United States Patent

Sternal

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[54] **APPARATUS FOR EFFECTING SUPERIOR SANDING**

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Related U.S. Application Data

[60] Division of Ser. No. 71,546, Sept. 11, 1970, Pat. No. 3,654,738, which is a continuation-in-part of Ser. No. 860,860, Sept. 25, 1969, abandoned.

[52] **U.S. Cl.** **51/140**

[51] **Int. Cl.** **B66c 23/60**

[58] **Field of Search** ..... 51/135–147; 144/2 R, 117

[56] **References Cited**

UNITED STATES PATENTS

2,762,173 9/1956 Bootcher 51/141

FOREIGN PATENTS OR APPLICATIONS

49,730 11/1889 Germany ..... 144/2 R

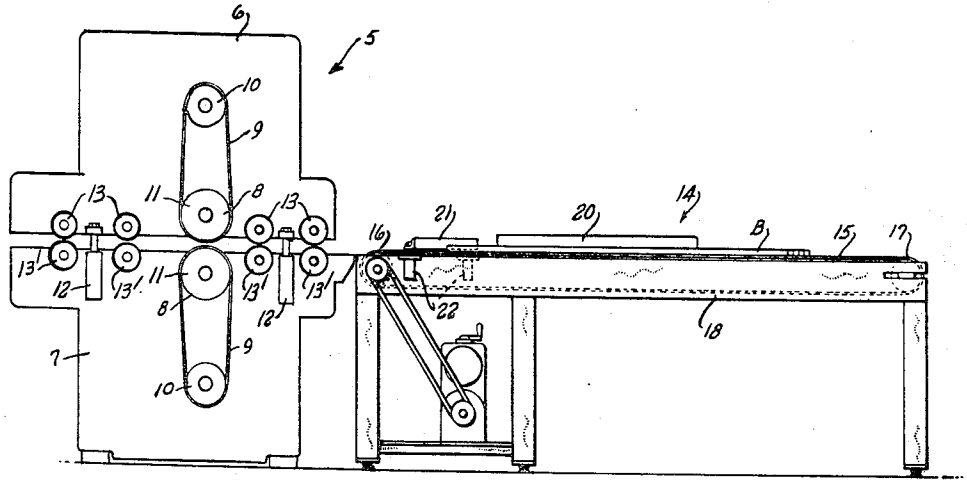
Primary Examiner—Othell M. Simpson

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[57] **ABSTRACT**

A sanding machine with complementary upper and lower sanding heads which have fast moving abrasive belts trained about and constantly shifted edgewise along superimposed contact drums between which the work is fed in a manner whereby the parallel narrow zones of work performing engagement of the abrasive belts with the opposite sides of the work extend at an oblique angle of not more than 75° to the lengthwise dimension of the work.

