

March 15, 1966

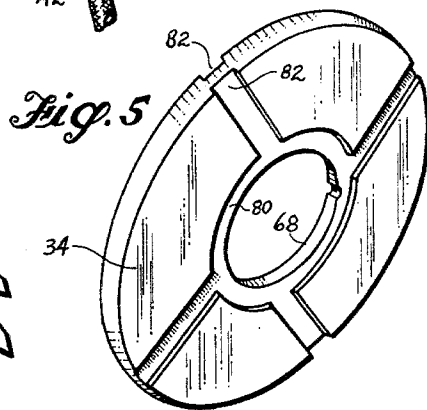
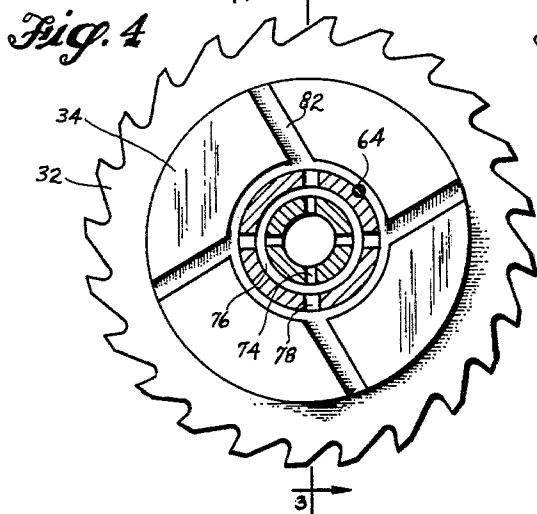
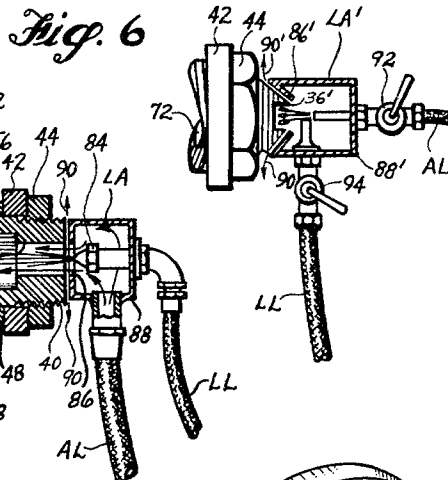
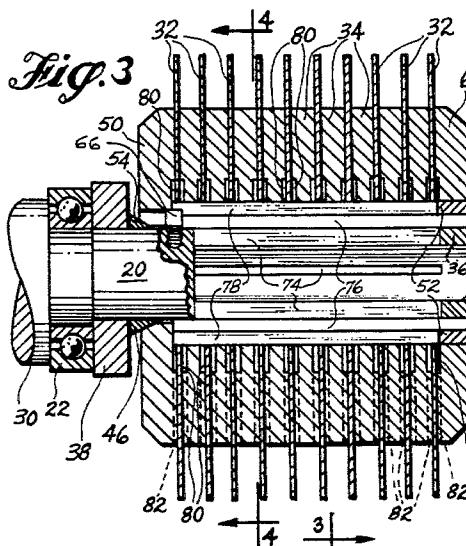
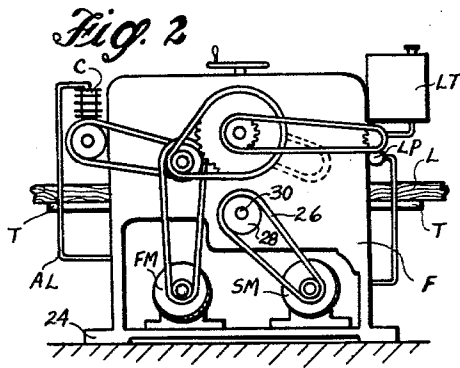
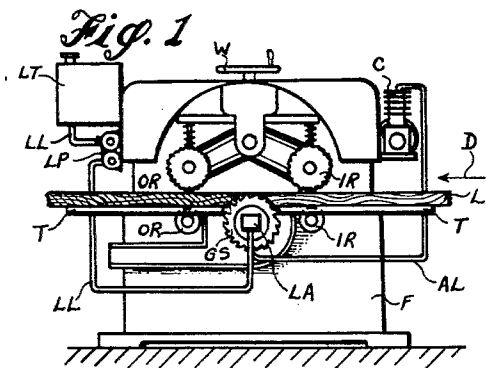
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MIST LUBRICATED RIPSAWING METHOD AND MECHANISMS

Original Filed July 27, 1961

3 Sheets-Sheet 1

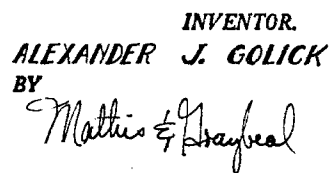


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## MIST LUBRICATED RIPSAWING METHOD AND MECHANISMS

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Original application July 27, 1961, Ser. No. 127,220, now  
Patent No. 3,156,274, dated Nov. 10, 1964. Divided  
and this application Aug. 5, 1964, Ser. No. 387,650  
5 Claims. (Cl. 143—158)

This application is a division of my application Serial  
No. 127,220, entitled Mist Lubricated Ripsawing Method  
and Mechanisms, filed July 27, 1961, and now issued as  
U.S. Patent No. 3,156,274, granted November 10, 1964.

