

[54] SAW GUIDES

[72] Inventors: **Louis R. Fairfield, Jr.**, Longview;
Raymond A. Van Vliet, Mossyrock, both
of Wash.; **Thomas A. McLauchlan**, Van-
couver, British Columbia, Canada

[73] Assignee: **Weyerhaeuser Company**, Tacoma, Wash.

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Related U.S. Application Data

[63] Continuation of Ser. No. 725,566, April 12, 1968,
abandoned, Continuation-in-part of Ser. No. 695,740,
Jan. 4, 1968, abandoned.

[52] U.S. Cl. **143/160 R**, 83/201.15, 143/157 C,
143/158, 143/164, 308/3 A

[51] Int. Cl. **B27b 5/28**

[58] Field of Search 143/160 R, 160 H, 157 C, 157 F,
143/158, 164; 83/201.15; 308/3 A

[56] References Cited

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Primary Examiner—Andrew R. Juhasz

Assistant Examiner—James F. Coan

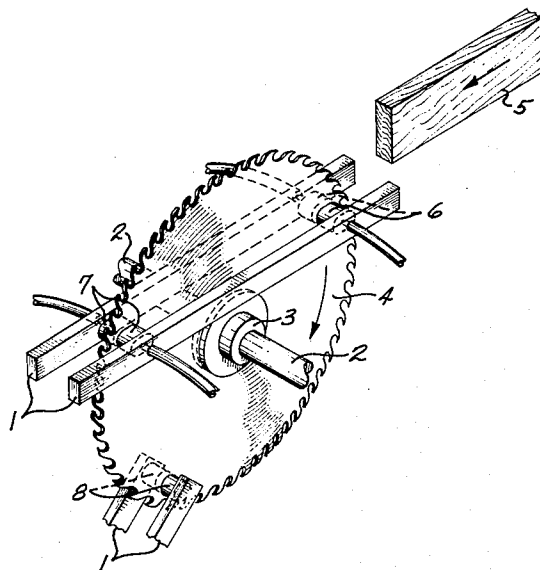
Attorney—Leslie G. Noller, John M. Crawford and Kenneth
W. Vernon