6 Claims, 5 Drawing Figures



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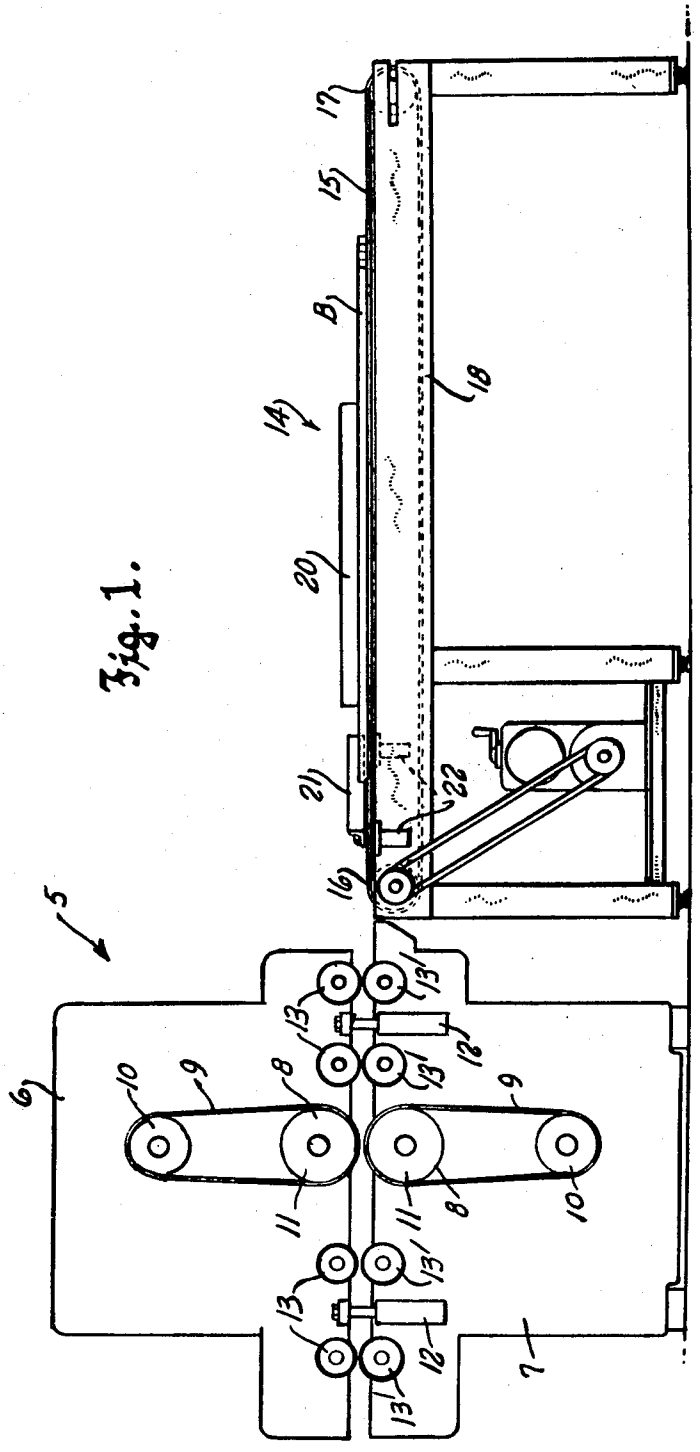
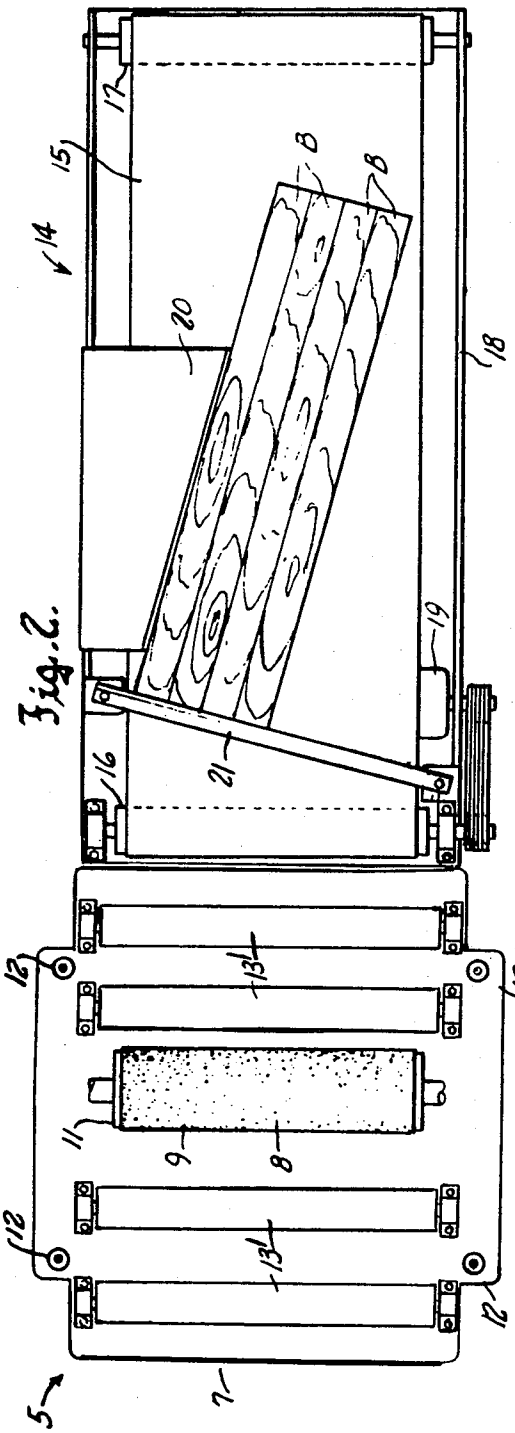


Fig. 1.