The present invention relates to a method of and saw-  
ing machines for the sawing of wood and like materials,  
and relates more particularly to improvements for self-  
lubricating high speed sawing machines such as gang rip-  
saw machines for simultaneously cutting a piece of lum-  
ber into a multiple of strips or slats, for example.

It is the principal object of the present invention to  
provide practical and highly efficient machines embody-  
ing certain novel operating techniques and details and  
features of construction whereby cutting efficiency is im-  
proved by virtue of substantially uniform delivery of  
atomized lubricant to all saw blades, whereby continuous  
operation of the machines can be maintained for long  
periods without shutdown for cleaning or saw replace-  
ment, whereby accuracy in cutting is improved, whereby  
the kerf loss is reduced to a minimum, and whereby  
smoother cuts are made.

In its broader aspects the present invention provides  
a basically new method of saw cutting wood and like  
material while lubricating, cooling and self-cleaning the  
saw blade surfaces by continuously directing thereon  
an atomized mist of lubricant generated in the locale of  
the saw assembly, to be in heat conductive relation there-  
with so that the cooling effect incident to the lubricant  
atomization absorbs thermal energy from the saw. This  
method of sawing constitutes an innovation in that thin,  
smooth kerfs with considerable saving (up to 20%) of  
material is effected, and in that smoother cuts, higher  
production, more prolonged equipment operation without  
shutdown, and fundamental improvements in saw design  
and versatility are thereby realized.

More specifically stated, certain objects and advan-  
tages of the present invention reside in its utilization of  
a saw assembly having atomized lubricant delivery means  
specifically configured to substantially uniformly distrib-  
ute atomized lubricant to all surfaces of the saws, and  
also in the provision of means delivering atomized  
lubricant to the saw mandrel without aspiration of am-  
bient air into the lubricant delivery passageways of the  
mandrel, thereby obviating the problem of the lubricant  
delivery being clogged by ambient sawdust or the like.

A further object of the present invention is to provide  
for the cleaning, cooling and lubricating of saw blades  
by feeding a pressurized and atomized lubricant thereto  
through passageways in the saw spacing disks, which  
passageways are in direct, radial communication with an  
axial bore in the assembly mounting mandrel through  
slots or the like substantially as long as the gang saw  
ensemble.

The present invention departs from conventional types  
of saws in general use through out the wood working  
industry, whereby relatively heavy gang saw blades of  
disk form are mounted on a driven shaft or mandrel  
underneath the working bed or table surface of the ma-  
chine, and wherein the disk type blades are of such diam-  
eter as to enable them to protrude through slots in the  
heavy bed, plus the distance required to completely  
penetrate the thickness of material being ripped or sawn.

For light finishing of millwork (dried lumber), blades of  
twelve or sixteen inches in diameter and of twelve or  
fourteen gage or heavier, are standard at the present time.  
In green lumber mills, larger diameters and much heavier  
gages are generally employed.

In addition to the heavy gages commonly used, the  
amount of material lost to the saw kerf is substantially  
increased by the set of the saw blades to provide the side  
clearance necessary to prevent binding of the blade and  
the resultant over-heating and burning. The combina-  
tion of heavy gage and set in the blades accounts for  
the excessive kerf.

The heavy saw gages in present day machines are  
necessary to provide adequate stability and thermal con-  
ductivity under heavy loads and high rim speeds. In  
general, the gage of the blade employed is somewhat  
proportional to its diameter. Under some circumstances  
the gage of the blade material has been reduced at the  
kerf by grinding, thus combining stability with minimum  
kerf.

In contrast to the heavy gage gang saws commonly  
now employed, the present invention provides saws cut-  
ting very thin kerfs at high rotational speeds, and pro-  
vides for long blade life and efficient ripping by virtue of  
means lubricating, cooling and cleaning all saw surfaces  
substantially uniformly by application thereto of lubricant  
in the form of atomized mist. More specifically, the  
present invention provides in conjunction with thin disk  
saws for cutting lumber, lubrication means whereby a  
lubricant is atomized at the saw assembly to augment  
the cooling effect by virtue of such atomization of the  
lubricant, and is continuously delivered to all kerf form-  
ing surfaces of the saws, the feeding and lubricant deliv-  
ery arrangement being such that a positive or super-  
atmospheric pressure is maintained, insuring delivery of  
atomized lubricant to all saw surfaces and further insur-  
ing that there is no aspiration of ambient air and en-  
trained sawdust or the like into the lubricant delivery  
passageways of the saw assembly. Moreover, it is a  
further advantageous and characteristic feature of the  
method of sawing wood and ganged sawing assemblies  
of the present invention that such provide atomization of  
the lubricating and cooling medium, as distinguished from  
use of lubricant delivery in entirely liquid phase, or  
lubricant delivery in essentially entirely gaseous phase,  
i.e., as a vapor or as an essentially vaporized medium. It  
is another feature and advantage of the gang saw lubricat-  
ing technique characteristic of the invention that such pro-  
vides atomized lubricant delivery substantially uniformly  
to all saw surfaces, irrespective of the inherent "pump-  
ing" action occurring as a result of the centrifugal action  
generated by the high speed of saw rotation.