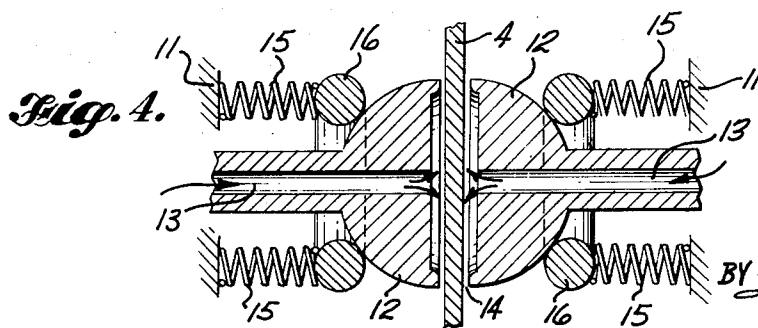
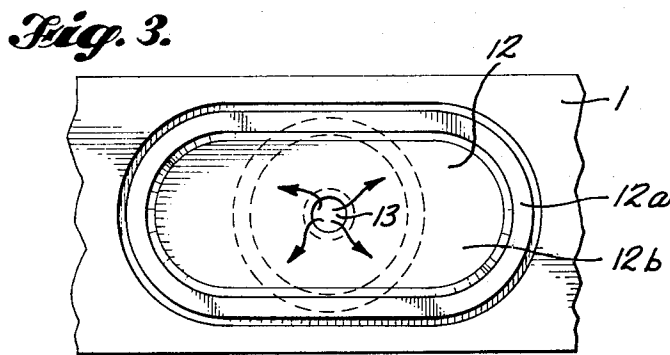
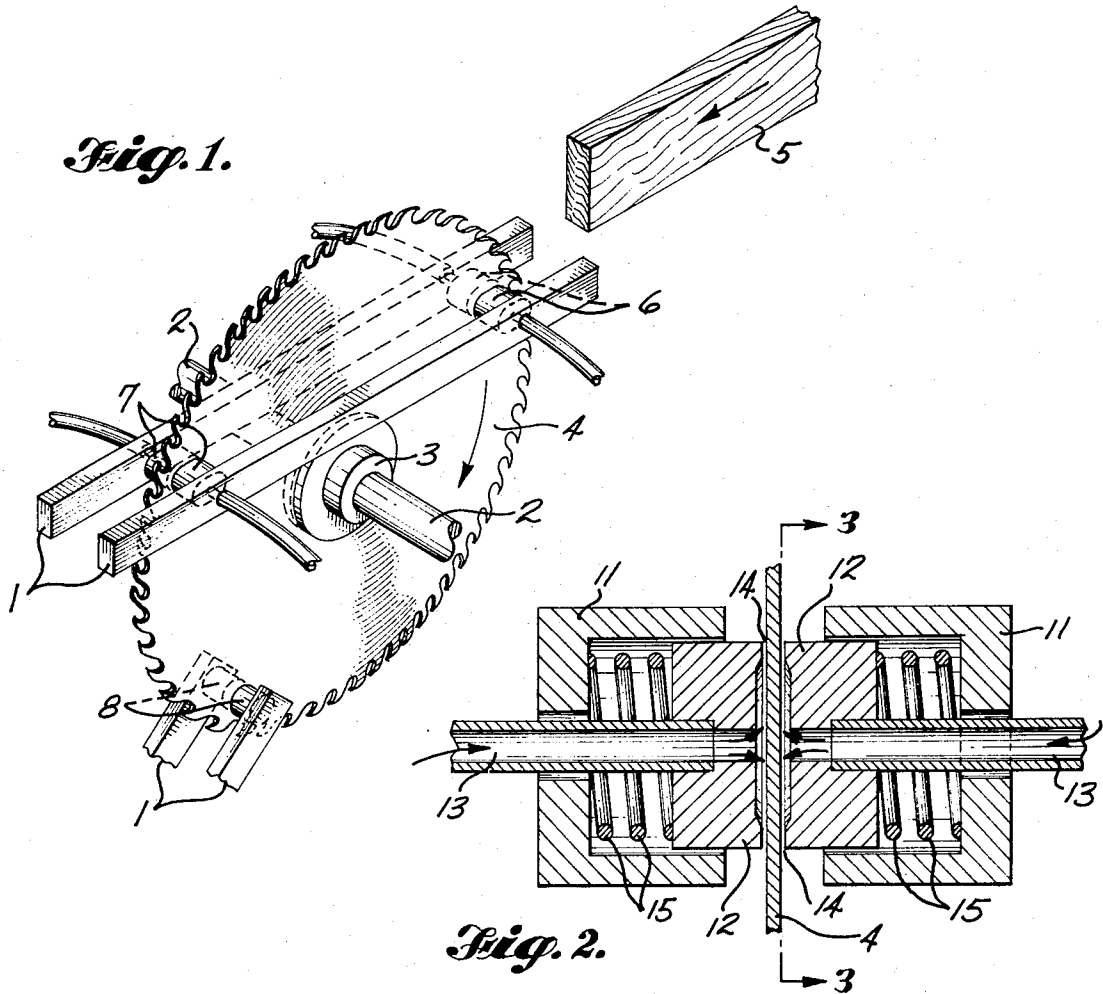
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ABSTRACT

