as 46, suitably mounted on frame 10 urges the active or lower runs of back-up belt 20 and abrasive belt 26 against a workpiece as will be hereinafter more fully explained.

Caul assembly 46 and belts 20 and 26 are enclosed within a housing 48 for collecting the dust generated during the sanding and polishing operation, the dust laden air being drawn out of the housing through spaced outlets 50 and 52 disposed at opposite ends of housing 48 by means of any conventional dust removal equipment.

As workpieces on the conveyor belt 42 advance under the housing 48, the leading edge of each workpiece engages an abutment roller 54 which actuates a stock feed switch 56, which in turn controls the vertical position of caul assembly 46. A delaying mechanism, not shown but well-known in the art, is responsive to the speed of conveyor belt 42 in order to delay lowering of the caul assembly until a workpiece is advanced under belts 20 and 26. As these switches and delay mechanisms are completely conventional and have been widely used in well-known commercial structure by applicant's assignee, no further explanation or amplification is believed necessary.

The mechanical means for raising and lowering caul assembly 46 comprises a suitable fluid caul cylinder 58 mounted on frame 10 and operatively connected to an elongated horizontally extending bar 60 having elongated horizontally extending levers 62 secured to the opposite ends thereof and disposed normal thereto. Levers 62 are mounted for swinging movement in bearings 64, respectively, on frame 10 and have their ends remote from bar 60 connected to brackets 66, respectively, extending upwardly from the caul assembly 46. Thus, when fluid under pressure is properly supplied to the caul cylinder 58 to lower or raise bar 60 the remote ends of levers 62 may be swung either upwardly or downwardly, respectively, about their pivots in bearings 64 to raise or lower caul assembly 46.

A work guide fence 68 (FIG. 1) is secured on the conveyor frame 30 and extends transversely of the run of abrasive belt 26 for guiding the advance of a workpiece on the conveyor belt 42. A similar work guide fence (not shown) may be disposed on conveyor frame 30 on the opposite end thereof (left hand side as viewed in FIG. 1) for maintaining workpieces within prescribed paths under the caul assembly. A plurality of vertically adjustable rollers 70 are mounted along the front and rear of housing 48 for urging workpieces against conveyor belt 42.

Referring to FIGS. 3-7, caul assembly 46 includes a suitable support member, such as an elongated channel member 72, of an inverted U-shaped cross section. Rigidly secured, as by means of welding for example, to the legs of member 72 is a pressure caul plate 74 (FIGS. 3 and 6) extending substantially along the length of channel member 72. Thin rigid cover plates 76 and 78 having U-shaped cross sections extend longitudinally along opposite sides of member 72 and are suitably rigidly attached at their bight portions 80 and 82, respectively, to the opposite sides of the caul assembly. Member 72, caul plate 74 and cover plates 76, 78 form a housing for the caul assembly. Cover plates 76 and 78 have leg portions which constitute flanges 84 and 86 that underlie side portions of caul plate 74 and are spaced downwardly therefrom as shown in FIG. 6.

Disposed adjacent the bottom surface of caul plate 74 is a resilient, inflatable air bag 88 which may have separate air cells 90, as shown in FIGS. 3 and 6. Any conventional suitable means (not shown) may be provided for supplying air at a regulated pressure to each of the cells 90.

A thin, flexible, preferably metallic sheet 92, which is located between cover plates 76 and 78 (see FIG. 6), extends substantially along the full length and width of caul plate 74. Rigidly secured, as by means of any suitable adhesive to the bottom surface of flexible sheet 92, is a resilient pad, generally indicated at 94, substantially the length of sheet 92 but appreciably less than the width of such sheet so as to be disposed between the free ends of flanges 84 and 86 as shown in FIG. 3.

Pad 94 consists of a pair of mat members 96 and 98 which are slightly compressible and may be formed preferably of a fibrous material or an elastomeric material. Mat members 96 and 98 are of equal width and length and are adhesively secured by any suitable means to a rubber membrane 100 sandwiched therebetween which extends laterally outwardly from both sides of the pad. The lateral free ends of membrane 100 are formed about the cover plates 76 and 78 (see FIGS. 3 and 6) and clamped thereto by suitable L-shaped members 102 and 104, secured onto the cover plates, respectively, as by means of screws 106. Membrane 100 prevents dust generated by the sanding and polishing operation from entering into the housing of the caul assembly.