Another and related advantage of the technique is that  
the increased velocity of flow of lubricant resulting from  
such pumping action, and from the atomization of the  
lubricant at the saw assembly, both effectively and ma-  
terially contribute to the self-cooling action. Atomiza-  
tion of the lubricant at the saw assembly provides that  
the entire saw assembly is more efficiently self-cooling, as  
compared with the case if lubricant were applied to the  
saw surfaces in liquid phase, for the reason that atomiza-  
tion has a cooling effect on the lubricant (by reason of  
the adiabatic expansion of the lubricant) and since  
atomization occurs at the saw assembly the full cooling  
potential of the thus cooled lubricant is realized at the  
saw assembly.

These and other objects, features, advantages and char-  
acteristics of the present invention will be apparent from  
the following description of certain typical and therefore  
non-limitive forms thereof, taken together with the ac-  
companying drawings, wherein like numerals refer to  
like parts, and wherein:

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FIG. 1 is a side view of a gang rip saw machine embodying certain improvements of the present invention and comprising a multiple saw assembly with means providing atomized lubrication of the saws;

FIG. 2 is an elevational view of the machine of FIG. 1, showing the side thereof opposite that shown in FIG. 1.

FIG. 3 is an enlarged sectional view of the gang saw assembly of FIG. 1, taken in the longitudinal axial plane of the unit as applied to and secured on its mounting and driving mandrel, i.e. substantially along line 3—3 of FIG. 4;

FIG. 4 is a view in lateral cross-section, taken substantially along line 4—4 of FIG. 3;

FIG. 5 is a perspective view of one of the spacer disks used between the disk saws of the unit;

FIG. 6 is a fragmentary view of a modified form of lubricant atomizing mechanism, showing a typical variation thereof from the form incorporated in the assembly illustrated in FIG. 3;

FIG. 7 is an enlarged fragmentary view of one of the gang saws and lumber supporting table, showing in more detail the manner of gang ripping involved, and the arrangement of lubricant delivering orifices in the saw assembly;

FIG. 8 is an end view which illustrates disk-like strip spacers mounted on the out-feed rolls;

FIG. 9 is a side view which illustrates an additional improvement wherein the out-feed rolls are of greater diameter than the in-feed rolls;

FIG. 10 is an end view partially in section, which illustrates in enlarged detail a precision aligning mechanism for a modified arrangement having upper and lower saw units;

FIG. 11 is an end view illustrating a further modification of the gang saw assembly, wherein the assembly includes heavy gage "hogging" blades outboard of a gang of thin blades;

FIG. 12 is a side view illustrating a portion of a modified saw blade having larger and fewer teeth than normally employed;

FIG. 13 is a view in longitudinal axial cross section, with certain parts shown in elevation, illustrating a modified form of lubricated gang saw assembly characteristic of the invention, wherein the atomized lubricant is delivered to a rotating manifold at the end of the saw mandrel, and the lubricant channelling is arranged entirely externally of the saw mandrel;

FIG. 14 is an end view of the saw assembly shown in FIG. 13, taken substantially along line 14—14 thereof;

FIG. 15 is a view similar to the views of FIGS. 3 and 13, showing yet another modification of lubricated gang saw assembly according to the present invention, the assembly in this instance being adapted to conversion of existing equipments, the conventional mandrel of which is foreshortened to accommodate the conversion cartridge; and

FIG. 16 is another view taken cross sectionally through the longitudinal axis of a gang saw assembly characteristic of another modified form of the invention, wherein the assembly mounts on an end-journalled mandrel and provides delivery of the atomized lubricant through a non-rotating mandrel ring and through communication passageways arranged entirely externally of the saw mandrel.

Considering the form of the invention illustrated at FIGS. 1—5, the rip saw machine there shown comprises a frame F supporting a horizontal feed table T across which the lumber pieces L or the like being ripped are fed in the direction indicated at D by means of respective upper and lower pairs of infeed rolls IR and outfeed rolls OR.

The upper feed rolls IR and OR are power driven from feed motor FM and are adjustable vertically by action of handwheel W in a manner conventional per se. Feed motor FM also drives a compressor C, as shown in FIG.

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2, forming a part of the self-lubricating mechanism of the invention, as more fully discussed below. Also, FIGS. 1 and 2 show a suitable physical location of lubricant supply tank LT and the lubricant pump LP, which is also suitably driven by feed motor FM, as by a chain drive from the feed roll drive spindle (again note FIG. 2).

Located between the two sets of feed rolls IR and OR is the gang saw assembly GS characteristic of the invention, which gang saw assembly GS is suitably rotatively driven at high speed by a separate saw motor SM. As shown in FIG. 1, a lubricant atomizer LA is positioned at the end of the gang saw assembly GS. Said lubricant atomizer LA suitably receives compressed air from compressor C through air line AL and pressurized lubricant through lubricant lines LL via lubricant pump LP.

As shown in more detail in the view of FIG. 3, the saw assembly GS is mounted on and driven by a mandrel or spindle 20 revolving in suitable supporting bearings mounted in frame structure F and designated at 22. As indicated, noting FIG. 2, said spindle 20 is driven by saw motor SM mounted on bedplate 24 of the frame structure F, said motor SM having a belt connection 26 to a pulley 28 on the mandrel shaft 30.