Fig. 2.
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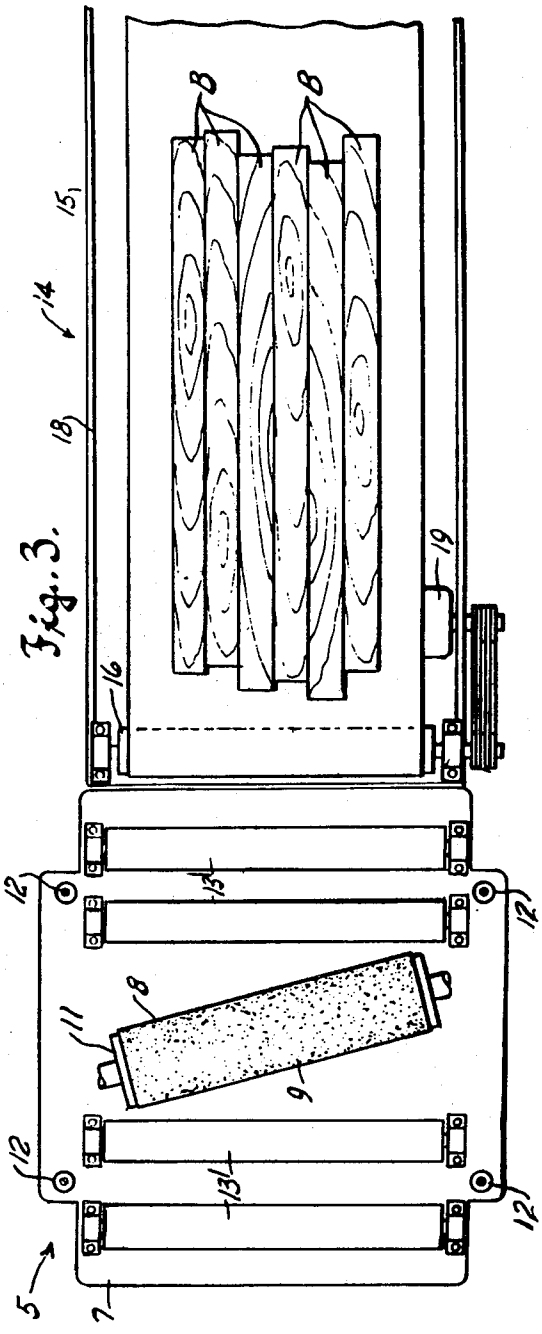

Fig. 3.
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Fig. 4.