The important feature of the present invention is the provision of a corrugated metallic strip 108 which is disposed between the bottom surface of bag 88 and the upper surface of sheet 92 (FIGS. 4a and 4b) with the longitudinal axes of the corrugations extending in a direction normal to the path of movement of abrasive belt 26, said strip extending substantially the full length and width of caul plate 74. Orientation of the corrugated strip in this manner allows flexibility thereof along the length of its projections and grooves while providing substantial rigidity normal thereto. The significance of this feature permits the pad 94, along with its attendant flexible elements to be bent in a direction normal to its length while maintaining substantial firmness 90° from said direction so as to uniformly urge the full width of the pad against the abrasive belt. In the absence of a workpiece, it should be noted that inflatable bag 88, corrugated strip 108, and flexible sheet 92 are supported along their sides by flanges 84 and 86.

A wear resistant canvas cloth 110, preferably a fabric impregnated with a lubricant, such as graphite by way of example, is stretched under pad 94 to protect such pad from excessive wear. Canvas cloth 110 extends along the length of pad 94 and is trained over canvas positioning members 112 (FIG. 4a) which are suitably adjustably mounted on the caul assembly adjacent opposite ends thereof (only one being shown in FIG. 4a).

Since the means for securing the free ends of the canvas cloth and the canvas positioning means are identical on opposite ends of the caul assembly, only one of each means will be described and shown (left end of FIG. 4a), it being understood that the right end of the caul assembly (FIG. 4b) incorporates a similar clamping and positioning means which function in the same manner. The free ends of the canvas cloth 110 are secured in clamps 114 having internal threads cooperatively engageable with elongated externally threaded studs 116 which are journaled for rotation in brackets 118 located adjacent opposite ends of the upper surface of the caul assembly. Wing nuts 120 are rigidly secured onto studs 116 so that turning the nuts 120 effects tensioning of the canvas cloth over positioning members 112.

Positioning members 112 are adjustable in an inclined downwardly direction by means of threadably cooperative adjusting members 122 and 124, the members 124 having hand wheels 126 secured thereto so that rotating said hand wheels displace the positioning members upwardly or downwardly. Of course, the positioning members may be disposed in a vertical plane, or in any other orientation, as desired. The purpose for providing the positioning members is to maintain the canvas cloth substantially parallel to the bottom surface of pad 94 to preclude biasing said pad toward the caul plate 74.

Means are provided to adjust the effective length of the pressure pad to correspond to the length of the workpiece and thereby prevent pressure from acting against the abrasive belt beyond the ends of said workpiece to prevent polishing through the veneer adjacent such ends. Such means comprise a pair of endless composite belts, generally designated 128 and 130 for raising selected portions of the left and right ends, respectively, of pad 94

adjacent the forward side of the caul assembly 46. For purposes of this description, the forward side of the caul assembly is taken to be the side toward which the work approaches.

Located on the opposite or rearward side of the caul assembly are a second pair of composite belts and since they are of identical construction as belts 128 and 130 and symmetrical thereto about a plane passing through the line indicated at B—B (FIG. 6) along the longitudinal axis of the caul assembly, it is believed that a detailed description only of composite belts 128 and 130 will suffice, and where applicable, identical reference characters will be employed to indicate similar structure.

Composite belt 128 is formed of a length of conventional roller chain 132 and a length of cable 134. As shown in FIG. 4a, roller chain 132 is trained about a sprocket 136 keyed to an elongated transversely extending shaft 138 and extends under the left end of flexible sheet 92 where the chain terminates and is fastened to cable 134 by means of a ferrule or cable terminal 140. Cable 134 extends along the length of flexible sheet 92 adjacent the forward side thereof and is guided over an idler guide pulley 142 which is mounted on an elongated transversely extending shaft 144 adjacent the right end of the caul assembly (FIG. 4b), said pulley being rotatable relative to shaft 144. The end of cable 134 is attached to its corresponding chain 132 by means of a suitable cable terminal 146.

Also affixed to terminal 146 is a pointer cable 148 trained about an idler guide pulley 150 (FIG. 4b) rotatably mounted on shaft 152 for rotation relative thereto. The upper run 154 of pointer cable 148 extends along the length of the caul assembly and is guided about a second idler guide pulley 156 (FIG. 4a) rotatably mounted on shaft 158 (FIG. 5) for rotation relative thereto. The end of pointer cable 148 terminates in a bracket 160 which is rigidly secured to roller chain 132 as by means of a screw and nut arrangement 162. It should be noted that the upper run 154 of cable 148 is disposed above the caul assembly housing, and suitably affixed thereon, as by means of a clamping assembly, generally designated 164, is a pointer 166 of an inverted L-shaped configuration as shown in FIG. 7, said pointer extending forwardly of cable 148, then downwardly in front of frame 76. Pointer 166 indicates the exact point at which the left end of pad 94, as shown in FIG. 4a, breaks away from the end of the workpiece.