The makeup of the gang saw assembly GS as shown in FIG. 3, comprises a succession of alternately arranged disk saws 32 and spacers 34 centered on a tubular mandrel end 36, ten such disk saws 32 being shown by way of example. Said tubular mandrel end 36 has a projecting, annular abutment flange 38 at one end of the saw assembly GS, herein designated the "inner end." At its other end, the tubular mandrel end 36 is threaded, as at 40, to receive a spacer clamping washer 42 and nut 44.

At the ends of the saw assembly, tubular mandrel end 36 accommodates inner and outer conically tapered collars 46 and 48. Collar 46 seats against mandrel flange 38, and collar 48 seats against washer 42 at the outer end of the tubular mandrel end 36, and a tubular hub member 52 provided with inner and outer counterbore surfaces 54 and 56 is retained between said collars 46, 48 in spaced, concentric relation to tubular mandrel portion 36, the inner end flange 50 of the saw assembly GS being preferably an integral portion of said tubular hub member 52. As shown in FIG. 3, inside saw 32 flatly engages said inner end flange 50. The outer end of said tubular hub member 52 is threaded as at 58 and the saw assembly is completed by an outer flange ring or clamping disk 60 and securing nut 62. All of the saws 32 and spacers 34 are keyed to tubular hub member 52 and end flanges 50, 60 by a key rod 64 (FIG. 4) and said tubular hub member 52 is in turn keyed to the mandrel 20 by a key screw 66 (FIG. 3).

All disk saws 32 of the assembly GS are of the same diameter, and are characterized by being unusually thin with teeth having very little set, or even with no set in some instances. Each saw disk 32 has a center hole receiving the tubular hub member 52 in a close fit. Likewise, each spacer 34 has a center hole 68 closely fitting hub member 52.

An important feature of the present invention resides in the fact that spacers 34 as applied between saw disk 32 are of a diameter leaving only the peripheral portions of the saws 32 exposed. This feature, in conjunction with the delivery of atomized lubricant to the saw surfaces through the spacers 34, and as discussed more specifically below, enables the saws 32 to be made considerably thinner than ordinarily, and the set of the teeth of saws 32 to be considerably reduced, as compared with the conventional set of rip saws. For example, in a machine for ripping  $\frac{3}{4}$ " stock, the blades are 6" in diameter and .035" in thickness, and the set of the teeth is only .005" on each side, resulting in a formed kerf of only approximately  $\frac{3}{16}$ ". As will be apparent, the thickness of the spacers 34 determines the width of the strips or slats cut. With the spacers 34 easily interchangeable, it

will also be understood that adaptation of the assembly to any desired strip or slat thickness can be readily effected.

Substantially uniform delivery of atomized lubricant to all saw surfaces of the saw assembly GS is also a fundamental feature of the present invention. As will be understood, effective and continuing lubrication of all saw surfaces facilitates the kerf cutting action by providing lubrication between the saw blade and the wood, facilitates use of thin saws with small blade set by continually cooling of the saws, and further facilitates commercial usage of the saws for long periods without shut-down in that the saws and lubricant delivery passageways are self-cleaning and the manner of lubricant delivery prevents the lubricant passageways from being clogged by ambient sawdust or the like.

To provide atomized lubricant delivery, with incident self-cooling and self-cleaning characteristics, the form of saw assembly GS' illustrated at FIGS. 1-5 has the tubular mandrel end 36 axially bored at its outer end, as at 70, which outer end bore is in direct, axial communication with an enlarged bore chamber 72 which in turn is provided with a series of long, radially extending slots 74 (four being shown by way of example), of a length to be substantially the width in the saw assembly of the width of the gang of saws 32, or nearly so. Said slots 74 in turn communicate with an annular hub chamber 76 provided in the interspace between the outside of tubular mandrel end 36 and the interior bore of tubular hub member 52. Said hub chamber 76, as will be noted in FIG. 3, entirely surrounds mandrel end 36 and particularly slots 74 therein, and is provided with a plurality of radially extending hub slots 78 (four being shown by way of example), in radial alignment with mandrel slots 74 and of a length to be substantially the width of the gang of saws 32. Said hub slots 78 in turn are in direct communication with angular spacer manifold chambers 80 provided in both sides of spacers 34 and in the saw engaging spaces of end flange 38 and flange ring 60.

Leading from said annular spacer manifold chambers 80 are a plurality (four being shown by way of example) of swept-back spacer and end flange slots 82 with their inner ends in radial alignment with hub slots 78 (FIG. 4) and with their outer ends emerging near the blades of the saws 32 and directly on the surfaces of said saws 32. With respect to said spacer and end flange slots 82, it has been found that the disposition thereof so as to be swept-back an angle of about 20-45° from radial augments the delivery of atomized lubricant, in view of the comparatively small cross-section of these passageways in relation to their length, and in view of the relatively high speed of rotation of the assembly GS. As will be apparent, the optimum swept-back angle of said spacer slots 82 is to a degree proportionately correlated to the speed of rotation of the saw assembly GS.