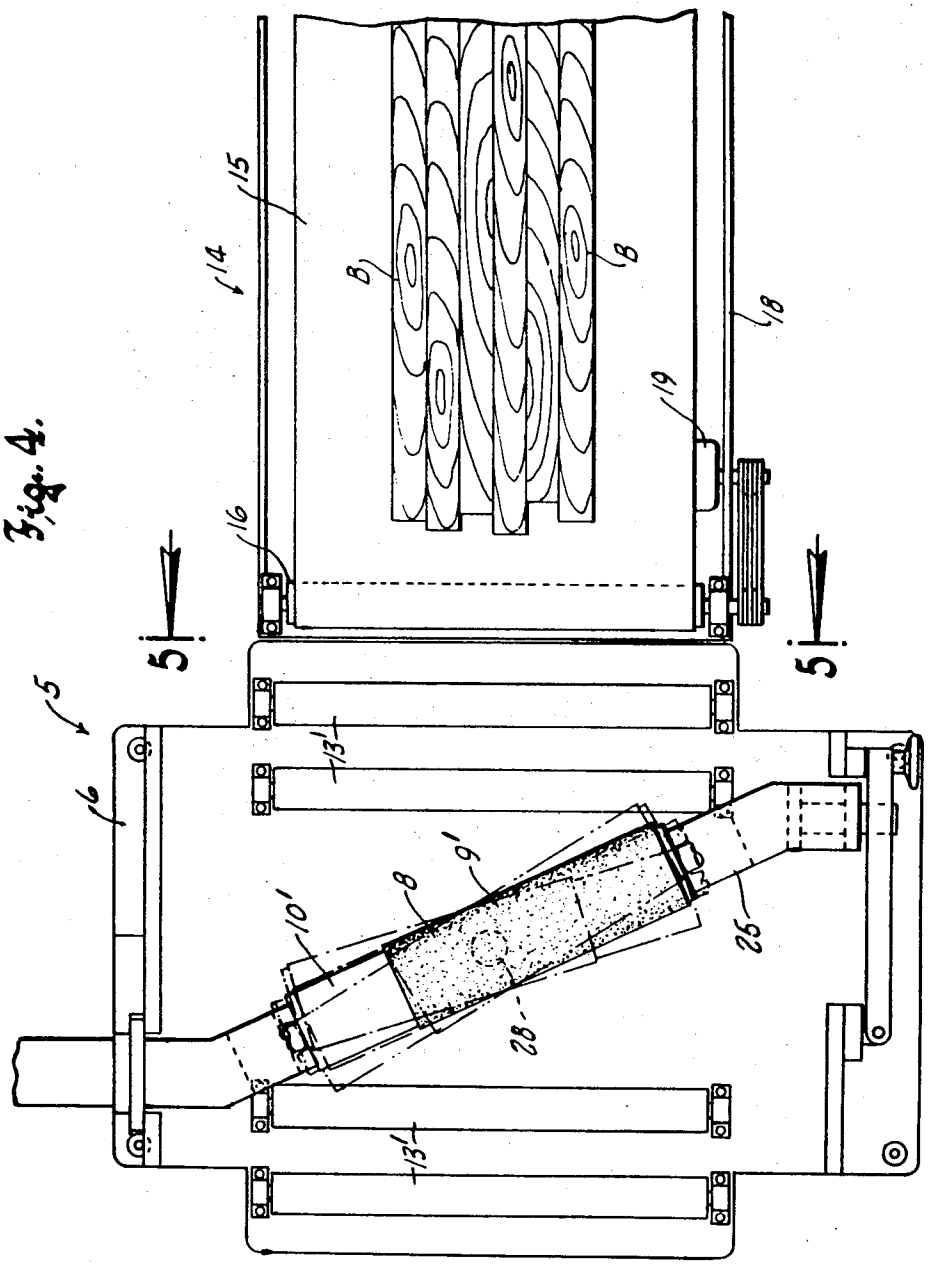
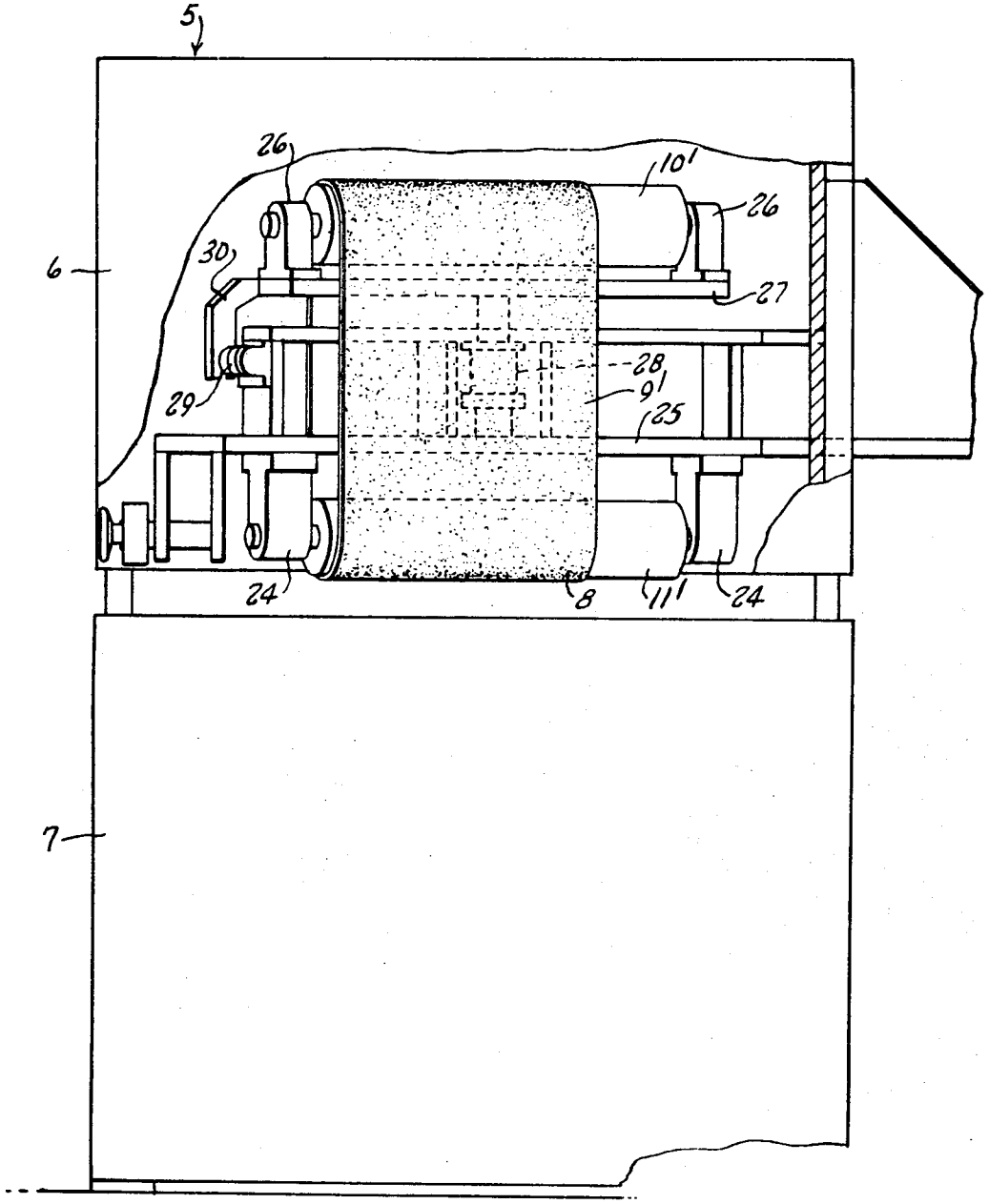