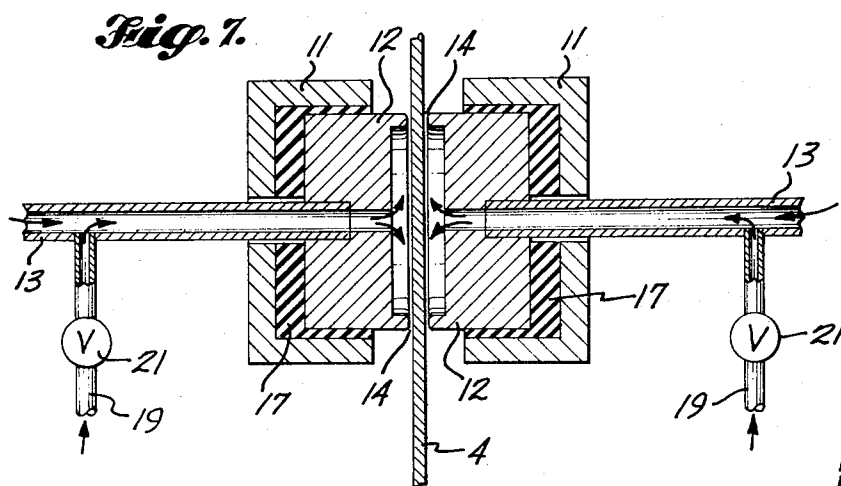
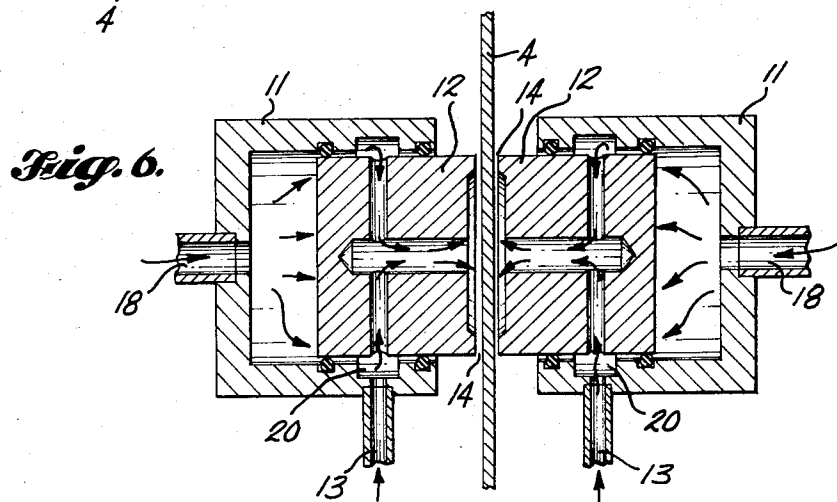
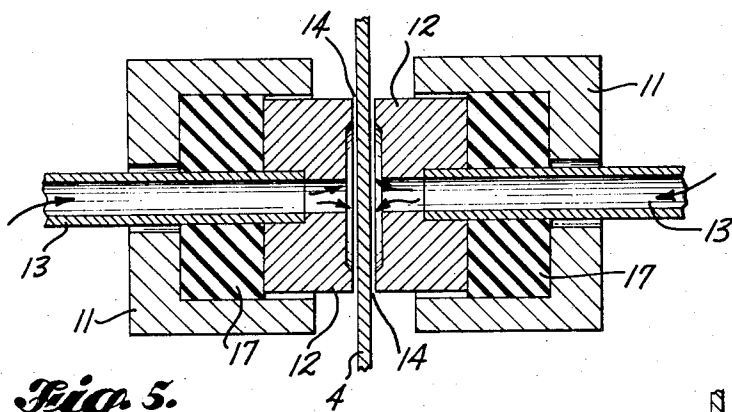
A method and apparatus for guiding a saw blade wherein the saw guides comprise opposed bearing shoes located on opposite sides of the saw blade, at least one of the bearing shoes urged toward each other and against the saw blade by an external force such as a compressed spring. Compressed air, water, water-air mixture or other fluid is supplied to the interior recesses of each of the bearing shoes and acts to form a fluid bearing surface at the bearing shoe-saw blade interface. The external force exerted on the bearing shoes is transmitted to the saw blade through the fluid medium with substantially no contact of the saw blade with the bearing shoes.

20 Claims, 10 Drawing Figures





INVENTORS
 LOUIS R. FAIRFIELD JR.
 RAYMOND A. VAN VLEIT
 THOMAS A. MCLAUCHLAN
 BY *Robert H. Mullen & Co.*
 ATTORNEYS



INVENTORS
 LOUIS R. FAIRFIELD JR.
 RAYMOND A. VAN VLEIT
 THOMAS A. McLAUCHLAN
 BY *Leslie B. Haller & Kenneth St. Vernon*
 ATTORNEYS

Fig. 8.