Delivery of atomized lubricant into the saw assembly, and particularly mandrel end bore 70, is accomplished in the form of the invention shown at FIGS. 1-5 by a lubricant atomizer indicated generally at LA. More specifically, said lubricant atomizer LA receives pressurized lubricant from line LL and pressurized air from air line AL, and provides by lubricant atomizing nozzle 84 and an envelope of pressurized air emerging from orifice 86 of air chamber 88 an air-mixed atomized spray of the lubricant into axial bores 70 and 72. Lubricant atomizer assembly LA is non-rotatively positioned by suitable means (not shown) contiguous to the outer end of mandrel 20. One problem with respect to any arrangement for delivering lubricant from a non-rotative source to a mandrel rotating at high speed is that normally any gapping between the non-rotative and rotative elements will engender an aspiration of ambient air and entrained sawdust or the like into the lubricant delivery passageways, with consequent clogging of the passageways in a rela-

tively short time. This problem is obviated by the disposition and arrangement of lubricant atomizer LA shown at FIG. 3 because of the pressurized air envelope surrounding the injected atomized lubricant. A portion of the air envelope emerging from orifice 86 of the lubricant atomizer LA bleeds out of the gap between the contiguous faces of the lubricant atomizer LA and the mandrel 20, as indicated by the arrows designated 90, and positively prevents any aspiration of ambient air and dust into the saw assembly passageways.

To summarize the arrangement of lubricant delivering passageways in the saw assembly GS, and to point out the important features thereof in terms of delivering atomized lubricant substantially uniformly to all surfaces of saws 32, it will be seen that the sequence of passageways involves mandrel end bore 70, enlarged mandrel bore chamber 72, mandrel slots 74, hub chamber 76, hub slots 78, annular spacer chambers 80, and spacer and end flange slots 82. The sequence and relative volumes of these passageways importantly contribute to the uniformity of lubricant delivery to all of the saws 32. In sequence, end bore 70 is followed by a relatively large mandrel bore chamber 72, then relatively small mandrel slots 74, then relatively large hub chamber 76, then relatively small hub slots 78, then relatively large annular chambers 80, then relatively small slots 82. There is thus a series of small, then large, then small, then large, then small, then large, then small passageways which tend to minimize velocity of flow effects and, in a manner which can be analogized to baffling in an automobile muffler, the relative pressure of the atomized lubricant emerging from the various spacer and end flange slots 82 is substantially uniform across the entire width of the saw assembly GS.

FIG. 6 shows a modified form of lubricant atomizer LA'. In this form of atomizer, the outer end 36' is conically tapered, the associated saw assembly GS being in all other respects the same as shown at FIG. 3. In the atomizer LA', pressurized air is delivered from line AL through a manually controllable valve 92 and the lubricant is suitably delivered from lubricant line LL through manually controllable valve 94, the lubricant atomization occurring by right angle related nozzles in a manner conventional per se in certain forms of liquid spraying devices. In this form of atomization, atomization occurs by the high velocity air flow across the lubricant nozzle, and the characteristic isolation of the lubricant atomization is accomplished by arranging the spacing between the atomizer air orifice 86' and the conical end 36' of the mandrel to be in a non-obstructed line of flow from atomizing chamber 88', the pressurization of air therein in part causing an outflow of air in the spacing between said orifice 86' and mandrel end 36', as indicated by the arrows designated 90'. As will be apparent, the lubricant delivery through line LL and valve 94 can be from any suitable source, such as simply by a gravitational feed.

FIGS. 7-12 serve to illustrate several further modifications and additional elements, which may be used individually or in combination, as design variation in the practice of the present invention.

In FIG. 7, a modified form is shown embodying respective infeed and outfeed fingers 100 and 102 which are formed as integral parts of the horizontal table T to extend between the disk saws 32 and overlie the spacers 34. The purpose of the fingers 100 and 102 is to support the thin strips of slats which have been cut by the saws 32 from lumber L moving in the direction indicated at D. The fingers 100 and 102 prevent the dragging of the cut material between the saws 34 and are advantageous where the cut strips or slats are quite thin.

In FIG. 8, there is illustrated a modified construction of the outfeed rolls, designated OR'. Spacers 104 are provided on the rolls, to fit between the strips or slats being cut from lumber L as such strips or slats feed past

the saw assembly. As will be appreciated, the purpose of said spacers 104 is to maintain the cut strips or slats in proper alignment and spacing, the guiding function thus effected being desirable and sometimes even necessary when the strips or slats are relatively quite thin.

In FIG. 9, there is illustrated a further modification as to the infeed and outfeed roll arrangement, wherein the outfeed rolls OR'' are of substantially larger diameter than the diameter of the infeed rolls IR. When said infeed rolls IR and outfeed rolls OR'' are revolved at the same speed, the increased diameter of the outfeed rolls OR'' results in a greater peripheral speed thereof than the peripheral speed of the infeed rolls IR, thereby providing a constant tension on the strips or slats being cut to prevent buckling thereof.