Composite belt 130 is disposed in a vertical plane spaced rearwardly from the vertical plane of composite belt 128 and comprises a length of conventional roller chain 168 and a length of cable 170. Keyed to shaft 144 behind idler pulley 142 is a sprocket (not shown) about which is trained the roller chain 168, said chain extending leftwardly under the right end of flexible sheet 92 (FIG. 4b) where the chain terminates and is fastened to cable 170 by means of a terminal 172. Cable 170 extends along the length of sheet 92 adjacent the forward side thereof but behind cable 134 (FIG. 3) and is guided under and over an idler guide pulley 174 which is mounted on shaft 138 adjacent the left end of the caul assembly 46, said pulley being rotatable relative to shaft 138 by means of bearings 176 (FIG. 5). The end of the cable 170 is attached to its corresponding roller chain 168 by a connection means (not shown) similar to that of cable terminal 146, to which is also affixed a second pointer cable 173 (see FIG. 5) trained about a pair of longitudinally spaced idler guide pulleys mounted on shafts 152 and 158 behind pulleys 150 and 156, respectively, said second pointer cable terminating in a bracket suitably secured to its respective roller chain 168. A second pointer 178 is clamped to the second pointer cable in the same manner as pointer 166 is attached to the upper run 154 of cable 148 with the exception that the second pointer indicates the point at which the right end of pad 94 breaks away from the end of the workpiece.

It should be apparent that the composite belt 130 ac-

companied with its associated elements is identical to that of belt 128 except for a reversal of the chain and tape assembly, that is, roller chain 132 of composite belt 128 is disposed beneath the left end of flexible sheet 92 whereas roller chain 168 of composite belt 130 is located beneath the right end of the flexible sheet 92.

It should be recalled that a pair of identical composite belts are provided on the rearward side of the caul assembly. However, the rearward belts are not provided with pointers since the junction of their chains and cables are in substantial alignment with the forward composite belts 128 and 130, respectively, that is, the junctions of the rearward belts lie in a vertical plane common to the junctions of the corresponding forward composite belts, said vertical plane being normal to the path of movement of abrasive belt 26.

Means are provided for displacing the composite belts longitudinally, such means comprising the elongated transversely extending shaft 138 journaled in a pair of bearings 176 and a pair of bearings 180 located in the caul assembly housing. The free end 182 of shaft 138 may be provided with any suitable hand manipulating means, such as a hand wheel or a crank, for example, to facilitate the rotation of shaft 138.

Rotation of shaft 138 effects rotation of the forward and rearward sprockets 136 which are keyed thereto in turn displace roller chains 132 longitudinally to raise the left end of flexible sheet 92 away from their respective flanges and thereby pad 94 away from the workpiece. Similar hand manipulating means (not shown) are provided for shaft 144 on the right end of the caul assembly 46 for longitudinally displacing roller chains 168 to raise the right end of flexible sheet 92 along with pad 94 away from the workpiece.

The back-up belt 20 may be a conventional endless belt of a uniform thickness, but the belt may also have means for concentrating pressure on the abrasive belt 26. Such means, for example, may comprise a plurality of shoes which are applied to the outer or abrasive belt engaging surface of the back-up belt 20 at uniformly spaced intervals along the length of the belt, such shoes bearing against the inner surface of the abrasive belt 26. Another load concentrating means may be a plurality of diagonal stripes which are secured to the outer surface of the back-up belt 20, for example, by an adhesive. The diagonal stripes may be arranged alternatively at right angles or may be in the form of chevrons to concentrate the grinding pressure on the abrasive belt without causing the belt to wear excessively. Although the back-up belt 20 contributes to the efficient removal of stock from workpieces and reduces the heat generated by the friction of the abrasive belt, the machine of this invention may be operated without a back-up belt, in which case the caul assembly urges the pad directly against the abrasive belt.

In operation, motor 28 is energized to drive pulleys 18 and 24 and thereby drive the back-up belt 20 and abrasive belt 26, respectively. The caul assembly 46 is raised relative to the belts and as the workpiece, guided by one or more work guide frames 68, advances toward the caul assembly, the leading edge of such workpiece engages abutment roller 54 to energize stock feed switch 56. A control means, operated in a timed relationship with a conveyor belt drive, actuates a valve for supplying fluid to caul cylinder 58 at the time the leading edge of the workpiece is disposed beneath abrasive belt 26. The caul assembly is lowered to urge belts 20 and 26 against the workpiece. Workpieces of the same length are fed continuously on conveyor 42 and as the trailing edge of the last piece advances past the abutment roller, the caul assembly 46 is raised relative to belts 20 and 26 after a time delay to permit the workpiece to move out from under the belts 20 and 26.

As a result of this invention, an improved belt sanding and polishing machine is provided for polishing veneered workpieces in an improved and more efficient manner.

When either of these shafts 138 or 144 is rotated, the corresponding forward and rearward chains are displaced longitudinally to shift the position of the junctures of the chains and cables under flexible sheet 92 to raise the end portions of sheet 92 and thereby end portions of pad 94 away from back-up belt 20 and abrasive belt 26 for adjusting the effective length of said pad commensurate with the length of the workpiece. By the provision of the corrugated metallic strip 108, it should be appreciated that flexing thereof can occur along the longitudinal axes of the corrugations, that is, along the lengths of the projections and grooves thereof to enable the effective length of the pad to be adjusted. However, appreciable rigidity is provided by strip 108 in a direction normal to the longitudinal axes of said corrugations so that uniform pressure is applied across the full width of pad 94, thus utilizing the entire surface area of the pad against the abrasive belt 26. Accordingly, pressure strip-like means is applied uniformly across the entire width of the abrasive belt whereby a more efficient use and longer life span of the belt is realized.

A preferred embodiment of this invention having been described and illustrated, it is to be realized that modifications thereof may be made without departing from the broad sphere and scope of this invention as defined in the appended claims.

I claim:

1. A sanding and polishing machine comprising: a frame; a pair of spaced pulleys rotatably mounted on said frame; an abrasive belt carried by said pulleys for movement in an orbital path and having an active run; pressure means mounted on said frame for applying pressure against said active run of said abrasive belt; a flexible sheet supported by said pressure means and having a pad attached to one side thereof; means for displacing selected portions of said sheet and said pad toward and away from said active run of said abrasive belt; and strip-like means disposed on the other side of said sheet for permitting flexibility of said sheet and said pad in one direction while maintaining substantial rigidity in a direction normal to said one direction.

2. A sanding and polishing machine as defined in claim 1 wherein said last mentioned means comprises an elongated strip of corrugated material having a plurality of projections and grooves extending transversely of the longitudinal axis of said strip.

3. A sanding and polishing machine as defined in claim 2 wherein said pressure means includes a housing; a plate secured to an upper portion of said housing; and a resilient means interposed between said plate and said corrugated strip for urging said corrugated strip, said sheet and said pad toward said active run of said abrasive belt.

4. A sanding and polishing machine as defined in claim 3 wherein said corrugated strip is readily bendable in a direction parallel to the longitudinal axes of said projections and grooves and is substantially rigid normal to said longitudinal axes.

5. A sanding and polishing machine as defined in claim 1 wherein said last mentioned means comprises an elongated strip of corrugated metal extending longitudinally in the same general direction as the active run of said abrasive belt having a plurality of alternate projections and grooves, respectively, extending transversely of the longitudinal axis of said strip; said strip being bendable in a direction parallel to the longitudinal axes of said projections and grooves but substantially rigid in a direction normal thereto.

6. A caul assembly for urging an abrasive belt against a workpiece comprising: a housing; a plate secured to an upper portion of said housing; a flexible sheet supported by said housing adjacent a lower portion thereof; said sheet supporting a pad depending therefrom; means for displacing selected portions of said sheet and said pad toward any away from said plate; and strip-like means for permitting flexibility of said sheet and said pad in one direction while maintaining substantial rigidity in a direction normal to said one direction.

7. A caul assembly as defined in claim 6 wherein said last mentioned means comprises an elongated strip of corrugated material having a plurality of projections and grooves extending transversely of the longitudinal axis of said strip.

8. A caul assembly as defined in claim 7 wherein said corrugated material in dispersed between said plate and said flexible sheet.

9. A caul assembly as defined in claim 8 wherein said corrugated strip is bendable in a direction parallel to the longitudinal axes of said projections and grooves, but substantially stiff normal to said longitudinal axes.

10. A caul assembly as defined in claim 9 having a resilient means interposed between said plate and said corrugated strip for urging said corrugated strip, said sheet, and said pad away from said plate.

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