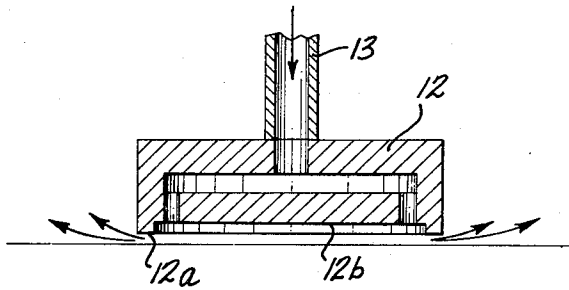
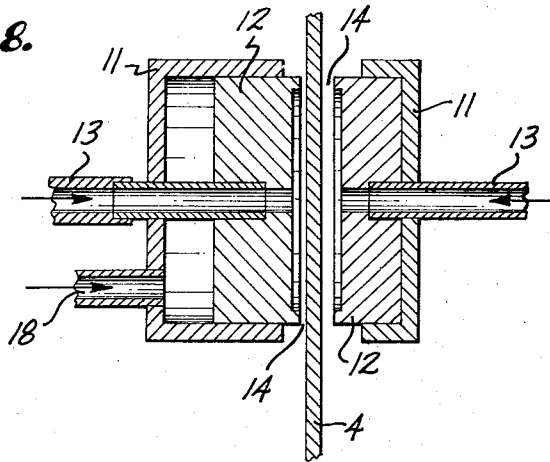


Fig. 9.

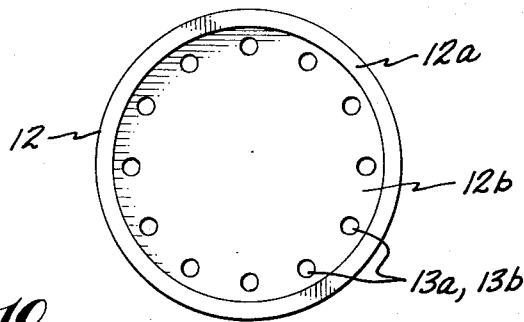


Fig. 10.

INVENTORS
LOUIS R. FAIRFIELD JR.
RAYMOND A. VAN VLEIT
THOMAS A. McLAUCHLAN

BY *Leslie E. Moller &*
Fennell H. Vernon
ATTORNEYS

SAW GUIDES

CROSS REFERENCE TO RELATED APPLICATION

This is a continuation of Ser. No. 725,566, filed Apr. 12, 1968, now abandoned, and which was a continuation-in-part of Ser. No. 695,740, filed Jan. 4, 1968, also now abandoned.

BACKGROUND OF THE INVENTION

85 percent, percent of

1. Field of the Invention

This invention relates to an improved method and apparatus for guiding saw blades, the improvement in the guides resulting in improved cutting accuracy, improved surface finish, reduction of kerf, and minimum guide maintenance.

2. Prior Art Relating to the Invention

Band and circular type power saws require a means of guiding the saw blade so that they will cut a straight path. A conventional method of guiding circular saws has been simple, solid blocks, usually lignum vitae, placed on opposite sides of the saw blade. Continuous contact of these guides with the saw blade cannot be maintained because of frictional heating; thus the blade can only be guided for short periods of time. In addition, guides of this type do not stabilize or damp vibration of the saw blade.

Air under pressure has been used to align and guide saw blades. Such a guide system is disclosed, for example, in U.S. Pat. No. 3,225,801. The precision dimensional and surface tolerances required for this type of gas bearing makes it impractical for saw guide application. In addition, such a gas bearing requires a great deal of air or other fluid delivered under relatively high pressure with the guiding force being effective only over a relatively narrow area.

SUMMARY OF THE INVENTION

This invention relates to an improved method and apparatus for guiding saw, whether circular, band, or gang. The guiding means comprises a pair of opposed guide shoes through which the saw blade travels. An external force is exerted on one or both of the guide shoes by compressed springs or other equivalent means. A fluid medium, such as compressed air, water or water-air mixture is introduced under pressure to an interior recess of each of the guide shoes, the fluid escaping along the bearing shoe rim and acting to support the guide shoes on a thin fluid film out of contact with the saw blade. The fluid film, however, transmits the guiding force exerted on the guide shoes to the saw blade.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a circular saw showing one method of placement of the improved guides of this invention.