FIG. 10 illustrates suitable mechanism for aligning the saw assembly GS with respect to the table T and for aligning upper and lower saw assemblies, when such assemblies are used as a vertically arranged pair. The alignment mechanism shown at FIG. 10 is mounted on the frame structure F and comprises a post or bracket 106 mounted in fixed position on said frame. The bracket 106 is formed with a vertical slot 108 for slidably mounting a bracket 110 which extends in a horizontal position at right angles to the bracket 106. The bracket 110 also is formed with a slot as at 112. Mounted in and depending from the bracket 110 is a movable spindle supporting bracket 114 mounting bearings 116 therein supporting the spindle 20. Bracket 110 is vertically adjustable in the post 106 by means of the adjusting screw 118 which is rotatably secured at one end of said bracket 106. The screw 118 is threaded downwardly through the flange portion 120 of the bracket 106. Another screw adjustment means 122 is similarly provided for lateral adjustment of the bracket 114 in relationship to the bracket 110.

In FIG. 11, there is illustrated a modification of a saw assembly wherein "hogging" blades 130 are provided on both sides of the assembly of relatively thin saws 32. These relatively thick hogging blades 130 serve the purpose of simultaneously cutting a substantially thicker or heavier portion of excess wood on the side edges of the lumber L from which the slats or strips are being formed. Hogging blades 130 of different thicknesses can be used so as to assure a uniformity of thickness of all slats or strips produced. It will be appreciated that there can often be substantial differences in the width of the wood from which the slats are formed, i.e. the lumber stock is of varying width as presented to the saw assembly. The hogging blades 130 make it possible to compensate for these deviations.

In FIG. 12, there is illustrated a modified saw blade 32' which is formed with larger teeth 132 and greater spacing 134 between the teeth. In conventional saw practice, the peripheral speed of the blade is limited by the tendency of the blades to burn at high speed due to greater friction and the limited ability of the teeth to dissipate the heat produced. Higher rim speeds produce smoother cuts, although with conventional systems, substantial flutter and distortion may also be encountered. With the spaces 34 and the improved atomized lubrication, self-cleaning and self-cooling features of the saw assembly characteristic of the present invention, these problems are largely eliminated and higher rim speeds, i.e., higher efficiency both in speed and quality of cut, are attainable. For example, while conventional practice is to operate rip saws at rim speeds in the range of up to 12,000 feet per minute, the present invention makes possible and practical rim speeds of up to 20,000 feet or more per minute, and use thereof for prolonged periods. With the higher rim speeds thus enabled, it is now possible to obtain smooth, accurate cuts with saw 32' composed of fewer, larger teeth 132 and with substantially greater spacing 134 between the teeth. This reduces the power

requirements and the cost of the blades and maintenance problems. The larger teeth 132 also improve the heat dissipation from the tips of the teeth 132 because of the greater mass of the tooth material to conduct the heat. The power requirements and smoothness of the cut are governed by the spacing, as at 134, the peripheral speed, and the rate of feed of material through the saws 32'. Further, the coolant action extends blade life considerably by reducing heating and wear at tips of teeth. So-called "hard" alloys and hard chrome plating of the saw blades are also rendered more practical and further magnify this advantage. The highly efficient, cooling action provided by the invention also makes practical the use in many instances of the so-called hollow ground saws having teeth with no set.

FIGS. 13 and 14 serve to illustrate yet another form of saw assembly GS' characteristic of the invention, wherein is employed a solid mandrel 20' with atomized lubricant passageways arranged entirely exteriorly thereof. In this form of saw assembly, the saws 32 and spacers 34 are assembled on a tubular hub member 140 having an outwardly arranged, integral end flange 142 and an inwardly arranged threaded end receiving flange ring 144 and assembly nut 146. In a manner like the form of saw assembly GS shown at FIG. 3, saw assembly GS' has the hub member 140 thereof centered on mandrel 20' by means of collar 46 lying against mandrel flange 38, and collar 48 engaged by washer 42, which is in turn held in position by assembly nut 44.

In the form of saw assembly GS' shown at FIGS. 13 and 14, the outer end flange 142 of the tubular hub member 140 is provided with a plurality (four being shown by way of example) of lubricant passageways 148 leading in inward directions into hub chamber 150 surrounding the mandrel 20' and into a plurality of hub slots 152 which are in turn in communication with the annular spacer and end flange chambers 80, in turn leading to spacer and end flange slots 82. End flange passageways 148 receive atomized lubricant from a rotating manifold spider 154 mounted on end flange 142 as by bolts 156. The axially disposed inlet end 158 of manifold spider 154 threadably receives a cap nut 160 in which is fitted the non-rotative flanged end 162 of the atomized lubricant delivery line 164. The non-rotative to rotative connection comprising nut 160 and flanged line end 162 can be of any suitable, substantially sealed type known per se, or can be simply close fitting, with the several right angles involved in the flow path between the interior of manifold spider 154 and ambient air providing that no aspiration of ambient air occurs. The substantial back pressure occurring in the area of end 158 of manifold spider 154 also aids in avoiding aspiration of ambient air through the non-rotating to rotating joint in that the flanged end 162 of the lubricant delivery line faces a manifold wall.

As will be apparent, the modified saw assembly GS' shown at FIGS. 13 and 14 offers the constructional advantage that a solid mandrel 20' is employed.

FIG. 15 serves to illustrate yet another form of mandrel assembly GS'', specifically designed as a unitized cartridge for converting existing rotary saw equipment to have the atomized lubrication features of the invention. In construction of this modified form of the invention, the existing saw mandrel 20'' is first shortened and rethreaded as at 170 to accommodate a cartridge comprising a tubular mandrel extension 172 having an integral, inner end flange 173 and receiving the assemblage of saws 32, spacers 34, outer flange ring 60, and assembly nut 62. As shown at FIG. 15, said tubular mandrel extension comprises a hardened and replaceable (for wear) outer end 174 with an axial bore 176 (like bore 70 of FIG. 3) leading into an enlarged bore chamber 178 (like chamber 72 of FIG. 3), which in turn communicates with a plurality of mandrel slots

180 (like slots 74 of FIG. 3) leading to a recessed, annularly surrounding chamber 182 (like hub chamber 76 of FIG. 3), which then directly communicates with annular spacer chambers 80 and slots 82. Delivery of lubricant into the saw assembly GS" shown at FIG. 15 is to said outer end insert 174 from a non-rotative end 184, and the nature of atomized lubricant delivery from said end 184 and the shielding against aspiration of ambient air is provided by said insert 174 and lubricant line end 184 is essentially the same as discussed in connection with the form of the invention shown at FIG. 6.

FIG. 16 serves to illustrate yet other design variations characteristic of the invention. In FIG. 16, solid mandrel 20" is journaled at its outer end in bearing 22' and receives the gang of saws 32 and spacers 34 on a tubular hub member 190 threaded onto said mandrel 20" at its inner end and provided with an integral flange end 192 at its outer end, the gang saw assembly being completed by inner flange ring 194 and assembly nut 196. Annular hub chamber 198 and hub slots 200 are in communication with annular chambers 80 and slots 82 in like manner as the form of the invention shown in FIGS. 13, 14, and receive atomized lubricant from passageways 202 in flange end 192, which construction is directly and respectively comparable to hub chambers 150, slots 52 and passageways 148 of the form of the invention shown in FIGS. 13, 14. Outer flange end 192 of the assembly shown in FIG. 16 mounts as by screws 204 a manifold ring 206 with a series of holes 208, which rotates within a non-rotative annular manifold chamber 210 fed atomized lubricant from line 212. In the form of lubricant manifolding shown at FIG. 16, the rotating to non-rotating seal is between the raised flanges of ring 206 and the raised edge flanges of ring 210, as shown. As will be apparent, the construction is such to obviate aspiration of ambient air into the manifolding, by virtue of the pressurized lubricant delivery and the disposition of the interfitting flanges of manifolding elements 206, 210.

With respect to the nature of the disk saws, and as pointed out in connection with FIG. 12, important improvements in saw blade construction are made possible by the present invention. As compared with the conventional rip saw thickness of .060" or more, saws used in the lubricated and self-cooling environment provided by the saw assemblies here presented can be about 0.025"-.050" thick, and the saw blade set can be less than .010".

With respect to the nature of the lubricant and coolant, such can be simply an oily-type liquid such as diesel oil or kerosene, or a blend thereof with aromatic solvents, or admixture or emulsion of such liquid with water, with various organic or inorganic additives known per se, such as corrosion inhibitors. Oil-in-water type silicone emulsions are a specific example of a good compounded lubricant of high lubricity. As to the pressurization of the lubricant, the pressure thereof at the atomizing nozzle should be at least about 10 p.s.i. gage, the air pressure (as at line AL in FIG. 3) should be at least about 5 p.s.i. gage, and the pressure of the atomized lubricant at the saw blades is to be at least slightly above the dynamic pressure occurring at the blade surfaces, it being notable in this regard that the comparison here involved is relative and that the centrifugal action of the rotating blades can generate a reduced pressure condition at the blade faces which is actually subatmospheric. As to the volume of lubricant employed, a typical installation involving a single gang assembly of nine blades can use about ten gallons of lubricant per eight hour shift, and it will be understood that the rate of consumption of lubricant will vary widely depending upon the character of the wood, the diameter, gage and speed of rotation of the blades, the set of the saw teeth, and the feed speed of the wood stock, as well as other related

factors, the important considerations being to maintain adequate lubricant flow to keep the saw blades pitch-free and to keep blade temperature below the scorch temperature of the wood.

Such lubricants can be metered to the saw assembly by any suitable means such as gravity or a positive displacement metering pump driven by the lumber feed mechanism (FIGS. 1 and 2). The lubricant feed means can also include a precooler to aid the cooling function at the saw blades, if desired. The extent of flow of lubricant can be controlled by the feed mechanism, the amount pumped being proportional to the feed speed. Likewise, the flow of coolant can be automatically stopped when the feed mechanism is stopped. Alternatively the flow can be controlled by any suitable means actuated by the material passing through the saws. This can consist of a direct mechanical linkage or electrical limit switches, or air operating valves in conjunction with appropriate solenoid valves, and the like.

As to the manner of atomization of the lubricant, the incident particle size resulting from the atomization has been found to be important to the effectiveness of the lubricating and cooling functions obtained. If the lubricant is not sufficiently atomized, the lubricant particles have essentially liquid characteristics and are not evenly distributed (i.e. carried by) the air stream. If the lubricant is too finely atomized, a "fog" is produced, having essentially gaseous characteristics (i.e. the lubricant is mostly vaporized) and the lubricant does not cling to the saw surfaces. The atomized lubricant should be at least principally in the form of what may be termed a "mist," rather than in the form of either liquid drops or vaporous fog, and the term "mist" is used herein in this context. It is to also be observed in this connection however, that the mist forming atomization of the lubricant at the saw assembly absorbs a substantial degree of thermal energy, by virtue of the reduction in particle size and increase in velocity of the lubricant incident to its atomization, so that the lubricant in mist form is functionally a cooling agent as well as a lubricating agent with good "clinging" properties.