Fig. 5.



APPARATUS FOR EFFECTING SUPERIOR SANDING

The instant application is a division of the allowed copending application, Ser. No. 71,546 filed Sept. 11, 1970, now U.S. Pat. No. 3,654,738 which in turn was a continuation-in-part of the now abandoned application, Ser. No. 860,860, filed Sept. 25, 1969.

This invention relates to sanding machines, and especially to belt sanders designed to size and finish rough-sawn boards and lumber. Such machines have complementary upper and lower sanding heads between which the work is fed so that in one pass through the machine both sides of the work are sanded.

The purpose and object of the invention is to make possible the sizing of rough-sawn lumber on a belt sander at production rates far in excess of those heretofore considered feasible. Prior to this invention, no one would consider feeding lumber through a belt sander at more than 250 feet per minute. With this invention, rough-sawn lumber can be fed through the sander at 800 feet per minute, which is approximately the rate lumber is fed through a conventional rotary knife planer.

But if a planer is used for sizing lumber, considerable waste is inevitable. It is not possible to take a light cut with a planer without "burning" the knives. Hence the rough sawn stock must be cut considerably larger than the desired final dimensions to enable the lumber to be dressed to size with a planer.

A belt sander, on the other hand, can take off as light a cut as desired and, with the sanding belts now available, can also remove considerable stock in a single pass; and in each instance will produce a smoother surface than that obtained with a planer. To be specific, with the belt sander of this invention, 0.050 of an inch – 0.025 per side – is removed at 800 feet per minute.

In view of the greatly increased feed rate made possible by this invention, there is no longer any plausible reason for not sizing rough-sawn lumber with a belt sander. On the contrary, there is a most impelling reason for doing so – a better product at lower cost.

Not only has this invention achieved phenomenally increased feed rates, but it has also eliminated the objectionable characteristic of sanded surfaces known as grain relief, which consists of low and high areas in the finished surface, generally following the grain, and which was encountered when certain species of wood were processed with conventional sanding machines, an example of which is disclosed in the Nylund U.S. Pat. No. 3,269,065.

Those skilled in this art know that in belt sanders, as in drum sanders, the heavy work performing engagement between the abrasive surface and the workpiece is confined to a narrow zone which extends transversely across the path of the workpiece as it moves through the machine. Ordinarily, this narrow zone of action extends squarely across, or normal to the path along which the conveying means of the machine advances the work. Hence when boards, planks, panels or other wooden surfaced workpieces are fed through the machine in the conventional way, with the lengthwise dimension thereof parallel to the path of travel, the sanding is done "with the grain."

It has been found that when some species of wood are processed in this conventional way, at high feed rates and heavy sanding pressure in sanding machines of the type represented by the aforesaid Nylund patent, considerable grain relief resulted – that is, the surfaces had pronounced high and low areas generally following the grain of the wood. Douglas fir was especially susceptible to this objection.

While the reason for this lack of uniformity or deviation from true flatness is not fully understood, it is believed that it is caused by the compressibility of the abrasive belts. It has been observed that when these belts are new, they cut the softer grain more aggressively than the harder grain. This results in a low spot wherever the softer grain exists; but when the belt has been in use for an appreciable time and its abrasive surface becomes loaded with wood dust so that it does not cut as well, the reverse is true. Such a loaded belt has lost some of its compressibility and because it does not cut freely, it has a tendency to compress the softer areas of the wood surface being sanded. Hence when these areas are relieved of compression they relax and rise above adjacent harder grain areas.

It is realized that the theory just expressed does not comport with the contention made in the aforesaid Nylund U.S. Pat. No. 3,269,065, in which the following statement is made at column 9, lines 54–60:

> "Hard, relatively unelastic spots distributed over the faces of the panel are subjected to the major sanding action. Soft, more elastic portions are sanded with lighter pressure. Any tendency for these soft, more elastic portions to be gouged out below the plane of the hard portions, as noted in usual sanding operations, is eliminated."