FIG. 2 is a cross section of the improved guide of this invention wherein the external force exerted on the bearing shoe is provided by compressed springs.

FIG. 3 is a view of section 3—3 of the guide of FIG. 2 showing the face of the bearing shoe.

FIG. 4 is a cross section of an alternate guide using compressed springs as the external force means.

FIG. 5 is a cross section of the improved guide wherein the external force exerted on the bearing shoes is provided by a resilient material.

FIG. 6 is a cross section of the improved guide wherein the external guide force exerted on the bearing shoes is pneumatic.

FIG. 7 is a cross section of the improved guide system of this invention illustrating a means of introducing a liquid solvent or lubricating fluid with a gaseous fluid to the interior recesses of the bearing shoes.

FIG. 8 is a cross section of the improved guide system wherein one of the bearing shoes is fixed.

FIG. 9 is a cross-section of an alternate bearing shoe providing entry of compressed air or other fluid to the peripheral portions of the bearing shoe.

FIG. 10 is a front elevation of the face of the bearing shoe of FIG. 9.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. 2 to 8 illustrate various configurations of the saw guide system of this invention. The basic components of the saw guides include a bearing frame, bearing shoes, means to exert a force on the bearing shoes to urge one or both of them into contact with the saw blade, and a conduit for supplying fluid, either liquid or gaseous, to the interior recesses of the bearing shoes. In FIGS. 2 to 9, reference numeral 11 refers to the bearing frame onto which bearing shoes 12 are mounted. Fluid is supplied to the interior recesses of bearing shoes 12 by conduits 13. An external force is exerted on one or both of the bearing shoes 12 by compressed springs 15 as shown in FIGS. 2 and 3, pneumatic or hydraulic means as shown in FIGS. 6 and 8, or by a resilient, elastomeric material 17 as shown in FIGS. 5 and 7. The external force exerted on the bearing shoe or shoes urges them into contact with saw blade 4 passing between the two opposed bearing shoes 12. By balancing the loading force on bearing shoes 12 with the static pressure in the plenum 12b of each of the bearing pads, a clearance 14 between saw blade 4 and bearing rim 12a can be established.

The shape of the bearing shoes does not appear to be of critical significance. They may be rectangular with rounded ends as shown in FIG. 3 or circular as shown in FIGS. 4 and 9. A recessed plenum area 12b is necessary for proper bearing operation. Bearing lift is largely dependent on the fluid pressure and the bearing area. Stability is greatly improved by using a recessed plenum to obtain more uniform pressure distribution. Plenum depth is not critical; however, it should be at least 0.001 inch and preferably ranges from one-sixteenth to one-eighth inch. The bearing shoe may be of any suitable material having a low coefficient of friction, such as bronze-filled polytetrafluorethylene, polytetrafluorethylene, brass, nylon, or wood.

As mentioned previously, the external force applied to the bearing shoe may be by compressed springs, pneumatic means, hydraulic means, or resilient, elastomeric material, such as sponge rubber. Control of the saw blade 4 is accomplished by locating the bearing shoes on opposite sides of the saw blade as shown in FIGS. 1 to 9. Referring specifically to the individual drawings, FIG. 2 shows a guide system with the external force exerted on bearing shoes 12 located on opposite sides of saw blade 4 by springs 15. In FIG. 4 springs 15 exert a guiding force against bearing shoes 12 through O-ring 16. In FIGS. 5 and 7, the external force is provided by elastomeric material 17. In FIGS. 6 and 8 the external force exerted against bearing shoes 12 is provided by compressed air, water or other hydraulic fluid entering chamber 22 through conduit 18.

FIG. 8 shows a bearing system wherein one of the bearing shoes is fixed, with the other urged against the saw blade by fluid pressure. When using this system the total force behind the movable guide shoe must be reduced sufficiently to allow the bearing pad to lift from the saw blade. The use of a fixed bearing shoe is advantageous in providing a saw location reference.