From the foregoing, it will be understood that various other constructional and operational modifications of equipment can be effected which utilize some or all features of the present invention. Thus, by further typical example, the invention is adaptable to arrangements of "over and under" saw assemblies where each saw assembly cuts about half-way through the lumber (as indicated in connection with the alignment components shown at FIG. 8), and can also be utilized in certain respects where the saw assembly comprises a single disk saw, in that even with a single saw there are still the problems of uniformity and efficiency of lubrication and the problem of maintaining atomized lubricant flow without aspiration of ambient air.

By the term "wood and like materials", it is considered that the mist-lubrication method and equipments according to the invention have utility for cutting wood and any like material where similar problems exist in terms of minimizing kerf loss, and lubricating, cooling, and cleaning the kerf-forming blade surfaces. Thus, in addition to wood such as lumber, the invention can be used as well for glue laminated or matte wood products, such as plywood, hardboard and fiberboard, or for plastic or glue impregnated wood products such as ship board or particle board, or for non-laminated or laminated plastics, for example.

Various further modifications according to the present invention will be apparent to those skilled in the art, within the scope of the following claims.

What is claimed is:

1. A gang saw assembly, comprising a rotatably mounted solid mandrel, a tubular hub member mounted coaxially of said mandrel and spaced internally therefrom, a gang of alternately arranged circular saws and

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outwardly channelled saw spacers arranged coaxially on said tubular hub member, the said tubular hub member having a plurality of radially directed, axially extending passageways therein providing elongated communicating means between an interspace between said tubular hub member and the mandrel and the spacer channels, the said tubular hub member further having an integral flange at one end thereof, a plurality of passageways arranged in said flange to communicate between the said mandrel and tubular hub member interspace and the exterior of said flange, rotatably mounted passageway means in direct communication with the said passageways in said flange, and means for injecting lubricant into the said rotatably mounted passageway means.

2. The saw assembly of claim 1, wherein said rotatably mounted passageway means comprises a manifold ring mounted on said tubular hub member flange, said ring having a plurality of passageways in direct communication with said flange passageways, and a nonrotative manifold chamber of annular configuration in direct and contiguous communication with said manifold ring to effect a non-rotating-to-rotating joint therebetween.

3. A gang saw assembly, comprising a rotatably mounted solid mandrel, a tubular hub member mounted coaxially of said mandrel and spaced internally therefrom, a gang of alternately arranged circular saws and outwardly slotted saw spacers arranged coaxially on said tubular hub member, the said tubular hub member having a plurality of radially directed, axially extending passageways therein providing elongated communicating means between an interspace between said tubular hub member and the mandrel and the spacer slots, the said tubular hub member further having an integral flange at one end thereof, a plurality of passageways in said flange arranged to communicate between the said mandrel and tubular hub member interspace and the exterior of said flange, rotatably mounted passageway means in direct communication with said passageways in said flange, lubricant injection means contiguous to the said rotatably mounted passageway means, and non-rotating-to-rotating seal means between said rotatably mounted passageway means and said lubricant injection means.

4. A gang saw assembly for rip sawing lumber, comprising a rotatably mounted, solid mandrel, a tubular hub member mounted coaxially of said mandrel and spaced internally therefrom, a gang of alternately arranged circular saws and outwardly channelled saw spacers arranged coaxially on said tubular hub member, the said tubular hub member having a plurality of com-

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municating passageways therein between the interspace between said tubular hub member and said mandrel and the spacer channels, said tubular hub member further comprising an integral flange at one end thereof, a plurality of passageways in said flange arranged to communicate between said mandrel and tubular hub member interspace and the exterior of said flange, a lubricant delivering spider mounted exteriorly of said flange with a plurality of interconnected passageways in direct communication with the passageways in said flange, the central portion of said spider including a common passageway chamber situated coaxially of said mandrel, and means for injecting lubricant into the said central portion of said spider.

5. A gang saw assembly for rip sawing lumber, comprising a rotatably mounted, solid mandrel, a tubular hub member mounted coaxially of said mandrel and spaced internally therefrom, a gang of alternately arranged circular saws and outwardly slotted saw spacers arranged coaxially on said tubular hub member, the said tubular hub member having a plurality of slots providing elongated communicating passageways therein between the interspace between said tubular hub member and said mandrel and the spacer slots, said tubular hub member further comprising an integral flange at one end thereof, a plurality of passageways in said flange arranged to communicate between said mandrel and tubular hub member interspace and the exterior of said flange, a lubricant delivering spider mounted exteriorly of said flange with a plurality of interconnected passageways in direct communication with the passageways in said flange, the central portion of said spider including a common passageway chamber situated coaxially of said mandrel, and lubricant injection means for delivering lubricant into the said central portion of said spider, and non-rotating-to-rotating seal means between the said lubricant injection means and the said central portion of said spider.

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