Whatever the answer to this disparity in theory might be, actual tests with a simultaneous top and bottom sander similar to that of the Nylund patent, using 36 grit belts running at 6,300 sfpm and a work feed rate of 150 fpm, and loading the machine in the conventional manner with four 6 inches wide planks of Douglas fir and removing 0.025 inch per side, objectionable grain relief was encountered.

It was then discovered that the objectionable lack of surface flatness was overcome by having the boards fed through the machine with their longitudinal edges – which are generally parallel to the grain – disposed at an angle of at least fifteen degrees to the path along which they were carried to and through the machine. Apparently the resulting partially cross-grain sanding prevented what had caused the objectionable grain relief, for it was found that whether the belt was new and cutting aggressively, or loaded and compressing the softer grain, a superior and far more level surface was obtained.

If the boards were placed at an angle to the path along which they moved – which was substantially less than 15° – the results were far from satisfactory. This demonstrated that the slight angle to which the sanding head is displaced from true squareness in the second station of the Nylund patent is of no consequence in eliminating the objection which gave rise to the discovery upon which the present invention is predicated.

In the aforesaid parent application, Ser. No. 860,860, it was stated that "Increasing the angle produces some slight improvement, but not enough to warrant going far beyond the indicated fifteen

degrees." It has now been discovered that, if that angle is substantially greater than fifteen degrees and the sanding belts are continuously shifted back and forth along the contact drums for a total edgewise travel of as much as 6 inches at a frequency of 20 to 30 times per minute, not only is the objectionable grain relief eliminated, but the heretofore unheard of feed rate of 800 feet per minute becomes standard operating procedure.

Moreover, from experience with a prototype machine built in accordance with this invention, it was found that the sanding belts did not require cleaning nearly as often as heretofore and that the useful life of the belts was significantly extended. To illustrate, prior to this invention it was customary to clean the abrasive belts at least every eight hours while the belts that were run on the prototype machine built to test the improved version of this invention did not require cleaning oftener than every 16 hours, and that after 40 hours of use, the belts were still good.

With these observations and objectives in mind, the manner in which the invention achieves its purpose will be appreciated from the following description and the accompanying drawings, which exemplify the invention, it being understood that such changes in the specific apparatus disclosed herein may be made as come within the scope of the appended claims.

The accompanying drawings illustrate several complete examples of the embodiments of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

FIG. 1 is a combination side view and vertical section through a sanding machine and its work feeding conveyor, more or less diagrammatically illustrated and equipped with one embodiment of the invention;

FIG. 2 is a top view of the machine shown in FIG. 1;

FIG. 3 is a view similar to FIG. 2, but illustrating another way of carrying this invention into effect;

FIG. 4 is a view very similar to FIG. 3, but depicting the improved version of this invention; and

FIG. 5 is a vertical sectional view through the machine, substantially on the plane of the line 5—5 in FIG. 4, but showing only the upper half of the machine.

Referring to the drawings, and considering first that embodiment of the invention illustrated in FIGS. 1 and 2, the numeral 5 designates generally a sanding machine of the type disclosed in the aforesaid Nylund patent, and which comprises an upper unit 6 and a lower unit 7. Each unit has a sanding head 8 which includes an endless abrasive belt 9 trained about at least two rolls 10 and 11, the latter being a contact drum in that it holds the abrasive belt against the workpiece fed through the machine. One of the rolls, preferably the contact drum is power driven to cause the belt to travel at high speed and repeatedly bring the entire length of the belt into sanding engagement with the work. The belt travels at a speed of over 6,000 surface feet per minute (6,000 sfpm) and in the direction opposite the direction in which the work moves through the machine.

The contact drums of the two sanding heads are directly one above the other with their axes parallel, and since the sanding heads are fixed with respect to their respective units 6 and 7, and the support the contact drums give the belt running over them is unyielding, the distance between the superimposed units 6 and 7 determines the amount removed from each side of the workpieces passed through the machine and between the complementary upper and lower sanding heads.

Hydraulic rams 12 adjustably support the upper unit 6 from the lower unit 7 and enable adjustment of the machine to different sized stock; and also provide for the adjustment of the depth of the cut to be made by each sanding head.

To feed the work through the machine, cooperating sets of power driven upper and lower feed rollers 13, 13' are provided. These rollers usually have rubber treads and may be spring loaded to have and maintain good tractive engagement with the workpieces they feed through the machine. All of these feed rollers move the work along the same straight path normal or perpendicular to the axes of the contact drums and midway between their adjacent surfaces. Hence the narrow zones of work performing engagement between the abrasive belts and the opposite sides of the workpieces moving through the machine are at right angles to or directly crosswise of the path along which the workpieces are conveyed.