Fluid pressure introduced to the interior plenum of the bearing shoes exerts a force against the ground plane of the saw blade causing the bearing shoes to lift out of contact with the saw blade leaving a gap or bearing shoe-saw blade interface 14. The balance between the external force exerted on the bearing shoe and the static fluid pressure in the plenum of the bearing determines the clearance at the saw blade-bearing rim interface 14. Referring to FIG. 6, utilizing a pneumatic or hydraulic external force, fluid pressure is introduced into plenum chamber 12b of bearing block 12 through conduit 13. Bearing shoe 12 of FIG. 6 has a channel cut around its periphery and inlets channeled from the periphery to the interior to allow passage of the fluid to the interior of the plenum chamber 12b of the bearing surface. Seals 20 are located as shown to prevent loss of pressure.

The most common fluid which can be used is, of course, compressed air; however, other gases can be used equally as well, such as carbon dioxide, nitrogen, argon, helium, etc. Liquids, such as water and other lubricating fluids, can also be used. The fluid pressure can be regulated to adjust the clearance at the interface 14. The guide configurations shown have a maximum efficiency of from 75 to 85 percent, that is, the load or external force that can be supported is 75 to 85 percent of the product of the fluid pressure entering plenum 12b of the bearing shoe and the surface area of the shoe. A regulated line pressure of about 50 psi and a bearing surface area of 2 sq. in., for example, will support about 75 lbs. at a height of 0.001. Enough fluid pressure should be used to permit a clearance at the saw blade-bearing shoe interface 14 to permit passage of surface irregularities in the saw plate. The external force applied to the bearing pads is transmitted to the saw blade through the fluid film at the bearing rim-saw blade interface 14. The fluid, however, does not contribute to the basic guide function.

In FIGS. 2 to 8 the fluid is introduced into the center of the bearing plenum chamber 12b. Fluid can be introduced around the periphery of the plenum chamber of the bearing shoe as shown by FIGS. 9 and 10 utilizing jets 13a. The peripheral jet bearing shoe must also include a plenum chamber 12b. If a flat surface bearing shoe were used having peripheral jets, it would require that each jet be supplied by an individually regulated source, thus making the use of flat surface bearing shoes impractical for saw guide application.

Additional advantages can be obtained by using a gas-liquid mixture for injection into the plenum chamber 12b of bearing shoe 12. The liquid is preferably a lubricant and may be water, soluble oils, kerosene, ethylene glycol, etc. The lubricating fluid has the effect of filling irregularities in the moving saw plate, thus eliminating a source of vibration. Bearing stability is also increased because of the increased static pressure in the presence of an incompressible fluid. Increased pressures can also be used.

A liquid accelerated through the constriction 14 between bearing rim 12a and the surface of the saw blade penetrates the boundary air layer at the saw blade surface, forming a thin liquid film on the saw blade surface not affected by forces created by the moving saw blade. Neither is this liquid film affected by passage of the saw blade through the cutting area during normal cutting conditions. The liquid film remains on the saw blade even while passing under a subsequent bearing or solid block in contact with the saw blade forming a very effective lubricant. Only very small quantities of liquid are needed to form this liquid film. Amounts as low as one-half gallon-hour have sufficed on a 30 foot saw plate; however, normal usage would be somewhat larger, for example 2-3 gallons-hour.

In this regard reference is made to FIG. 1 wherein a pair of opposed force transmitting solid blocks 8 are used in conjunction with bearing shoes 6 and 7. These are preferably constructed from a low coefficient of friction material such as lignum vitae, bronze or a fluorocarbon polymer. It should be noted that the solid guide blocks need not be present in opposed pairs. A single block acting against one side of the blade only is frequently very effective. In some saw constructions it may be desirable to locate more than one solid pressure guide.

Experience using water or other solvents applied through the bearing shoes has indicated no surface wear of the solid bearing block after 8 hours of continuous operation, even with the bearing blocks under a constant load of 50 to 100 psi. A coefficient of friction of about 0.015 was measured between the bearing blocks of the type shown in the drawings and the saw blade using a liquid applied along with compressed air to the plenum chambers of the bearing shoes. Attempts made to supply a similar liquid film on the moving saw blade by spray mist, water jets, or flooding, failed to provide a lubricating surface such as achieved by injection of the liquid into the plenum of the bearing shoe. These attempts failed as they were not able to penetrate and remove the moving layer of air present on the surface of the rapidly moving saw blade.

One method of introducing liquid into a gaseous stream supplied to the bearing shoes is shown in FIG. 7 wherein a liquid is introduced through conduit 19 directly into the moving gaseous stream entering through conduit 13. Valves 21 are used to regulate the amount of liquid introduced. The liquid must be injected into the gaseous stream before entering the bearing pad.

The saw guides described are applicable to any saw type or thickness. Saw thicknesses ranging from 0.058 to 0.200 feet have been used.

Guides made according to this invention can be located on the saw plate where most advantageous. Multiple guides can also be used. In FIG. 1 a circular saw blade 4 having a collar 3 and rotating about axle 2 passes between three bearing guides 6 and 7, and solid guides 8 held in place by frame 1 as shown. Circular saws are guided most effectively with the guide located ahead of the cut. When using thin kerf saws location of the guides below the cut is not as effective in preventing saw deviation or sniping.

The following examples illustrate the improvement attained in use of a saw guide system as described.

EXAMPLE I

A guide system as shown in FIG. 1 was set up using a saw blade 30 inches in diameter, 0.095 inches in thickness and having 60 teeth each 0.125 inches in width. The speed of the saw was approximately 9,600' per minute. Two guides, supplied with compressed air or air-water mixture were located on the saw blade as shown by reference numerals 6 and 7 of FIG. 1. Lumber could be fed through the saw at a 4 inches depth at up to 700' per minute maximum with complete control. Line accuracy was 0.007 inches at the 95 percent confidence level. The lumber described had excellent finish.

Without the guides in place, loss of control was experienced at 400' per min. with the best line accuracy at approximately 150' per min. and ± 0.050 inches line accuracy at the 95 percent confidence level. The surface finish was affected by vibration of the saw blade.

EXAMPLE II

Four inch lumber was sawed using a circular saw blade 0.072 inches and 30 inches in diameter and having 60 teeth 0.092 inches wide. The speed of the saw was approximately 9,600' per min. Lumber was fed into the saw at approximately 250' per min. Three guides, supplied with compressed air or air-water mixture, were located as shown in FIG. 1 by reference numeral 6, 7, and 8. The reference numerals 6 and 7 denote the bearing guides while the reference numeral 8 denotes solid pressure guide blocks. Water injected through bearing guides 6 and 7 along with the compressed air formed a lubricating film on the surface of the saw blade such that little or no wear of solid blocks 8 in pressure contact with the saw surface occurred. Satisfactory performance was achieved for both 2 inch and 4 inch lumber.

Without the guides the saw was completely unstable while running free and could not be used for sawing operations.

What is claimed is:

1. Guide means for a saw blade comprising

- a. a pair of opposed bearing shoes having substantially coextensive opposing faces, the faces of the bearing shoes having a circumferential rim and a recessed interior portion,
- b. means to continuously apply an external guiding force to at least one of the bearing shoes so as to continuously urge it toward the other bearing shoe and against the side of a saw blade passing between, and
- c. means directing fluid to the interior recesses of each of the bearing shoes under sufficient pressure to provide a fluid bearing surface at the bearing shoe-saw blade interface for transmitting said guiding force from said bearing shoe to said side of said saw while establishing a clearance between said shoe rim and said saw.

2. Guide means according to claim 1 wherein the external force is provided by a compressed spring.

3. Guide means according to claim 1 wherein the external force is provided by pneumatic means.

4. Guide means according to claim 1 wherein the external force is provided by a resilient, elastomeric material.

5. Guide means according to claim 1 wherein one of the bearing shoes is fixed and immovable.

6. Guide means according to claim 1 wherein the bearing pad is composed of a material having a low coefficient of friction.

7. Guide means according to claim 1 including compressed air supply means in communication with said fluid directing means.

8. Guide means according to claim 1 including a liquid supply means in communication with said fluid directing means.

9. In a sawing machine having an endless saw blade which travels through the work zone of the machine the combination comprising

- a. a rigid support member,
- b. a pair of opposed bearing shoes mounted on the supporting member adjacent the point at which the saw blade enters the work performing zone, the bearing shoes having substantially coextensive opposing faces, the faces having a circumferential rim and a recessed interior portion,
- c. means to continuously apply an external guiding force from said support member to at least one of the bearing shoes to continuously urge it toward the other and against the saw blade, and
- d. means directing a fluid to the interior recesses of each of the bearing shoes under sufficient pressure to provide a fluid bearing surface at the bearing shoe-saw blade interface for transmitting said guiding force from said bearing shoes to said saw blade while establishing a clearance between said rim and said saw blade.