The workpieces are fed into the machine by a conveyor 14 which may comprise an endless belt 15 trained over horizontally spaced rolls 16, 17 that are journalled in bearings mounted on a frame 18. The frame is of such height that the upper stretch of the conveyor belt is level with the entrance into the sanding machine, and the adjacent roll 16 is driven through a variable speed drive unit 19 so that workpieces placed upon the conveyor belt will be advanced into the machine at a speed commensurate with the desired feed rate of the machine — for instance, 150 fpm in the embodiment of the invention shown in FIGS. 1 and 2.

Suitably fixed to the frame 17 and disposed above the upper stretch of the conveyor belt is a guide fence 20. This fence is at an angle of 15° to the path of the conveyor belt and workpieces placed thereon. Thus when the workpieces — as, for instance, the four boards B shown in FIG. 2 — are placed on the conveyor belt and collectively pressed against the fence, they will be properly oriented for passage through the machine.

A gate 21 extends across the conveyor belt near its delivery end to restrain the workpieces placed on the belt until they are properly positioned as determined by the guide fence; and then the gate is lifted, as by hydraulic or pneumatic cylinders 22. In this manner, all of the boards B will move into the machine at the correct angle of 15° to the path of their travel, so that when they pass between the sanding belts the narrow zones of work performing engagement between the belts and the opposite sides of the boards will be oblique to the longitudinal edges of the boards by an angle of 75°, with the result that the sanding will be partially cross grain.

The same result is obtained, if – as in FIG. 3 – the sanding heads, and especially the contact drums thereof, are displaced 15° from their conventional positions. In this case the guide fence is of course omitted and the workpieces are fed straight through the machine with the grain parallel to the path of the conveyor.

As will be readily appreciated, in the two embodiments of the invention illustrated in FIGS. 1 and 2 and 3, the conveyor means by which the workpieces are fed to and through the machine consists of the feed rollers 13, 13', and the conveyor 14; and while the greatest advantage of the invention no doubt rests with sanding machines of the type described, wherein both sides of the workpieces are simultaneously sanded, the invention will also improve the results obtained with the more conventional sanding machines in which only one side is sanded.

In the improved version of the invention illustrated in FIGS. 4 and 5, the machine is essentially the same as the one shown in FIG. 3. Accordingly, it has upper and lower sanding units each of which comprises superimposed rolls with an abrasive belt 9' trained thereover. In each case, one of the superimposed rolls is the contact drum 11', and the other the idler roll 10'. Since FIG. 4 is a top view of the machine, only the idler roll 10' of the upper sanding unit is visible, but in FIG. 5 both rolls are shown.

As seen in FIG. 5, which illustrates only the upper sanding unit and, for clarity, omits some structural details, the contact drum 11' is journaled in bearings 24 fixedly suspended from the underside of a beam 25 that is a rigid part of the frame of the machine. The idler roll 10' is journaled in bearings 26 on a yoke 27 that is mounted on the beam 25 for limited up and down belt-tensioning adjustment, and for oscillation about a vertical axis that intersects the axes of the contact drum and the idler roll medially of the ends thereof.

Belt tensioning adjustment of the yoke 27 is effected conventionally by means of a pneumatic cylinder 28 that is coaxial with the axis about which the yoke and the idler roll oscillate.

Oscillation is imparted to the yoke 27 by a motor 29 that produces constant reciprocation. Preferably, the motor 29 is a pneumatic cylinder fixed to the beam 25, with its piston connected to an arm 30 that extends downwardly from the yoke. The angle through which the idler roll is oscillated (indicated in dotted lines in FIG. 4) extends far enough to either side of parallelism with the contact drum to cause the sanding belt to shift or travel edgewise along the contact drum a substantial distance. Experience has shown that a total edgewise travel of at least 6 inches produces good results, and that the frequency of the oscillations should be between 20 and 30 per minute.

Control of the motor 29 to effect reversal thereof can be accomplished in any desired way, as for instance in the manner it is done in U.S. Pat. No. 3,118,314, where the oscillation of the idler roll was employed primarily to control tracking of the belt.

Although the width of the sanding belt is a matter of choice and limited only by factors that control the overall size of the machine, a belt width of at least 18 inches is desirable which, of course, means that the contact drum and idler roll must be at least 25 or 26 inches long. The distance the belt is shifted back and forth along the contact drum bears a relationship to the width of the belt and should be approximately one-third that dimension.

The grit size of the abrasive belt is also a matter of choice, but for sizing rough-sawn lumber that has been cut to dimensions slightly more than .050 of an inch greater than the desired size, a grit size between 24 and 60 produces good results.

As in the embodiment of the invention shown in FIG. 3, the contact drums 11' extend obliquely across the path of the lumber or other work passed through the machine, but – as noted hereinbefore – the degree of obliqueness is greater in the improved version of the invention. For best results, the angle at which the contact drums are disposed should be at least 20° less than the 90° of conventional sanding machines. A greater divergence from squareness is even better, but design considerations make it impracticable to exceed an angle of thirty degrees. Below twenty degrees, the results obtained are noticeably inferior – but still acceptable at the 15° identified in the aforesaid now abandoned parent application. Hence, the angle at which the contact drums are set should be between 15° and 30° less than squareness with the path of the work, and preferably at least twenty degrees. This means that the narrow zone of work performing engagement between the abrasive belts and the top and bottom of the lumber or other work moving through the machine, extends obliquely across its path at an angle of between 60° and 75°, and preferably not more than 70°.

For the contact drums to extend obliquely across the path of the work, the beams 25 and also the idler rolls 10' must be similarly disposed.

Obviously, of course, for the lumber or other work to be fed through the machine at the high rate of 800 feet per minute, the feed rolls of the machine must grip the same tightly and feed the work with a force that exceeds the opposing force exerted upon the lumber or other work by the oppositely travelling abrasive belts.

Those skilled in the art will also appreciate that the invention can be embodied in forms other than as herein disclosed for purposes of illustration.

The invention is defined by the following claims.

I claim:

1. A belt type sanding machine wherein a rotating contact drum presses an endless abrasive belt against a surface of elongated workpieces fed substantially lengthwise through the machine so that the work performing engagement between the belt and said surface of the workpieces takes place along a narrow zone parallel with the drum axis and extending transversely across each workpiece, said machine being characterized by:

A. conveyor means for feeding workpieces to and through the machine; and

B. means for effecting such relative disposition of the abrasive belt and the workpieces that the narrow zone of work performing engagement between the abrasive belt and said surface of the workpieces extends obliquely across each elongated workpiece at an angle of not more than substantially 75°.

2. The sanding machine of claim 1, wherein the conveyor means feeds the workpieces along a path at right angles to the contact drum axis,

and wherein said means for effecting said relative disposition of the abrasive belt and the workpieces comprises a guide fence associated with the conveyor means and against which the workpieces are placed preparatory to being fed into the machine.

3. The sanding machine of claim 1, wherein the oblique disposition of the narrow zone of work performing engagement between the abrasive belt and the workpieces is obtained by having the axis of the contact

drum set at said oblique angle to the path along which the conveyor means feeds the workpieces.

4. A belt type sanding machine for sizing and finishing workpieces, said machine having upper and lower sanding heads each of which has an endless abrasive belt traveling at high speed and a contact drum over which the abrasive belt is trained and by which the belt is held against the adjacent surface of workpieces fed through the machine, said heads being so positioned relative to one another that the axes of their contact drums are parallel and spaced apart a distance determined by the desired finished thickness of the workpieces being handled, so that rough sawn boards and lumber generally will be sized and have the opposite sides thereof finished in one pass through the machine, said machine being characterized by:

A. conveyor means for feeding work to and through the machine along a straight path at right angles to the parallel axes of the contact drums; and

B. guide means at the entrance to the machine, with which the workpieces are engaged preparatory to their entry into the machine and by which such workpieces are positioned with their longitudinal side edges displaced substantially not less than 15° from the straight path along which they are fed to and through the machine by the conveyor means.

5. The sanding machine of claim 4, further characterized by:

A. gate means adjacent to the entrance into the machine to hold back workpieces placed on the conveyor means; and

B. means for quickly moving said gate means to an inoperative position allowing workpieces on the conveyor means to advance to the machine.

6. The sanding machine of claim 4, wherein the conveyor means includes an endless conveyor belt in front of the entrance to the machine,

wherein said guide means comprises a fence above the top stretch of the conveyor belt, mounted in fixed position at an angle of not less than fifteen degrees to the conveyor belt,

said machine being further characterized by:

a gate across the conveyor belt to hold one or more boards placed on the conveyor belt from being advanced thereby to the sanding heads of the machine until the gate is opened,

so that a number of boards can be arranged in side-by-side abutting relationship on the conveyor belt with one of them against the fence,

and means for opening the gate to release all of the boards for movement by the conveyor belt.

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