10. In a sawing machine having an endless saw blade which travels through the work zone of the machine the combination comprising

- a. a rigid support member,
- b. a pair of opposed bearing shoes mounted on the supporting member adjacent the point at which the saw blade enters the work performing zone, the bearing shoes having substantially coextensive opposing faces, the faces having a circumferential rim and a recessed interior portion.
- c. means to continuously apply an external guiding force from said support member to at least one of the bearing shoes to continuously urge it toward the other and against the saw blade,
- d. means directing a fluid to the interior recesses of each of the bearing shoes under sufficient pressure to provide a fluid bearing surface at the bearing shoe-saw blade interface for transmitting said guiding force from said bearing shoes to said saw blade while establishing a clearance between said rim and said saw blade, and
- e. a second rigid support member and at least one force transmitting bearing block mounted on the supporting

member adjacent to the saw blade, the bearing block mounted so as to contact the saw blade.

11. The sawing machine of claim 9 wherein the fluid is gaseous.

12. The sawing machine of claim 9 wherein the fluid is liquid.

13. The sawing machine of claim 9 wherein the fluid is a gas-liquid mixture.

14. A method of guiding a saw blade through a work performing zone comprising

- a. providing a resilient guiding force against opposite sides of a saw blade by exertion of continuous external pressure on bearing shoes whose faces are in contact with the saw blade,
- b. introducing a fluid under pressure into a cavity in each of the opposed bearing shoes in contact with the saw blade, the fluid escaping from the guide shoe recesses along the bearing shoe-saw blade interfaces, and
- c. regulating the fluid pressure at the bearing shoe-saw blade interfaces to substantially support the bearing shoes on a thin fluid film providing both a fluid bearing surface and a medium to transmit the guiding force exerted on the bearing shoes to the saw blade.

15. The method according to claim 14 wherein the fluid is a gas.

16. The method according to claim 14 wherein the fluid is a liquid.

17. The method according to claim 14 wherein the fluid is a gas-liquid mixture introduced into the bearing pad recesses, the liquid acting to lubricate and cool the saw blade.

18. The method according to claim 17 wherein the liquid is water.

19. The method according to claim 17 wherein the liquid is a solvent for removing pitch and other residues from the surfaces of the saw blade.

20. The method of guiding a saw blade through a work performing zone comprising

- a. providing a resilient guiding force against opposite sides of a saw blade by exertion of continuous external pressure on bearing shoes whose faces are in contact with the saw blade,
- b. introducing a fluid under pressure into a cavity in each of the opposed bearing shoes in contact with the saw blade, the fluid escaping from the guide shoe recesses along the bearing shoe-saw blade interfaces, said fluid is a gas-liquid mixture introduced into the bearing pad recesses, the liquid acting to lubricate and cool the saw blade,
- (c) regulating the fluid pressure at the bearing shoe-saw blade interfaces to substantially support the bearing shoes on a thin fluid film providing both a fluid bearing surface and a medium to transmit the guiding forces exerted on the bearing shoes to the saw blade, and
- d. providing an additional guiding force against the saw blade by means of at least one force transmitting bearing block in pressure contact with the saw blade.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,674,065 Dated July 4, 1972

Inventor(s) LOUIS R. FAIRFIELD, JR. ET AL

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In column 1, line 8, "85 percent, percent" should be deleted.

in column 1, line 9, "of" should be deleted;

in column 1, line 38, "saw," should read --saws,--;

in column 2, line 39, "show" should read --shoe--;

in column 3, line 13, "0.001." should read --0.001 inch.--;

in column 3, line 50, "gallon-hour" should read --gallon/hour--;

and "foot" should read --inch--;

in column 3, line 52, "lons-hour" should read --lons/hour--;

in column 4, line 9, "feet" should read --inches--.

Signed and sealed this 9th day of January 1973.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents