

WOOD-MIZER LT20

OWNER'S & OPERATOR'S MANUAL

AUGUST 1987

This manual is to replace or to be used in conjunction with all previous information received on the Wood-Mizer LT20. All future mailings will be an addition to or a revision to individual sections of this manual as we obtain new information.

We sincerely hope this manual will take care of any questions, and help increase productivity with your lumbermill.

If you have any questions, please write or call our Customer Service Department at (317) 271-1542.

In the event your manual is lost or destroyed, a replacement manual is available upon request to customers only at a cost of \$25.00 each, including shipping and handling.

The information and instructions given in this manual do not amend or extend the limited warranties for the equipment given at the time of purchase.

Ordering Parts

As our number of customers grow, so do the amount orders processed by the Customer Service Department. Trying to maintain open accounts and net terms has only caused confusion and slowed down our service to you. In an attempt to give you the fastest service possible, we have adopted these four methods of payment: MasterCard, Visa, pre-payment, or COD.

Office Hours:

Monday	8:00 a.m. to 5:00 p.m.
Tuesday	8:00 a.m. to 5:00 p.m.
Wednesday	8:00 a.m. to 5:00 p.m.
Thursday	8:00 a.m. to 5:00 p.m.
Friday	8:00 a.m. to 5:00 p.m.
Saturday	8:00 a.m. to 4:00 p.m.

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SECTION 1.1 WARRANTY INFORMATION

LASKOWSKI ENTERPRISES, INC., (Seller), an Indiana Corporation, with principal place of business at 8180 West 10th Street, Indianapolis, Indiana 46214-2430, phone (317) 271-1542, hereby warrants the WOOD-MIZER® Sawmill to the original Buyer only.

15 DAY SALE OR RETURN MONEY BACK GUARANTEE

Within fifteen (15) days after delivery if Buyer is not completely satisfied with the WOOD-MIZER® Sawmill, Buyer may notify Seller for a full refund of the purchase price (used saw blades and damaged parts excepted) and re-transfer ownership to Seller upon return of the WOOD-MIZER®, shipping pre-paid by Buyer. Buyer retains risk of loss during such period and until re-delivered to Seller.

LIMITED WARRANTY

The warranty period commences with the date of delivery of the WOOD-MIZER® Sawmill to the original Buyer and expires ninety (90) days from that date for electrical and moving parts and one (1) year from that date for non-moving parts, except for main drive motor/engine, winch, tires, axle, battery, and battery charger (which exceptions are warranted by their respective manufacturers).

SELLER DISCLAIMS ANY WARRANTY WHATSOEVER, WHETHER EXPRESS OR IMPLIED, FOR BELTS AND SAW BLADES, AND BUYER PURCHASES ALL SAW BLADES "AS IS" AND "WITH ALL FAULTS", AND NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE ARE TO BE IMPLIED.

During such warranty period Seller warrants to the original Buyer that the WOOD-MIZER® Sawmill is manufactured and delivered in accordance with Seller's published specifications for the equipment at the time of sale and that the WOOD-MIZER® shall be free of defects in material and workmanship. The sole liability and responsibility of Seller shall be to replace or repair, at Seller's principal place of business in Indianapolis, Indiana, (or at such other location approved by Seller and at Seller's sole discretion) free of charge including related labor, any defective part, and repair of defective workmanship. Buyer shall pay shipping costs. Correction of any non-conforming part, in the manner and for the period of time provided above, shall constitute fulfillment of all liabilities of Seller to Buyer, whether based on contract, negligence, or otherwise with respect to, or arising out of such equipment.

To obtain return shipping information or information on warranty performance, call Customer Service at Area Code 317/271-1542, charges reversed.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER EXPRESSED OR IMPLIED WARRANTIES INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, EXCEPT AS TO TITLE. Any description, photograph, sample or model of the equipment used as a sales aid shall not extend to create any warranty, the Seller's warranties being specifically restricted to the published specifications for the WOOD-MIZER® at any time of purchase. No Dealer or Agent has the authority to bind Seller other than to the published specifications for the WOOD-MIZER® at any time of purchase. No verbal statement or promise made by a Dealer or agent or by the Seller shall constitute or extend any warranty, except as herein provided. Neither Buyer nor Seller shall be liable to the other for special, indirect, or consequential damages. The remedies set forth herein are exclusive, and the liability of Seller with respect to any contract or sale or anything done in connection therewith, whether in contract, in tort, under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the equipment or part on which such liability is based. **SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS OR THE EXCLUSION OR LIMITATION OF INCIDENTAL OR ON HOW LONG AN IMPLIED WARRANTY LASTS OR THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU.**

Seller shall have no obligation under this warranty in the event the WOOD-MIZER® is damaged in transit by common carrier, is overloaded, is abused, is not used in conformity with the directions accompanying the equipment or if the equipment is modified.

SELLER SPECIFICALLY DOES NOT WARRANT THAT THE EQUIPMENT SHALL MEET OR COMPLY WITH THE REQUIREMENTS OF ANY PARTICULAR SAFETY CODE OR REGULATIONS OF ANY STATE, MUNICIPALITY, OR OTHER JURISDICTION.

This warranty gives the Buyer specific legal rights, and the Buyer may also have other rights which vary from state to state.

**SECTION 1.1
WARRANTY INFORMATION - cont'd**

**WOOD-MIZER® EXTENDED WARRANTY FOR PURCHASE OF
TRADE-IN REPLACEMENT PARTS**

Upon expiration of the stated Warranty periods for the Wood-Mizer® Lumbermill, owners thereof shall have the right to trade in worn or damaged parts and purchase replacement parts at 50% of the published retail price for such parts, on the following conditions:

1. Trade-in replacement parts shall be for Wood-Mizer® owner use only and shall not be re-sold or supplied to non-Wood-Mizer® owners.
2. The 50% replacement cost is based upon a trade-in value of worn or damaged parts. Upon request of Laskowski Enterprises, Inc., the worn or damaged parts shall be returned to the company. The company shall have the right to request trade-in parts to be returned to its plant in Indianapolis, Indiana prior to shipping out of new replacement parts. In the event the company does not request trade-in parts to be returned prior to shipping, such worn or damaged parts shall be retained for ninety (90) days by the owner prior to disposal. The company shall not be responsible for any storage charges for the storage of trade-in parts retained by the owner.
3. Shipping costs for return of trade-in parts shall be at the owner's sole expense.
4. The Company shall have the right to change the published retail price at any time without notice.

It is understood that the granting of this extended Warranty for purchase of replacement parts is not and does not extend or modify any other existing Warranty whatsoever, whether express or implied, for the Wood-Mizer® or any accessory products or replacement parts therefore.

Laskowski Enterprises, Inc.

By: _____

Oct. 1985 L

SECTION 1.2

SAFETY

The safety tips and warnings listed below should be observed at all times. **Read and understand ALL safety instructions before you operate the mill!**

Turn engine off and let wheels come to a stop:

- 1) Before removing any covers or guards.
- 2) Before adjusting the blade guides.
- 3) Before changing the blade.
- 4) Before refilling gas tank.
- 5) Before making any type of carriage adjustments.
- 6) Before rotating log.

Disengage clutch mechanism:

- 1) After each cut.
- 2) Before adjusting throat width.
- 3) Before returning the bandsaw carriage.

Always:

Wear eye protection and avoid wearing loose clothing while operating mill.

Raise side support braces when rolling log onto carriage.

Position mill on flat, level surface. Level mill before operating.

Disengage clutch after each cut is completed.

Adjust outer blade guide to a 1" clearance or less between the guides and the log.

When rolling a log onto carriage, keep the area behind the log clear of people.

Change the blade with one person only.

Clamp log firmly in place before cutting.

Keep all observers a safe distance from work areas.

Do not operate gasoline engines in confined spaces.

Store gasoline away from sawdust and other flammable materials.

SECTION 1.3

CUSTOM SAWING GUIDELINES

The most common question asked by new Wood-Mizer® owners concerns what you charge when sawing for someone. Although there is no single answer to this question, there are some guidelines to follow that may help. Each region is going to vary as to the going price to have wood sawn, size and species of available timber, and amount of sawing business available. The following guidelines aren't intended to cover all situations, but are offered to help in understanding some different pricing approaches.

PRICING BY THE HOUR OR DAY

Many owners use this method to charge for their sawing. The obvious advantage of this approach is that your income doesn't change with each type of cutting job. If you are cutting difficult wood or set up at a location that doesn't allow efficient handling of logs and finished lumber, the risk of low production rates is passed on to the customer. Your hourly rate remains fixed so the lower production won't effect your income. Many of the owners using this hourly method require their customer to supply the manpower to handle all logs and lumber. If the customer wants higher production, he simply supplies more manpower or equipment to increase output. The owner is simply there to operate the mill. This places most of the burden on the person having the wood cut. Rates vary in different areas from \$15.00 to \$35.00 per hour. Some charge a delivery fee based on miles to the site for mill set-up.

MILL RENTAL OR LEASE

Some Wood-Mizer® owners rent or lease their mills for people to do their own cutting. The advantage in this case, is that the mill can generate income without requiring any of the owner's time. Things to be cautious about are the competency of the person using the mill, possible legal liability if someone is injured using the mill, and possible damage to the mill when being used by inexperienced operators. Rental rates vary from \$10.00 to \$20.00 per hour. Blades can be sold in addition. We do not recommend this method.

PRICING BY THE BOARD FOOT OR VOLUME

This is the most common pricing approach in the logging industry. It's main advantage goes to the person wanting the lumber cut. His price is fixed no matter what the production rates are. Rates can vary from under \$.10 per foot to over \$.25 per foot. The equation for how much you earn is simple--the more you cut, the more you make. The actual amount you make can be affected by many factors which make that equation much more difficult. The type or species of the logs, the length of time they have been down, the condition of the logs, the cutting location, and the size of the logs and thickness of lumber the customer requests will affect your production rate. Each of these factors is important enough to consider individually.

The type of species of log will greatly affect your production rates. White oak, mosquito, and hard maple cut at a rate lower than that for poplar or pine. Although some regions won't accept it, you should try to establish a higher cutting fee for the more difficult species. Some people charge a \$.05 premium per board foot for certain species. If your area won't accept this premium you may be better off not cutting certain wood types.

SECTION 1.3

CUSTOM SAWING GUIDELINES - cont'd

PRICING BY THE BOARD FOOT OR VOLUME - cont'd

The length of time the logs have been down will also affect the rate at which you can produce. Generally, the longer wood has been down, the harder it is to cut. Because of this, it is good to find out how long the timber has been down as well as the species before quoting. The condition of the logs can also affect the production rate. Logs that have been dragged over rocks and mud will require additional time to debark or clean. If you cut through the mud, your blade will dull in just a few minutes. A premium per board foot or an hourly rate should be charged to clean the logs. You could also refuse to cut mud-laden logs.

The cutting location is important. Your price should be based on a set-up where you can simply roll or load logs onto the mill without moving the mill. If you are required to move the mill several times in a day, you should be able to charge a fixed amount per move. Some operators charge \$5.00 per move.

The amount of wood to be cut should be considered when pricing. If a customer had only two logs, a premium should be expected. Some operators charge a premium of a few cents per foot for any job less than 1000 board feet. A minimum fee can be established on small jobs.

The size of the logs you plan to cut should be a factor in pricing. Large diameter logs can take extra time to handle by hand. Having to stop to trim side limbs or large flares at the butt can greatly reduce total output. Too small a log can involve too much handling for the total yield it produces.

The size of lumber the customer requests can cause you to more than triple the number of cuts you would need to make to get the same volume of wood. This is true with cutting 1x4s vs. 2x12s. Some mill owners charge a certain price for 1" or 2" boards. Very wide boards require much more time to cut than narrower widths. The feed rate for a cut of 24" is less than 5' per minute and takes more time and runs more risk of wavy cuts than cutting thru boards that are 8" wide at a feed rate of 20' or more per minute.

The Wood-Mizer has several advantages over circular mills and when pricing your sawing you should take advantage of them. Many Wood-Mizer owners get premiums over the going rates in the area by selling these advantages. Recognize that a \$4,000-13,000 mill can't compete in the area of output per day with a \$100,000 mill operation. Where you can compete (and beat) the big mills is in portability, lumber quality, versatility, and total yield of usable lumber per log.

PORTABILITY

The money your customer can save in not having to haul his lumber to the mill can let you charge a few cents more per board foot than the large mills. Be sure that this savings is used to your advantage, either to secure a cutting job or to get a premium for saving the customer a hauling bill. In Indiana, average hauling costs within 30-40 miles of the mill is \$40.00/MBF (\$.04 per board foot).

SECTION 1.3

CUSTOM SAWING GUIDELINES - cont'd

LUMBER QUALITY AND ACCURACY

The surface texture of a board cut on a Wood-Mizer is far smoother than on a circular mill. A good sawyer can get finished framing lumber directly off the mill. The more accurately any mill cuts, the less you need to oversize your cuts to assure a given finished dimension.

LUMBER SIZE CAPABILITIES

The Wood-Mizer lets you cut 1/2" lumber for paneling with less overall log waste than most mills cutting 2" lumber. The LTSLR option lets you cut shingles and lap siding (weatherboard). The Wood-Mizer can also resaw large timbers into accurately-sized dimensional lumber. These capabilities are very significant advantages.

YIELD PER LOG

The Wood-Mizer's high yield of usable lumber per log is one of its most important and sometimes most overlooked advantages. This higher yield has an easy-to-calculate real cost savings for every log cut. A 14" to 18" diameter log measured by Doyle Scale when cutting with the Wood-Mizer will consistently produce as much as 50% over scale. This can allow you to charge a much higher rate than a large mill and still have the same net cost as the larger mill per finished board foot. It is actually possible to charge twice the rate as some mills and still save a customer money. An equation to calculate the cutting rate you can charge so the net cost per board foot is the same as the different mills is:

$$\left(VL \times \frac{1}{1 + ERC} \right) + CR + HF - \left(VL \times \frac{1}{1 + ERW} \right) = WR$$

Where:

- VL** = Value of the lumber in log form
- ERC** = Efficiency Rate of Competitor (Amount of usable lumber over scale the competitor's mill will cut)
- CR** = Competitor's Rate (Rate that the competitor's mill charges)
- HF** = Hauling Fee to the mill
- ERW** = Efficiency Rate of Wood-Mizer (Amount of usable lumber over scale the Wood-Mizer will cut)
- WR** = Wood-Mizer Rate (Rate that you can charge to have the same net cost per board foot as the competitor's mill)

SECTION 1.3

CUSTOM SAWING GUIDELINES - cont'd

YIELD PER LOG - cont'd

This equation looks quite involved but can be easily calculated when you fill in actual values. For example: A customer has some prime poplar logs valued at 25¢ per board foot (\$250.00 per thousand). He can have lumber sawed at a circular mill at 10¢ per board foot that cuts approximately 10 to 15% over scale. (i.e., for every 1000 board foot by Doyle scale, the mill cuts 1100 to 1150 usable board foot of lumber). The hauling fee within 30 miles of the mill is 4¢ per board foot. Most Wood-Mizer® operations cut 50% over Doyle scale on logs under 20" in diameter. Given these figures, the equation will tell you what you could charge for cutting so the net cost per board foot is the same as the circular mills.

$$(.25 \times .87) + .10 + .04 - (.25 \times .67) = \text{rate}$$

$$.218 + .10 + .04 - .190 = \text{rate}$$

$$.168 \text{ rate} = .168¢$$

This means that you can charge 16.8¢ per board foot for the lumber you cut and the customer's cost is no more than if he had it hauled into a circular mill and cut at 10¢ per board foot. The reason for this is that you can cut half again as much usable lumber as the scale volume compared to the 25% of the circular mill. For example, if he pays \$250.00 for 1,000 scaled board foot in log form, you can give him 1,500 board foot of usable lumber from those logs. This essentially cuts the price he is paying for his lumber by 30-40%! Because of this difference in efficiency, you should easily be able to get a higher cutting rate than the larger mills.

It isn't our intention in this example to advise you to charge the 16.8¢ board foot fee for cutting. In this example you could possibly charge a rate of 15¢ and essentially pass on the difference of 1.8¢ per board foot to the customer. Even when cutting pine worth 10¢ a board foot, you can compete at over 15¢ per board foot versus 10¢ of a large mill, when you calculate the savings in efficiency and hauling costs. Anything less than the 15¢ board foot is money you are putting in the customer's pocket.

One thing to consider when looking at the efficiency of the Wood-Mizer® is that your advantages increase as the value of the logs increase. If you have poplar worth 20¢ per board foot, you cut the net cost of the lumber 30-40% by giving him 50% of the scaled volume in usable lumber when cut. This is essentially an 8¢ board foot savings. If the wood were oak valued at 50¢ per board foot, you could cut his cost by 20¢ a board foot; walnut valued at \$1.00 per board foot would reduce cost by 40¢ and so on.

When cutting by volume or board foot, **always charge for the amount of usable wood produced, rather than scale volume.** If you charge by scale volume, every board foot you cut past scale you are cutting for free.

If you determine your volume by output, reduce risks of low-volume days by knowing what and when you cut, and **always** charge something for the additional factors that reduce your production, cutting by volume can be a profitable venture.

SECTION 1.3 CUSTOM SAWING GUIDELINES - cont'd

SAWING FOR A PERCENTAGE OF THE WOOD YOU CUT

This can be a good way to charge for your sawing, but it will not bring in money unless you have a ready market for the wood you cut.

Cutting this way essentially makes you a small-scale lumber yard. If you can sell your lumber at a good price, this can be a very profitable arrangement. Percentage you keep as a sawyer can range from 25-50% depending on species and region.

COMBINATION PRICING

One key to securing more cutting jobs is to be flexible in your pricing. A customer who owns a substantial amount of standing timber may not be concerned about the higher yields from the Wood-Mizer®. In this instance, he may be willing to let you cut at the current large mill rate and keep some of the over-run lumber.

There may be certain jobs or wood types that you may want to cut on an hourly rate instead of a board foot rate. You may also charge more or less per foot depending on how much labor the customer supplies. A combination of several pricing approaches may be what will work best in your operation.

A few points to remember:

If you price by the day, establish a rate that will leave you the income you want **after** expenses.

If you rent your mill, know the people who use it and be sure they are properly trained.

If you price by the board foot, use the high yield, portability, cutting versatility, and surface texture to get the highest rate possible for your region. (Be conscious of all factors that can reduce output and charge accordingly.)

SECTION 1.4

WOOD-MIZER® CUSTOM LUMBER CONTRACT

THIS AGREEMENT, by and between _____ (Sawyer),
and _____ (Customer),
with the Wood-Mizer® one-man sawmill as follows:

1. Sawyer agrees to cut customers log at: Customer's site _____ or Sawyer's property _____; for \$ _____ per hundred board foot of lumber cut. Charges are based on actual lumber cut rather than scaled volume. (Note: net usable lumber will be greater than scale when cut with the Wood-Mizer®.) A board foot of lumber is defined as 12"x12"x1".
2. In addition to above, Customer shall pay Sawyer \$ _____ for delivery and location setup of Wood-Mizer®. Also, if Sawyer is required to relocate Wood-Mizer® on site, there shall be an additional charge of \$ _____ per move. In the event a saw blade is broken or damaged by foreign matter (nail, rock, metal, etc.) in Customer's log, there is a charge of \$ _____ per damaged blade.
3. Sawyer will arrive at Customer's location at _____ o'clock _____ .M., on _____, 19____ to start operation. Customer agrees to provide _____ men to assist in loading and unloading logs and lumber. All logs shall be stacked in location of mill so that there can be continuous loading of mill by rolling logs up the mill ramp without moving mill. Lumber shall be stacked at mill location to allow continuous cutting operation.
4. Other Charges: _____
5. Payment in full shall be made as follows: _____
6. It is understood by the Customer that log handling and cutting may be hazardous. Customer shall be responsible for conduct of helpers and observers and agrees to hold Sawyer and the Wood-Mizer® Lumbermill manufacturer harmless for any injury or damage whatsoever to helpers or observers arising out of operation of the mill and the handling of logs and lumber. It shall be Customer's duty and obligation to keep all children and observers out of the work area. Customer represents that he is the owner of the logs and/or has the authority to enter into this Agreement on behalf of all interested parties.

Dated this _____ day of _____, 19____.

Sawyer:

Customer:

SECTION 1.5

LOG SCALES

Log scales are measurements that indicate the amount of lumber in a log. The measurement is indicated in board feet, with one board foot being a piece of lumber 1" thick, 12" wide, and 1' long (a 12" square of wood that is 1" thick). All board-foot log rules give the estimated volume of the log in board feet for a specified diameter and length. A log that is 12" in diameter by 7' long has less lumber in it than a log that is 12" in diameter by 13' long. A board-foot log rule tells you how many board feet of lumber is in each log.

The three most well-known rules are International, Scribner Decimal C, and Doyle Log Rules. There is also a Spaulding or Columbia Log Rule that approximates the value of the Scribner Decimal C Log Rule. Each of these scales uses a different formula to calculate the same thing -- the amount of lumber in a log. The scales amount varies from one scale to another because of the different formulas used to calculate the volumes.

The Doyle Rule is generally used on commercial operations in the Eastern and Southern States. The Scribner Rule, or the Scribner Decimal C Rule, is used by the U.S. Forestry Service and other federal agencies, numerous scaling bureaus, and many private operators. The International Rule is used to some extent by the U.S. Forestry Service and some private operators. It is important to note that all rules give the approximate volume of lumber in a log and that there are also a series of specific rules for deducting volume for defects like crooks, sweeps, and knots. Remember, the Wood-Mizer will get significantly more lumber (sometimes up to 30% more) than a scale will indicate because most scales are based on the 1/4" saw kerf of larger circular mills.

All log rules use two measurements to determine volume. The first is overall length. The second measurement is the "DIB", the Diameter Inside the Bark on the small end of the log. On a round log this is the width of the small end just inside the bark. On an oval log you measure the widest and the narrowest directions and take their average (i.e., if the small end of a log is oval-shaped and measures 18" at the widest point and 12" at the narrowest point, the scale DIB is $(18 + 12) / 2 = 15"$).

Once you have the two measurements, you can use the scale to determine volume. You locate the DIB in the left-hand scale and that line of numbers indicates the amount of lumber for different length logs. Each column is marked underneath with a log length. You match the DIB line with the column for the log length and that number is the volume in board feet.

EXAMPLE: If a log is 12' long and the DIB (diameter measured inside the bark on the small end) is 14", the Doyle Scale volume is 75 bd ft (board feet); the International Scale volume is 100 bd ft; the Scribner Decimal C Scale volume is 90 bd ft*.

*The value on the Scribner Decimal C Scale needs to be multiplied by 10 to give you volume in board feet.

SECTION 1.5

LUMBER SCALE

THICKNESS AND WIDTH	LENGTH OF BOARD IN FEET					
	6	8	10	12	14	16
	CONTENTS IN BOARD FEET					
1 x 3	1.5	2	2.5	3	3.5	4
1 x 4	2	2.6	3.3	4	4.6	5.3
1 x 5	2.5	3.3	4	5	6	6.6
1 x 6	3	4	5	6	7	8
1 x 7	3.5	4.6	6	7	8	9.3
1 x 8	4	5.3	6.6	8	9.3	10.6
1 x 10	5	6.6	8.3	10	11.6	13.3
1 x 12	6	8	10	12	14	16
2 x 4	4	5.3	6.6	8	9.3	10.6
2 x 6	6	8	10	12	14	16
2 x 8	8	10.6	13.3	16	18.6	21.3
2 x 10	10	13.3	16.6	20	23.3	26.6
2 x 12	12	16	20	24	28	32
2 x 14	14	18.6	23.3	28	32.6	37.3
3 x 6	9	12	15	18	21	24
3 x 8	12	16	20	24	28	32
3 x 10	15	20	25	30	35	40
3 x 12	18	24	30	36	42	48
4 x 4	8	10.6	13.3	16	18.6	21.3
6 x 6	18	24	30	36	42	48

SECTION 1.5

LOG & LUMBER SCALE

INTERNATIONAL ¼ INCH LOG RULE

DIB* (small end)	BOARD FEET PER LENGTH BELOW					
	6'	8'	10'	12'	14'	16'
6	5	10	10	15	15	20
7	10	10	15	20	25	30
8	10	15	20	25	35	40
9	15	20	30	35	45	50
10	20	30	35	45	55	65
11	25	35	45	55	70	80
12	30	45	55	70	85	95
13	40	55	70	85	100	115
14	45	65	80	100	115	135
15	55	75	95	115	135	160
16	60	85	110	130	155	180
17	70	95	125	150	180	205
18	80	110	140	170	200	230
19	90	125	155	190	225	260
20	100	135	175	210	250	290
21	115	155	195	235	280	320
22	125	170	215	260	305	355
23	140	185	235	285	335	390
24	150	205	255	310	370	425
25	165	220	280	340	400	460
26	180	240	305	370	435	500
27	195	260	330	400	470	540
28	210	280	355	430	510	585
29	225	305	385	465	545	630
30	245	325	410	495	585	67

*DIAMETER INSIDE BARK

SECTION 1.5

LOG & LUMBER SCALE

DOYLE SCALE

DIB* (small end)	BOARD FEET PER LENGTH BELOW					
	6'	8'	10'	12'	14'	16'
6	2	2	3	3	4	4
7	3	5	6	7	8	9
8	6	8	10	12	14	16
9	9	13	16	19	22	25
10	14	18	23	27	32	36
11	18	25	31	37	43	49
12	24	32	40	48	56	64
13	30	41	51	61	71	81
14	38	50	63	75	88	100
15	45	61	76	91	106	121
16	54	72	90	108	126	144
17	63	85	106	127	148	169
18	74	98	123	147	172	196
19	84	113	141	169	197	225
20	96	128	160	192	224	256
21	108	145	181	217	253	289
22	122	162	203	243	284	324
23	135	181	226	271	316	361
24	150	200	250	300	350	400
25	165	221	276	331	386	441
26	182	242	303	363	424	484
27	198	265	331	397	463	529
28	216	288	360	432	504	576
29	234	313	391	469	547	625
30	254	338	423	507	592	676

* DIAMETER INSIDE BARK

SECTION 1.5

TREE SCALE

DOYLE LOG RULE

DAG*	NUMBER OF 16 FOOT LOGS IN TREE							
	½	1	1½	2	2½	3	3½	4
12	20	30	40	50	60	-	-	-
14	30	50	70	80	90	100	-	-
16	40	70	100	120	140	160	180	190
18	60	100	130	160	200	220	240	260
20	80	130	180	220	260	300	320	360
22	100	170	230	280	340	380	420	460
24	130	220	290	360	430	490	540	600
26	160	260	360	440	520	590	660	740
28	190	320	430	520	620	710	800	880
30	230	380	510	630	740	840	940	1040
32	270	440	590	730	860	990	1120	1220
34	300	510	680	850	1000	1140	1300	1440
36	350	580	780	970	1140	1310	1480	1640
38	390	660	880	1100	1290	1480	1680	1860
40	430	740	990	1230	1450	1660	1880	2080
42	470	830	1100	1370	1620	1860	2100	2320

* DIAMETER 4'-6" ABOVE GROUND

TO ESTIMATE TREE VOLUME

1. Determine tree diameter in inches at 4½ ft. above ground.
2. Determine usable length in feet from stump height to large branches.

SECTION 1.5

TREE SCALE

INTERNATIONAL ¼ INCH LOG RULE

DAG*	NUMBER OF 16 FOOT LOGS IN TREE							
	½	1	1½	2	2½	3	3½	4
12	30	60	80	100	120	-	-	-
14	40	80	110	140	160	180	-	-
16	60	100	150	180	210	250	280	310
18	70	140	190	240	280	320	360	400
20	90	170	240	300	350	400	450	500
22	110	210	290	360	430	490	560	610
24	130	250	350	430	510	590	660	740
26	160	300	410	510	600	700	790	880
28	190	350	480	600	700	810	920	1020
30	220	410	550	690	810	930	1060	1180
32	260	470	640	790	940	1080	1220	1360
34	290	530	730	900	1060	1220	1380	1540
36	330	600	820	1010	1200	1380	1560	1740
38	370	670	910	1130	1340	1560	1840	1940
40	420	740	1010	1250	1480	1700	1920	2160
42	460	820	1100	1360	1610	1870	2120	2360

* DIAMETER 4'-6" ABOVE GROUND

TO ESTIMATE TREE VOLUME

1. Determine tree diameter in inches at 4½ ft. above ground.
2. Determine usable length in feet from stump height to large branches.

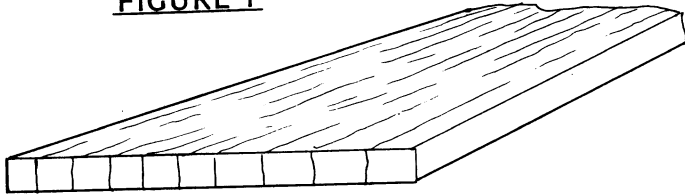
SECTION 1.6

LOG SAWING AND DRYING TIPS

Although most people know of the term, quartersawing, many do not know what it means. What is quartersawing? Why and when should you quartersaw? How do you quartersaw? These are questions we hope this article will answer.

The Society of American Foresters defines quartersawed as "timber converted so that the growth layers meet the face of any part at an angle $\neq 45^\circ$ (not less than 45°). When the angle is $\neq 80^\circ$ (not less than 80°) the timber is termed fully quartersawn". This technical definition is one reason that the term is confusing to many people new to sawing. In simpler terms this means that a fully quartersawn board has growth rings that are approximately perpendicular to the face of the board **See Figure 1**. The board is still considered quartersawn as long as the growth rings aren't less than 45° to the face of the board. **See Figure 2**.

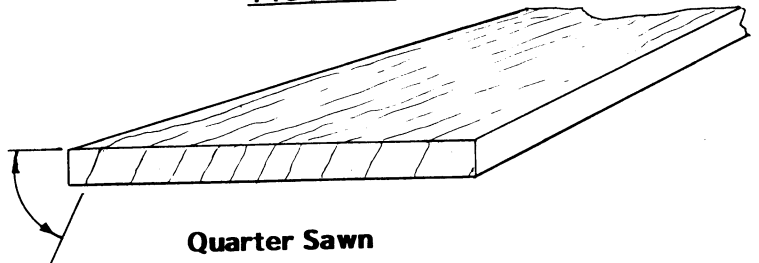
FIGURE 1



Fully Quarter Sawn or Rift Sawn

$90^\circ \pm 10^\circ$

FIGURE 2



Quarter Sawn

$45^\circ - 80^\circ$

There are several reasons to consider quartersawing your lumber. In certain hardwoods the grain patterns found are in high demand. Quartersawn oak has a very distinct grain pattern and is more valuable than plainsawn oak. Quartersawn wood is also more dimensionally sound and will not cup or dish while drying, and will shrink less than plainsawn boards. For these reasons most cabinet makers, quality furniture shops, and craftsmen prefer quartersawn boards.

Not all lumber will increase in value when quartersawn. Because of this, the added handling and time involved should be weighed against the added value of the quartersawn lumber. Quartersawing framing lumber isn't normally suggested. Quartersawing furniture grade hardwoods is suggested.

SECTION 1.6

LOG SAWING AND DRYING TIPS - cont'd

We have found commercial quartersawing of logs to be simple and fast on the Wood-Mizer®. Judgement as to where the first cut should be made depends on the shape of the log (oval, square, or round) and as such is arbitrary. Seeing that this method results in the best quality lumber, we felt you would be interested in the approach we use. Referring to the sketches below, **Figure 1** shows an end view of a log we will say is 17 inches in diameter. The first cut is made 11½ inches above the bed. The top cant (A) is laid to the side and six cuts of one inch (B) are made and those boards laid aside. The remaining cant (C) is rotated 90° (See **Figure 2**) and boards are cut starting 13 inches from the bed down to 3 inches (boards D). These boards are acceptable as commercial grade quartersawn lumber. The two boards above and below are plain sawed. The boards (D) are then placed vertical and edged. Cant (A) is processed in like manner. Boards (B) are then mounted vertically, sliced through the center (**Figure 3**), and edged (**Figure 4**). Using this approach, 60 to 70 percent of a good log can be converted into the most valuable of lumber rapidly and effectively.

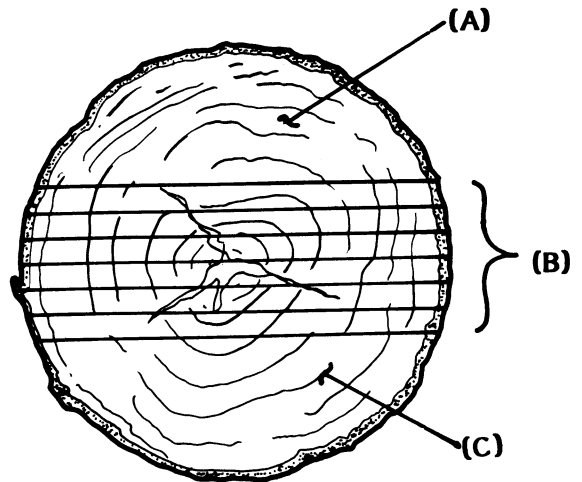


FIGURE 1

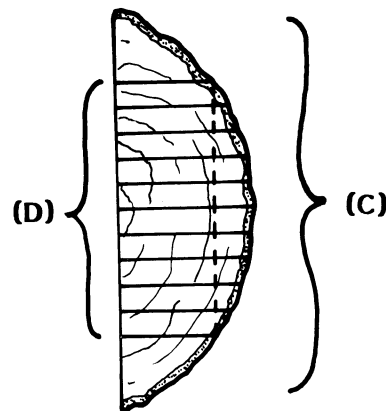


FIGURE 2



FIGURE 3

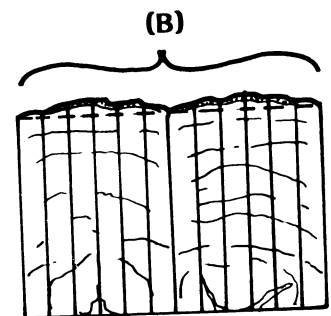


FIGURE 4

SECTION 1.6

LOG SAWING AND DRYING TIPS - cont'd

LUMBER VOLUME AND SIZING

An important step in cutting lumber is to determine the correct size. Lumber is normally sold according to its **nominal** size, which indicates the dimensions of the rough lumber in inches (1X2, 2X4, etc.). The first dimension is the thickness of the board and the second its width. After a board has been surfaced with a planer on all sides and dried, it will then be the **actual** size. For instance, the actual size of a 2X4 is 1½ X 3½ inches.

When you are cutting framing lumber you should be able to cut its actual size (1½ X 3½ for a 2 X 4) directly on the mill to avoid any planing to size. You may want to allow an over cut of approximately 10% for shrinkage when dried.

The chart below compares nominal and actual size of most common sizes.

Nominal and Actual Sizes of Lumber (In Inches)

Nominal Size	Actual Size
1 X 2	25/32 X 1 5/8
2 X 2	1 5/8 X 1 5/8
1 X 3	25/32 X 2 5/8
2 X 3	1 5/8 X 2 5/8
1 X 4	25/32 X 3 5/8
2 X 4	1 5/8 X 3 5/8
1 X 5	25/32 X 4 5/8
1 X 6	25/32 X 5 5/8
2 X 6	1 5/8 X 5 5/8
1 X 8	24/32 X 7 1/2
1 X 10	25/32 X 9 1/2
2 X 10	1 5/8 X 9 1/2
1 X 12	25/32 X 11 1/2
2 X 12	1 5/8 X 11 1/2

Circular mills cut 1" hardwoods to be planed to 3/4". You can cut 15/16" lumber by dropping the carriage a full inch for each board (15/16" board and 1/16" saw kerf = 1" drop) and you should easily be able to get a planed 3/4" board. This is because the surface texture and accuracy are better with the Wood-Mizer®.

VOLUME

Lumber is commonly sold by the **board foot**. This unit is actually a calculation of volume. To find the number of board feet in a board, multiply the nominal thickness times the nominal width times the actual length in feet. This product is then divided by 12. Thus, a one-foot-long 1X12 and a two-foot-long 1X6 would both be sold as one board foot.

SECTION 1.7

LUMBER DRYING

GENERAL WOOD CHARACTERISTICS

As with any sawmill, the ultimate value of your lumber depends greatly on what happens to the boards **after** they are cut. The amount of damage or "de-grade" the lumber will have is affected by many factors. By far the most important of these is drying.

The two most common methods of drying wood are **kiln-drying** and **air-drying**. The kiln-drying process involves drying lumber in a closed chamber. Wood is dried to a given level by a carefully controlled combination of heat, relative humidity and air circulation. Wood-Mizer® produces a 1,000 bd. ft. capacity kiln that allows the small business to dry wood quickly and practically through a unique method of drying wood.

Kiln-drying wood with the Model 1000 Dry Kiln is a new method that creates whole new approaches and options for the wood supplier. The following is a brief explanation of how the Model 1000 Dry Kiln works, stated as simply as possible.

First, picture yourself as a small, single molecule of water in vaporous (steam) form. Now picture yourself inside a cell of wood. You find yourself in what appears to be a tremendous cavern with huge tunnels interconnecting to other caverns. The walls of these caverns (which are the walls of the wood cells) appear as a sieve with large openings . . . large enough that you can crawl through them into the adjoining caverns.

This gives you an idea of the size of a single molecule of water in relationship to wood. This is important, as the principle for drying in the Model 1000 Dry Kiln is centered primarily around drying of moisture through vaporous form. Water is one of the few elements which will exist in this very tiny form when heated above its boiling point. Below its boiling point, it has an affinity (tremendous attraction) to other molecules of water (cohesion) and to other substances such as wood fibers, etc. (adhesion).

Once one recognizes that the cellular structure of wood is not a significant barrier to the flow of water in its vaporous (steam) form, the principle of this type of drying is simple to understand. This also explains why vacuum-drying is so much faster than air and conventional kiln drying (approximately 10 times faster than conventional means).

There is only one reason for using vacuum in our process -- reducing the boiling point of water. At sea level, water boils at 212°F. Denver, Colorado is a mile high (reduced atmosphere) and water boils there at about 180°F. As the atmospheric conditions get rarer and rarer and come closer and closer to a complete vacuum, the boiling point of water drops to lower and lower temperatures. In the Model 1000 Dry Kiln, the vacuum is capable of reducing atmosphere to a point that water will boil at about 90°F.

We believe it is desirable in wood-drying to keep the wood fibers at temperatures similar to those in which they grow. By reducing the boiling point of water to the range of 90°F, the Model 1000 allows the rapid drying process in vaporous form to occur with minimal damage to the wood fibers.

SECTION 1.7

LUMBER DRYING - cont'd

The drying process is accomplished by adding heat through layers of thin heating blankets between which layers of wood are stacked, bringing the temperature of the wood to a point higher than boiling, and then allowing the boiling vapors to escape from the wood. These vapors then condense back into liquid form on condensing coils attached to the interior of the kiln walls. The rate at which heat is added to the wood and the rate at which steam is boiled out of the wood are controlled by microprocessing circuitry. The microprocessor is completely field-programmable and allows the operator to rapidly schedule the drying rate required for the specific species and thickness of wood being dried.

This all adds up to a self-contained, 1000-board foot capacity, vacuum dry kiln designed to rapidly dry thick stock with low degrade levels. The drying time of the Model 1000 is 1/10th that of most conventional kilns. The unit dries 4/4 red oak from green to 7% in approximately 3 days, 8/4 in 6 days. This fast turnaround gives users the ability to handle specialty drying needs without tying up a high-volume conventional kiln for extended periods. It is also practical for the small user drying the more common 4/4 stock, especially when fast turnaround is critical.

Air-drying is the most common method of drying lumber for most small mill operators. The following paragraphs are quotes from the "How to Dry Small Quantities of Lumber" pamphlet prepared by the North Central Forest Experiment Station Forest Service, United States Department of Agriculture.

Before using freshly sawn hardwood lumber in your woodworking projects, you must dry it. These paragraphs will outline how you can dry short lengths of green boards inexpensively at home. Green lumber up to 2 inches thick can be dried for indoor use in 1 to 4 months, depending on the species and wood thickness. Moisture contents of the dried lumber range from 6 to 11 percent, depending on the conditions in the indoor room. However, when using this method of drying, you should expect a significant amount of defects to occur.

Freshly cut lumber contains up to 1 pound of water for each pound of dry wood. If used in the green condition, the lumber will dry while in use, leading to shrinkage, decay, paint failure, and loosening of joints. The lumber must be dried first to avoid these problems.

When warm dry air is moved over the surfaces of green wood, the wood absorbs heat from the air and this heat evaporates the water held in the wood. Stack the wood in rows or tiers separated from each other by a few crosslaid pieces of dry lumber about 3/4-inch square (called stickers) and support it well above the ground. Place heavy weights on top of the stack to keep the boards flat. Align the stickers vertically to prevent sagging.

Build the stack where warm, dry air can move through the tiers. Heated or dehumidified indoor space or an attic above heated space are good locations. However, unheated sheds can be used to accomplish most of the drying. If no shed or indoor space is available to handle all of the lumber, you can build the stack outdoors, but it must be protected with a slightly sloping roof of plywood or other panel-type material.

SECTION 1.7

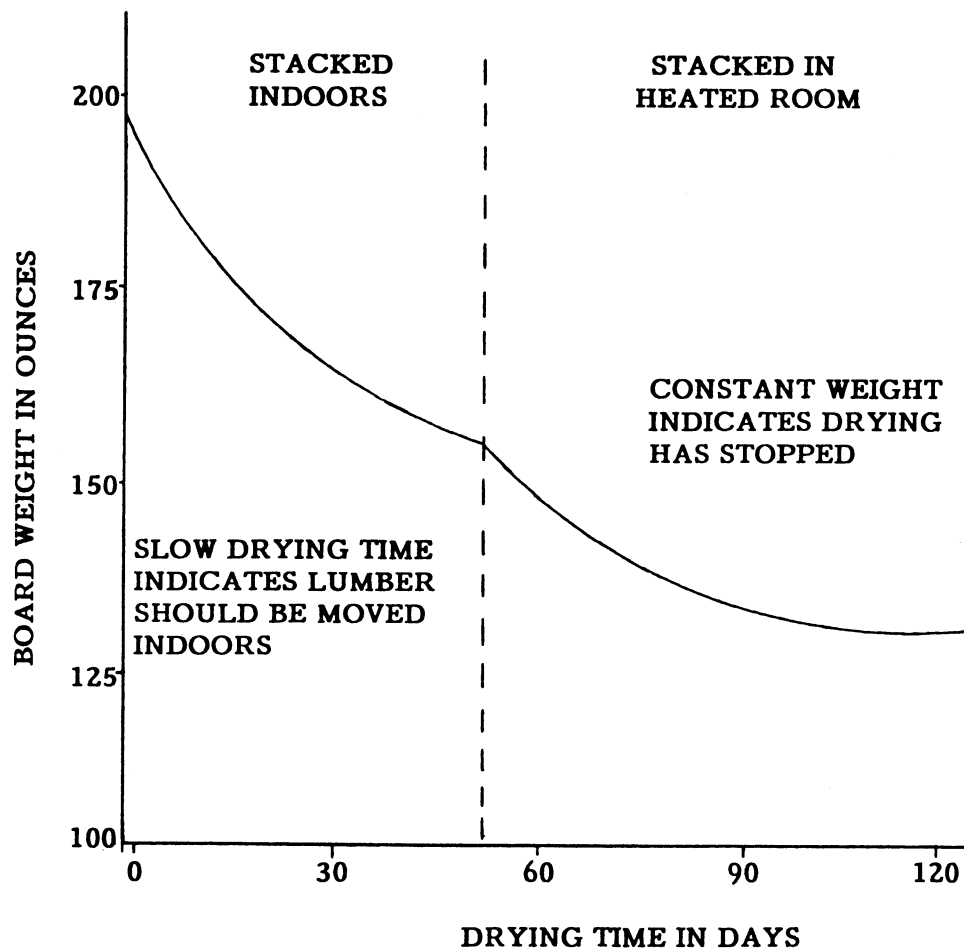
LUMBER DRYING - cont'd

Stacks built outdoors or in unheated sheds will dry well in the warm months, but much more slowly in cold winter months.

Outdoor conditions are not dry enough to remove enough moisture from the wood to reach the 6-10 percent moisture contents required for indoor use. Therefore, you will have to move the material in the stack into a heated or dehumidified interior space to complete the drying. The lumber should be stacked indoors in the same manner as described earlier.

HOW WILL I KNOW WHEN THE WOOD IS DRIED?

Weigh a few boards from the stack at least once a week. When their weight stops dropping, the boards have stopped drying. One easy way to keep track of the wood's progress is by graphing the board weight, such as in the graph below. The graph shows the weight loss of white oak, originally weighing 200 ounces, which was dried outdoors until the rate of weight loss was very low and then moved to a heated indoor space and dried until no further weight loss occurred. Although a hard-to-dry species such as white oak took 4 months to dry, easier drying species like yellow poplar and silver maple can be dried in less than 1 month.



SECTION 1.7

LUMBER DRYING - cont'd

Approximate time in days to air-dry green 1-inch (2.54 cm.) lumber to 20 percent moisture content

SPECIES	TIME	SPECIES	TIME	SPECIES	TIME	SPECIES	TIME
Softwoods	Days	Sugar:		Beech, American		Sugar	
Baldcypress	100-300	Light	15-90	Birch:	70-200	Oak:	50-200
Douglas-fir:		Sinker	45-200	Paper	40-200	Northern red	70-200
Coast	20-200	Western white	15-150	Sweet	70-200	Northern white	80-250
Interior north	20-180	Redwood:		Yellow	70-200	Southern red	100-300
Interior south	10-100	Light	60-185	Butternut	60-200	Southern White	
Interior west	20-120	Sinker	200-365	Cherry, black	70-200	(chestnut)	120-320
Hemlock:		Spruce:		Cottonwood:		Pecan	60-200
Eastern	90-200	Engelmann	20-120	Black	60-150	Sweetgum:	
Western	60-200	Red	30-120	Eastern	50-150	Heartwood	70-300
Larch, western	60-120	Sitka	40-150	Elm:		Sapwood	60-200
Pine:		White	30-120	American	50-150	Sycamore:	
Eastern white	60-200	Hardwoods	Days	Rock	80-180	American	30-150
Jack	40-200	Alder, red	20-180	Hackberry	30-150	Tanoak	180-365
Lodgepole	15-150	Ash:		Hickory	60-200	Tupelo:	
Ponderosa	15-150	Black	60-200	Magnolia	40-150	Black	70-200
Red	40-200	Green	60-200	Maple:		Water	70-200
Southern:		White	60-200	Bigleaf	60-180	Walnut, black	70-200
Loblolly	30-150	Aspen:		Red	30-120	Willow, black	30-150
Longleaf	30-150	Bigtooth	50-150	Silver	30-120	Yellow-poplar	40-150
Shortleaf	30-150	Quaking	50-150				
Slash	30-150	Basswood	40-150				

SECTION 1.7

LUMBER DRYING - cont'd

A FEW POINTERS

1. End coat your green logs and green lumber with beeswax or a commercial sealer to prevent excessive end checking.
2. Use light-colored wood for stickers.
3. Keep dried lumber indoors in a dry location until you're ready to make the final product.
4. Stickers should be located approximately 16" apart and at both ends of the boards.

SECTION 1.8
GRADING LUMBER
STANDARD HARDWOOD GRADES

FIRSTS & SECONDS (FAS) GRADE

Use: For long, generally wide cuttings. As required for fixtures and interior trim.

Board Size: 6" and wider, 8' and longer.

Number of Clear Face Cuttings: Determined by Surface Measure (S.M.) of piece.

Size of Clear Face Cuttings: 4" or wider by 5' or longer and 3" or wider by 7' or longer.

Yield in Board of Clear Face Cuttings: 83 1/3% or more.

SELECT GRADES

Use: For long, medium to narrow width cuttings, where only one good face is required. As required for molding and wall paneling.

Board Size: 4" and wider, 6' and longer.

Clear Face Cuttings and Yield: Same as Firsts & Seconds (FAS) on better face. Poorer face to grade not below No. 1 Common.

NO. 1 COMMON

Use: For medium length, narrow to wide cuttings. As required for furniture manufacture.

Board Size: 3" and wider, 4' and longer.

Number of Clear Face Cuttings: Determined by Surface Measure (S.M.) of piece.

Size of Clear Face Cuttings: 4" or wider by 2' or longer and 3" or wider by 3' or longer.

Yield in Board of Clear Face Cuttings: 66 2/3% or more.

IMPORTANT EXCEPTIONS

1. Walnut, butternut and all quarter-sawn woods are 5" and wider in Firsts & Seconds (FAS) grade.
2. Minimum size of clear face cuttings in walnut and butternut are:
 - a. FAS: 4" or wider by 3' or longer and 3" or wider by 6' or longer.
 - b. No. 1 Common: A clear face cutting shall not contain less than 144 sq. inches; minimum width 3", minimum length 2'. There is no limit to number of cuttings.
3. FAS Poplar 8" and wider must contain not less than 66 2/3% heartwood on one side and not less than 50% on the reverse side. Pieces 7" wide allow 1" aggregate sapwood on either or both faces; pieces 6" wide must be all heartwood. Clear stock with excessive sapwood is usually sold as "SAPS", or sometimes FAS (SND), meaning "sap-no-defect".

SECTION 1.8

GRADING OF WESTERN PINE

Select Grades

B & BETTER SELECT (1 & 2 Clear). B & Better is the highest recognized grade of Pine . . . a practically perfect grade. Although graded from the better side, even the backs of pieces in B & Btr. are of extremely high quality. To all practical purposes, the grade is clear.

B & Btr. Ponderosa Pine is used for finishing work of the very highest order, including interior trim, siding, paneling and cabinet work. It is also used for special industrial purposes where practically clear lumber in fairly large pieces is desired.

C SELECT. C Select is the second grade of Pine finish lumber and is designed to provide a top grade paint finish wood. Many pieces have a B & Btr. face with backs of a slightly lower quality than are permitted in the higher grade. Other pieces have a clear appearance but contain small parts of slightly torn grain, fine checks or possibly light pitch.

C Select is suitable for the very highest uses where entirely clear lumber is not required.

D SELECT. D Select includes pieces showing a finished appearance on one side only, the back of the board at times containing knots, pitch, wane or a combination thereof. In such cases, the face is correspondingly high. A type often used is a high line piece requiring a cut to eliminate a defect too serious to go into finished work.

It is especially useful grade for the small planing mill and works up into various articles of woodwork with little waste.

MOLDING GRADE. This is a special grade exhibiting characteristics of both Select and Factory grades. As the name suggests, a high yield in long, clear but narrow cuttings suitable for producing moldings is the basis of the grade.

Price of molding Grade is intermediate between D Select and Third Clear, and the board will normally be found to be too good for Third Clear and not good enough for D Select. It is a sound value for the custom woodworker, because he can produce almost anything he needs from it at a relatively reasonable cost.

Common Grades

NUMBER 1 COMMON. Number 1 Common is the highest of five grades into which Pine Common is classified and contains pieces of the small knot variety. Knots are always sound, red or intergrown, smooth and are limited in size to slightly more than 2" in diameter, depending upon the size of the piece. As a rule, the knots average very much smaller and are well distributed along the board.

Only pieces that show smooth dressing around knots are allowed in No. 1 Common. Knots in No. 1 Common are usually round or oval in shape and seldom occur on the edges of the board.

SECTION 1.8

GRADING OF WESTERN PINE - cont'd

Common Grades - cont'd

NUMBER 2 COMMON. Number 2 Common, a very popular grade, represents a large percentage of the total production of Ponderosa Pine lumber. An all-around utility grade, it is suitable for all uses where a good grade of Common is required. It contains the same type of defects as No. 1, but in greater degree.

Generally similar to No. 1 in appearance, No. 2 allows larger and more pronounced characteristics. In narrow widths, knots are usually limited to 2½" in diameter, and in wider widths to 3½", but the average is considerably less than the maximum.

NUMBER 3 COMMON. Number 3 Common comprises pieces of less uniform appearance than those in the two higher Common grades, varying from a piece of otherwise No. 1 or No. 2 quality with a single characteristic which causes it to be Grade No. 3, down to pieces showing numerous coarse knots, or boards with loose knots or an occasional knot hole. A piece containing a knot hole is generally of otherwise high quality.

A limited amount of heart shake and pitch may be found in low line pieces of No. 3, provided they do not occur in serious combination with other defects. A type frequently found is a piece with a No. 2 face, but showing several skips in dressing.

SECTION 1.9

DEFINITIONS

At one time or another, every Wood-Mizer® customer finds himself involved in conversation dealing with woodlot management or forestry concepts. Unfortunately, many aspects of woodlot management and professional forestry can only be explained or described in technical terms. Therefore, it is important for sawyers to become familiar with basic forestry concepts and terms if they are to communicate successfully with other professional foresters. The following is a selected list of definitions used when discussing forestry management concepts and practices.

Acre - An area of land which contains 43,560 square feet (about 208.7 feet square).

Afforestation - Establishing a forest on an area which has not previously had trees growing on it.

All-Aged Forest - A forest stand in which trees of all ages and usually all sizes are present. Seldom exists in nature.

Allowable Cut - The volume of wood or the amount of product which can be cut, under a particular management plan, during a given period of time.

Annual Ring (or Growth Ring) - The growth layer of one year as viewed on the cross section of a stem, branch, or root; composed of early and late wood.

Board Foot - A unit for measuring wood volumes, equalling 144 cubic inches, which is commonly used to measure and express the amount of wood in a tree, sawlog, veneer log, or individual piece of lumber. For example, a piece of wood 1 foot x 1 foot x 1 inch or one measuring 1 foot x 3 inches x 4 inches both contain 1 board foot of wood.

Bole - The main trunk of a tree.

Bolt - A short log or a squared timber cut from a log.

Buck - To saw felled trees into shorter lengths.

Butt - The base of a tree or the lower end of a log.

Catface - A well-defined healing or healed wound usually near the base of a tree bole.

Check - A lengthwise separation of the wood, which usually extends across the rings of annual growth, commonly due to mechanical stresses which occur during drying. It is not considered to be cull unless excessive.

Commercial Cutting - A cutting which yields a net income (receipts for the sale of products exceed the cost of the cutting).

Conifer - A tree belonging to the order **Coniferales**, which is usually evergreen; cone-bearing; and with needles, awl, or scalelike leaves, such as pine, spruces, firs, and cedars; often referred to as "softwoods" which does not necessarily refer to the hardness of the wood.

SECTION 1.9

DEFINITIONS - cont'd

Conservation - The protection, improvement, and wise use of natural resources to assure the attainment of their highest economic and social values.

Cord - A standard cord is a stack of cut wood 4 feet high, 4 feet wide, and 8 feet long. The dimensions of a face cord are 4 feet by 8 feet but composed of sticks under 4 feet long (commonly 12, 18, or 24 inches).

Crop Tree - A tree identified to be grown to maturity and which is not removed from the forest before the final harvest cut. Usually selected on the basis of its value (quality and species) and its location with respect to other trees.

Crown - The leaves and branches of a tree.

Cubic Foot - A wood volume measurement containing 1,728 cubic inches, such as a piece of wood measuring 1 foot on a side. A cubic foot of wood contains approximately 5 to 7 usable board feet of wood.

Cull - (a) A tree or log of merchantable size but having no market value. (b) A tree or log which is unusable for the intended product and, therefore, not measured. Cull includes such things as rot, crookedness, cavities, and excessive limbiness.

Cutting Cycle - The planned time interval between major harvesting operations in the same stand. The term is usually applied to uneven-aged stands. For example, a cutting cycle of 10 years in a northern hardwood stand means that every 10 years a harvest would be carried out.

Deciduous Tree - A tree which loses all of its leaves at some time during the year (during the winter season in New York). May include some conifers, such as larch.

Defect - The portion of a tree or log which is unusable for the intended product and, therefore, not measured. Defects include such things as rot, crookedness, cavities, and excessive limbiness.

Dendrology - The study of the identification, habits, and distribution of trees.

Diameter Breast Height (DBH) - Tree diameter measured 4½ feet above ground level (the established standard place to measure tree diameter).

Environment - The prevailing conditions which reflect the combined influence of climatic, soil, topographic, and biological (plants and animals) factors present in an area. Environmental factors are extremely important in determining how well a particular species will grow in a given area.

Even-Aged Forest - A forest in which all of the trees present are essentially the same age (within 20 years). This is in contrast to an all-aged (uneven-aged) forest.

Forest (or Woodland or Woodlot) - A plant community in which the dominant vegetation is trees and other woody plants.

Forestry - The science, art, and practice of managing trees, forests, and their associated resources for human benefit.

SECTION 1.9

DEFINITIONS - cont'd

Girdling (or Frilling) - Completely encircling the trunk of a tree with a cut that severs the bark and cambium (active growing layer of cells) and usually penetrates into the sapwood to kill the tree by preventing the movement of food materials. It is sometimes necessary to add oil, such as kerosene, or a chemical to deaden trees, especially beech trees.

Grading - Evaluating and sorting trees, logs, or lumber according to quality and value.

Harvesting - (a) In general use, removing all or portions of the trees on an area. (b) Technical definition: A harvest cut is the removal of trees on an area to obtain income, to develop the environment necessary to regenerate the forest, or to achieve some special objectives such as the development of special wildlife habitat needs. Harvesting is in contrast with intermediate cuttings.

Hardwood - A term used to describe broadleaf, usually deciduous, trees such as oaks, maples, ashes, and elms. It does not necessarily refer to the hardness of the wood.

Heartwood - The inner core of a woody stem, wholly composed of non-living cells and usually differentiated from the outer sapwood by its darker color.

High-Grading - The removal from the stand of only the most valuable trees; often confused with selection cutting. High-grading usually reduces stand quality seriously, and is not recommended.

Knot - That portion of a branch which has become incorporated in the body of a tree stem.

Log - (a) A piece of the woody stem of a tree. (b) The trunk portion of a tree. (c) A unit of measurement of a merchantable tree stem section 8, 16, or 32 feet in length.

Log Rule - A device, usually presented in tabular form, which expresses log volume content based on log diameter (inside the bark of the small end) and length.

Marking - Selection and indication, usually by blaze or paint spot, of trees to be cut or retained in a cutting operation.

Non-commercial Cutting - A cutting which does not yield a net income, usually because the trees cut are too small, poor quality, or not marketable.

Preservation - (a) As applied to wood, the treatment of wood products to prevent damage by insects or decay organisms. (b) With respect to land, the practice of attempting to maintain a natural environment undisturbed by the influence or activities of humans.

Pruning - The removal of live or dead branches from standing trees. With forest trees, pruning is generally done along the trunk to remove the side branches (which cause knots in the wood) to produce a higher quality wood (knot-free).

Pulpwood - Wood cut primarily to be converted into wood pulp for the manufacture of paper, fiberboard, or other wood fiber products.

Punky - A soft, weak, often spongy wood condition caused by advanced decay.

SECTION 1.9

DEFINITIONS - cont'd

Release Cutting (or Cleaning) - A cutting operation carried out to release young trees (seedlings or saplings) from competition with other trees of the same size (termed a cleaning) or larger and overtopping trees (termed a liberation cutting).

Roots - That portion of the tree which is generally underground and which functions in nutrient absorption, anchorage, and storage of food products. There are several general types of roots including: (1) Tap Root - A strong central descending root with lateral roots branching off horizontally; typical of species such as black walnut, white oak, and some pines. (2) Heart-shaped Root - Consists of several large roots descending at various angles into the soil with smaller roots branching from these. Produces heart-shaped root mass which is broadest near the soil surface but which penetrates a considerable distance into the soil; typical of species such as beech and maple. (3) Flat Root - Consists of several large roots which extend out nearly horizontally with smaller roots branching from these. This produces broad, flat, shallow root systems typical of spruce, hemlock, and trees growing in poorly drained soils, or soils where the water table is close to the soil surface.

Rotation - The number of years required to establish and grow trees to a specified size, product, or condition of maturity.

Sapling - Small trees, often less than 20-30 feet tall.

Sapwood - The outer region of a woody stem containing some living cells and functioning primarily in water movement and food storage.

Sawtimber - Trees that will yield logs suitable in size and quality for the production of lumber. In New York, hardwoods must generally be over 16 inches in diameter at breast height in order to be considered sawtimber.

Scale Stick - A flat stick, similar to a yardstick, which is calibrated so log volumes can be read directly when the stick is placed on the small end of a log of known length.

Seasoning - The process of drying lumber or other forms of wood for better utilization by natural (air-dried) or artificial (kiln-dried) processes.

Slash - Residue left on the ground after logging, pruning, or other forest operations including tree tops, branches, and bark.

Snag - A standing dead tree without leaves and most branches, or a standing section of the stem of a broken off tree. Considered valuable to wildlife as either a perch or nesting site.

Sprout (or Sucker) - A tree that has grown from the base, stump, or root of another tree.

Stand - A grouping of trees occupying a given area and sufficiently uniform in composition, age, and condition so as to be distinguishable from the forest on adjoining areas. A forest stand is said to be pure if 80% or more of the trees present are of the same species. If less than 80% of all trees present are of the same species, the stand is said to be mixed.

Stumpage - The value of a tree or group of trees as they stand in the woods uncut (on-the-stump).

SECTION 1.9

DEFINITIONS - cont'd

Urban Forestry - A new field, developed in 1970's, concerned with management of urban trees, parks, and green spaces for a better environment.

Veneer - A thin sheet of wood cut on a veneer machine and often used for plywood facing; requires big, high quality logs.

Volume Table - A table which estimates the volume of wood contained in a standing tree based on measurements of the tree, most commonly diameters measured at breast and merchantable heights.

Wilding - A seedling naturally reproduced outside of a nursery used in reforestation.

Windfall - A tree uprooted or broken off by wind.

Wolf Tree - A tree which occupies more space in the forest than its economic value justifies. Usually a tree which is older, larger or more branchy than other trees in the stand. These trees represent a positive value to a variety of wildlife.

Wood Pulp - Mechanically-ground or chemically-digested wood (composed primarily of wood fiber) which is used in the manufacture of paper, fiberboard, and other products.

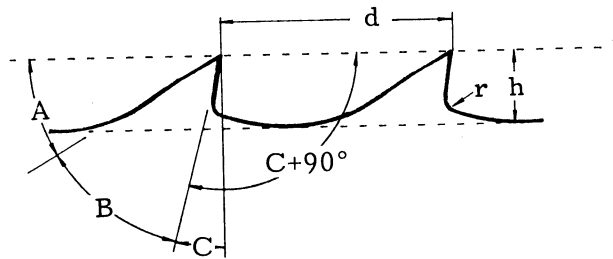
SECTION 2.1

BLADE THEORY AND TERMINOLOGY

If any one area of our sawmill can determine the success or failure of a cutting operation, it is the blade. Because of this, a clear understanding of both definition and theory about bands is essential. What we have found to be the most productive has not always matched what the textbooks say. For the most part, we believe this is due to the low horsepower and narrow width of our blades compared to larger production band mills. Below is a summary of our best current understanding of blades used with the Wood-Mizer®.

Wood-Mizer® currently offers two types of blades for use with all models of our lumbermills. The characteristics of these two blades are identical with the exception of the material thickness. Our standard blade is .035" thick and performs well in most normal cutting applications. Wood-Mizer® has recently begun offering a .042" thick blade to its customers. Tests by our Research Department and customers in the field indicate the .042" blade will cut for longer periods of time before requiring resharping. The .042" blade also performs considerably better in soft woods such as Eastern Spruce. Maintenance of the two different blades is identical, although slight adjustments of the Tooth Setter and Set Equalizer are necessary to allow for the difference in material thickness.

Tooth shape characteristics



The shape of the tooth line is determined by the following characteristics:

- d = Pitch (tooth space)
- h = Depth of gullet (tooth height)
- r = Root radius
- A = Clearance angle (topping angle)
- B = Tooth angle (tooth point angle, sharpness angle)
- C = Hook angle (hook)
- C + 90° = Breast angle
- A + B + C = 90°

PITCH

The teeth per inch on a bandsaw blade is called its pitch. The pitch of the Wood-Mizer® blade is 1.33 (or 3/4" tooth spacing). The smaller the pitch, the more stress or load on each tooth. A larger pitch results in a smoother sawn surface. The pitch is not part of the tooth geometry that is changed on the Wood-Mizer®.

DEPTH OF GULLET (TOOTH HEIGHT)

The area between teeth that carry sawdust out of the cut is called the gullet. The gullet of the standard Wood-Mizer® blade has proven to be adequate to carry enough

SECTION 2.1

BLADE THEORY AND TERMINOLOGY - cont'd

sawdust under most cutting conditions. The gullet is determined by the shape, pitch, and height of the saw teeth and needs to be large enough to carry away all sawdust produced. If the space of the gullet is too small, the sawdust is forced out at the side of the blade into the kerf. This increases the friction between the blade and the wood, resulting in heat, sap build-up on the blade, and increased power consumption. If the blade is sharpened several times, the tooth height will decrease, which will result in a gullet area too small to carry the saw dust. Too short a tooth will also result in the inability to set the teeth. To overcome this, the gullet should be ground slightly deeper when when tooth height becomes less than 3/16".

CLEARANCE ANGLE

The clearance angle is the angle at the top of the tooth. This angle extends long enough down the standard Wood-Mizer® blade that it should not need to be ground during the normal life of our blades. It is generally understood that this angle should never be less than 5° and can be as large as 30°. If this back **clearance** is insufficient, the back of the tooth in the tip region will press against the wood, causing a rubbing action that will overheat and cause early dulling of the blade. The higher the feed rate, the higher the required clearance angle.

TOOTH ANGLE

The tooth angle determines the strength of the tooth. Using the standard clearance angle and recommended hook angle of 10° to 15° , the Wood-Mizer® blade is within the recommended 45° to 75° range.

HOOK ANGLE

The hook angle is the number of degrees that the tooth face leans forward of 90°. Hook angle and tooth set are the two most critical factors in cutting ability of a blade. Both will have a decisive effect on cutting quality and production capabilities. The proper hook angle is determined by the type of wood and the intended rate. The generally accepted rule is that softwoods require a greater hook angle than hardwoods. Generally, the smaller the hook angle is, the slower the cutting capacity of the mill will be.

The object of the hook angle is for the teeth to "hook" themselves into the timber to remove a certain amount of wood so that the blade feeds itself into the log. If the hook angle is too great in relation to the feed rate, the blade will "pluck" and attempt to move forward in the cut. This results in chatter,

SECTION 2.1

BLADE THEORY AND TERMINOLOGY - cont'd

a coarse cut, and poor cut quality. This slow feed speed doesn't allow the teeth to fill their function and the tooth points will develop a rubbing action, resulting in premature dullness. If the hook angle is too small, the blade must be forced into the log in order to make the saw cut. This creates side deflections in the blade and will also cause a rubbing action that will wear the teeth faster.

Recommended hook angles are $12\ 1/2^\circ$ to 15° on softwoods, 10° to $12\ 1/2^\circ$ on hardwoods. In theory you should use less of a hook angle when cutting wider boards because of the slower feed rate.

FACE ANGLE

The face angle is the angle of the tooth face in relation to the body of the blade. This angle should remain at 90° for all teeth to pull sawdust forward out of the kerf. This is critical to getting a good cut and the primary reason for sharpening new blades. Blade manufacturers set the blade after it is sharpened, turning the face angle out as much as 7° . Grinding a blade on a properly aligned sharpener will true all the teeth face angles to 90° .

TOOTH SET

The tooth set is measured as the distance that a tooth is bent in relation to the body of the blade. The further a tooth is set, the wider the cutting path of the blade. The further a tooth is set, the wider the cutting path of the blade. Wider sets require higher horsepower. A nominal set of $.075 +$ or $-.015$ is good for most woods. On a $.035$ " blade, this translates to each tooth being set to $.020$ ($.020$ left + $.020$ right + $.035$ material thickness = $.075$ total set). Remember that as you sharpen your teeth, the set will decrease and require resetting as the tooth is ground shorter. Softwoods can require a wider set than hardwoods with total set not to exceed $.090$ ".

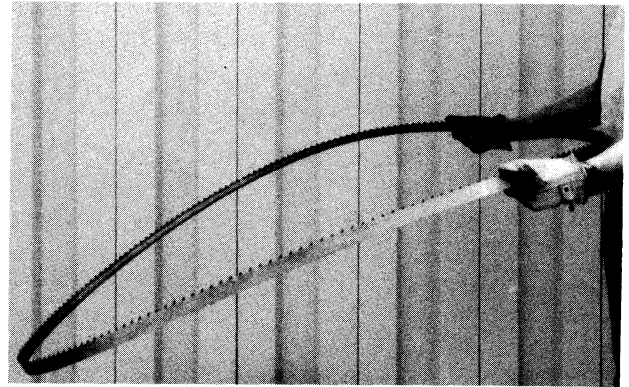
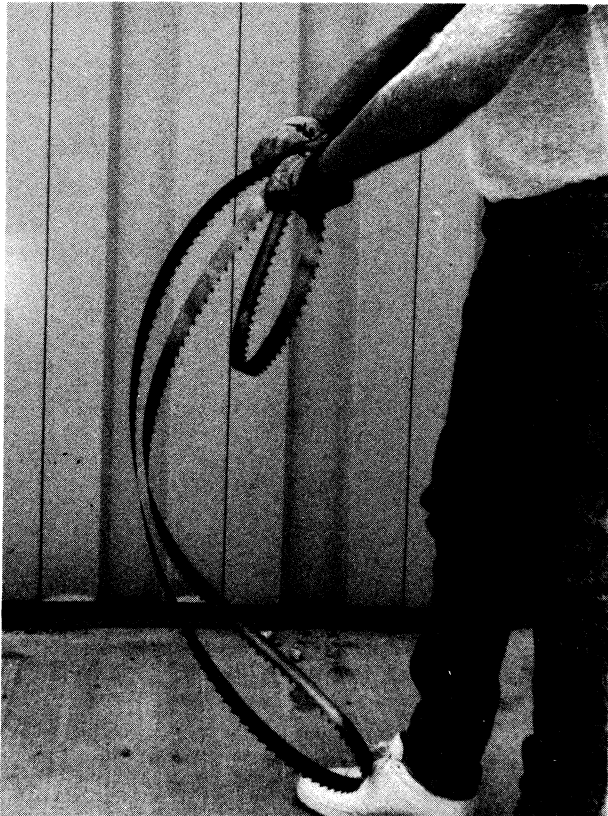
CRITICAL BLADE MAINTENANCE AREAS

- If the saw teeth require setting, always clean the blade, set, then equalize **before** sharpening.
- Be certain that the tip of the tooth has at least $2/3$ of tooth height ground to a hook angle between 10° and 15° .
- Do not grind any more metal than required to regain a new, clean cutting face from tip of tooth to gullet radius.
- If you grind too little amount off a new blade, you'll notice black areas on face of tooth; never leave black on tip.
- If you grind too little off of a used blade, you will not remove rounded or dull tip of tooth.

SECTION 2.2 BANDSAW BLADE COILING INSTRUCTIONS

Warning: Wearing gloves is advised!

1. Hold the blade out in front of you with the teeth pointed up. (Approximately 1/4 to 1/3 of the blade circumference should be between your hands.)
2. Position your thumbs on the outside of the blade against the sides of the teeth. Locate your fingers near the inside bottom of the blade.
3. Hold your hands about shoulder width apart and lift the blade parallel with the ground. Squeeze the blade inward, making it oval shaped.



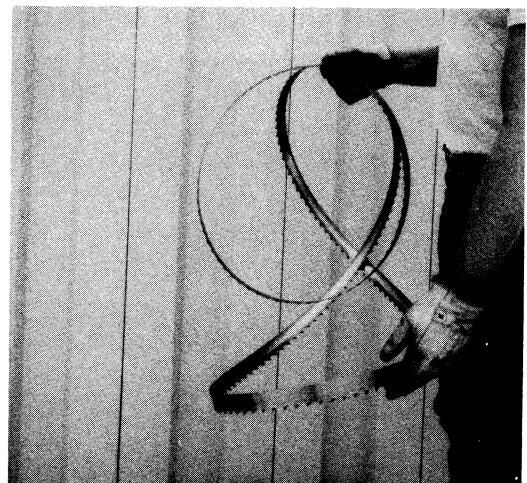
4. Keeping your wrists "locked" in position, rotate your forearms upward and outward, rotating your thumbs toward each other. (The teeth will rotate inward and the bottom of the blade will rotate outward.)
5. Now bring your hands together and the blade will form 3 loops. Snap the bottom loop upward and catch the 3-loop coil in your hands.

Another method:

1. With the blade at your side, teeth pointed away from you, hold the blade on the ground with your foot.
2. Grasp the blade with your knuckles against your belt.
3. Turn your hand 180 degrees while pushing downward. (The blade will fall into 3 coils on the the ground.)

To uncoil:

1. Shake the 3 coils in your hand until 2 of the coils form an "x" (one coil laying over another at a right angle).
2. Hold the "x" and let the third loop drop downward.
3. Grasp the remaining 2 coils in either hand and separate them. (The blade will open into a full loop).



SECTION 2.3

TOOTH SETTER/GAUGE OPERATING INSTRUCTIONS

There are two steps to maintaining blades used on the Wood-Mizer sawmill. They should always be followed in this order:

1. Toothsetting
2. Blade Sharpening

If the blade to be reset and sharpened has been cut with, clean the blade before removing from the mill by engaging the clutch and running the water lube option on it for 15 seconds. After removing the blade, wipe dry with a rag to keep it from rusting.

The blades supplied by Wood-Mizer have a raker style set in the teeth. If you view a blade standing on edge, you will see the teeth are set (or bent out) in a repeating sequence; straight, right, and left (See Figure 1). The teeth that are set left and right do the cutting while the straight teeth (rakers) clear the cut of sawdust. A new blade is preset and should not need setting until about the second or third sharpening (checking the set of a new blade is recommended, however, as some blades may have inconsistently set teeth from the manufacturer). As the blade is sharpened and the face of the tooth recedes, the set will become smaller (See Figure 2). You should check the blade regularly with the setter/gauge to see that .011"-.017" (for .035" blades) or .015"-.021" (for .042" blades) set is maintained. All teeth should be set the same amount within .001" (+ or -).



FIGURE 1

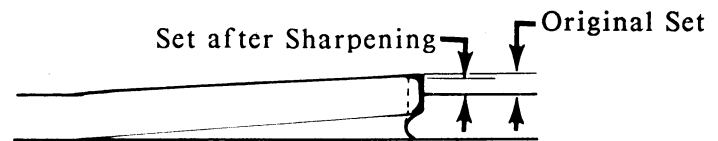


FIGURE 2

The optional LTTSG Tooth Setter/Gauge is a fixture that will accurately and evenly set the teeth of a bandsaw blade. Proper setting practices are critical to efficient and accurate sawing. Follow the preceding instructions to properly operate the tooth setter/gauge.

SECTION 2.3

TOOTH SETTER/GAUGE OPERATING INSTRUCTIONS - cont'd

TOOTH SETTER/GAUGE SET-UP

The LTTSG Tooth Setter/Gauge may be mounted on a workbench or stand using the mounting holes found in the base plate of the setting fixture. The setter may also be mounted to the front pin of one of the bed rails of the mill (except LT20G) by using the provided 'J'-hooks, wing nuts, and washers. Mount the setter so that there is at least 32" to the rear and to either side of the tool to allow enough room for the blade supports. Refer to Figure 3 to identify parts of the tooth setter which will be referred to throughout these instructions.

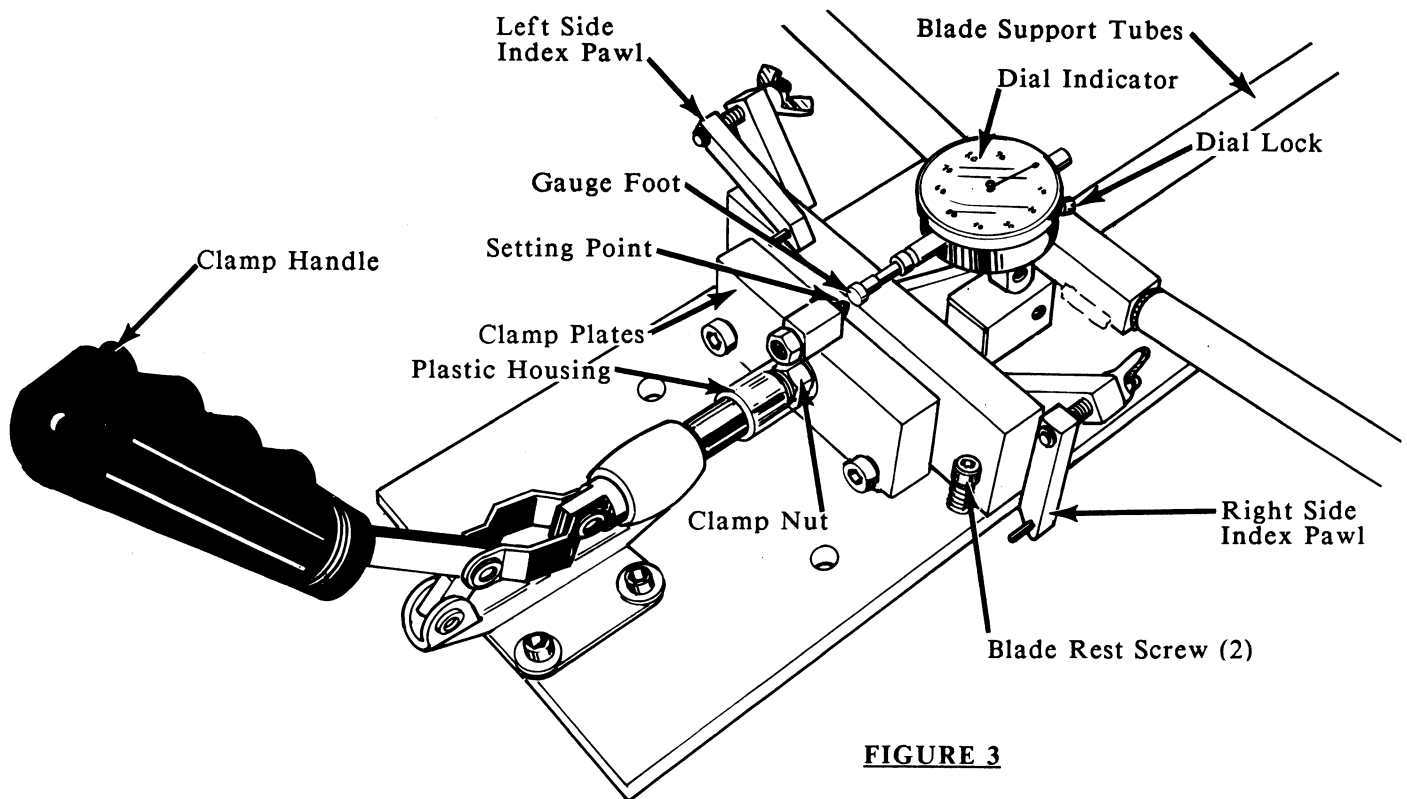


FIGURE 3

Install the three blade support tubes to the threaded mounting bar found at the rear of the setter. Slide a blade support roller onto each blade support tube (See Figure 4) about 1" from the ends of the right and rear tubes and 2 1/2" from the left tube (minor adjustments may be necessary for maximum freedom of circular travel of the bandsaw blade).

Adjust both the left and right index pawl assemblies down out of the way. These will be adjusted later.

The dial indicator of the tooth setter/gauge is pre-aligned at the factory. The alignment of the gauge should be checked when setting up the setter to ensure it has not been bumped out of alignment during shipment.

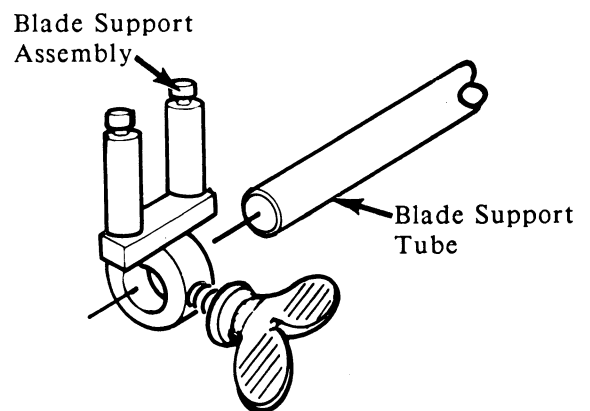


FIGURE 4

SECTION 2.3

TOOTH SETTER/GAUGE OPERATING INSTRUCTIONS - cont'd

TOOTH SETTER/GAUGE SET UP - cont'd

To check the gauge:

1. Turn the plastic housing to adjust the clamp nut (See Figure 5) so the alignment shim can be clamped firmly in the middle of the clamping fixture, directly in front of the gauge foot (be sure the setting point is adjusted back as not to contact the shim). The clamping fixture is opened and closed by throwing the clamp handle forward and back. The clamp nut allows you to open the space between the clamping plates for different thicknesses of blades. It should be adjusted so that a light push on the handle locks the blade (or alignment shim) tight.

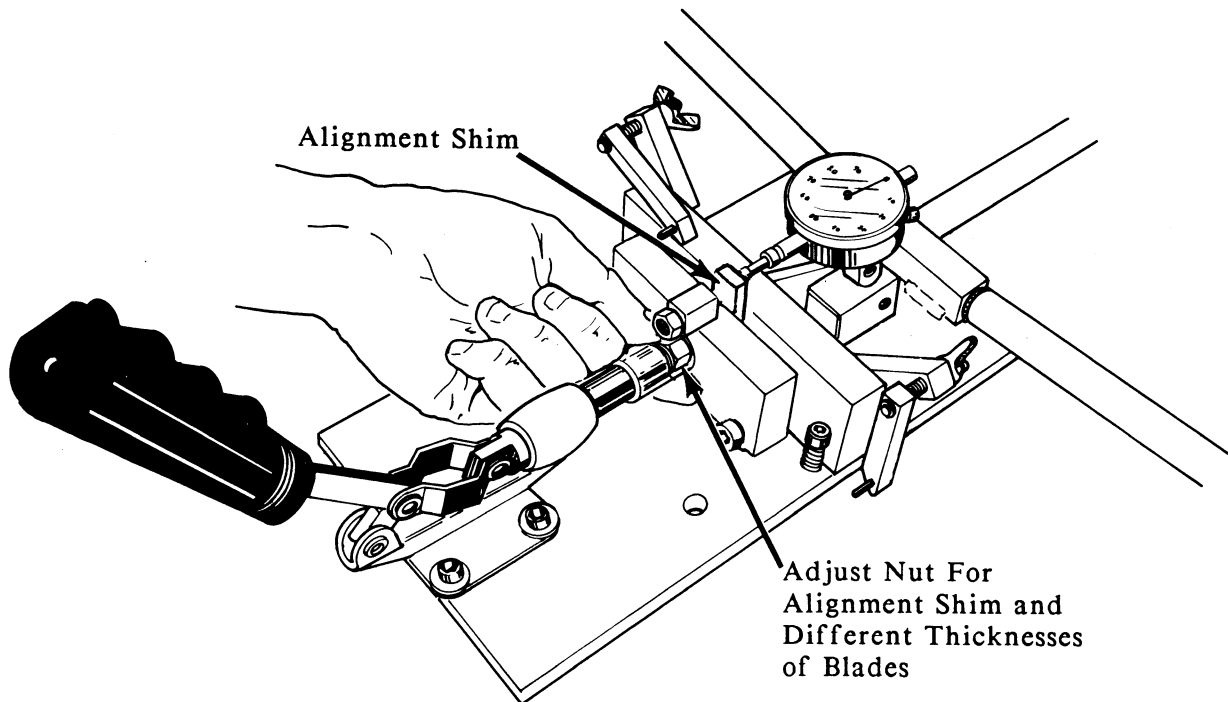


FIGURE 5

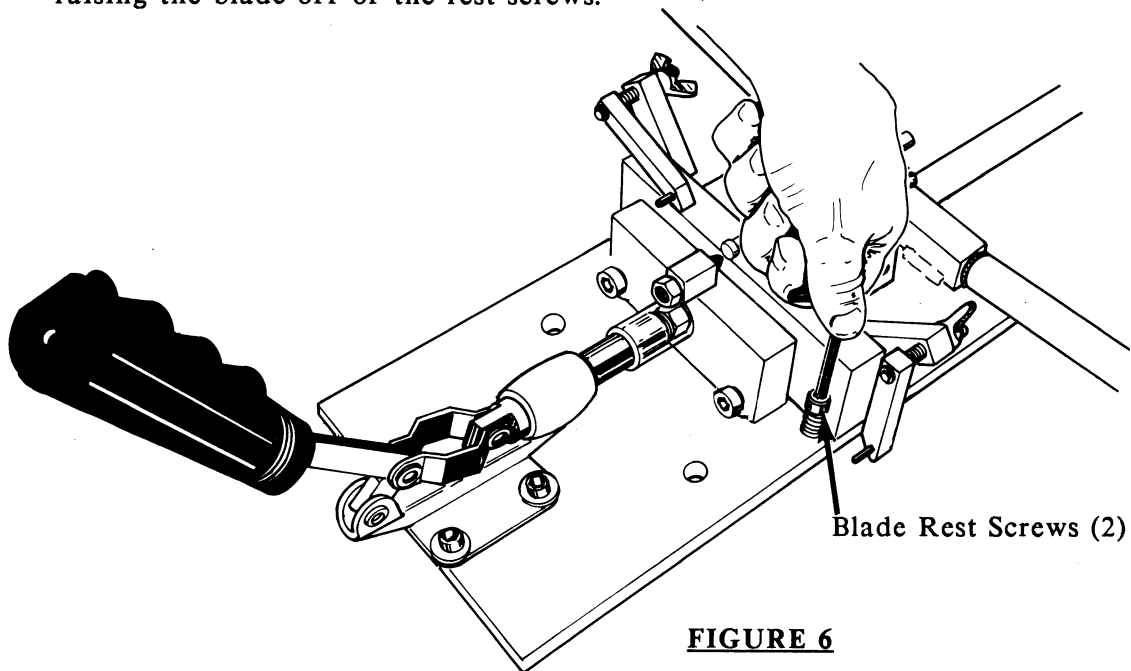
2. With the alignment shim firmly clamped in front of the gauge foot, check the indicator dial and see that it reads '0'. Hold a light to one side of the setter and look in from the opposite side to see that the gauge foot is **completely** flat against the alignment shim. There should be no light visible between the foot and the shim. If this alignment is out, refer to the realignment instructions.

SECTION 2.3

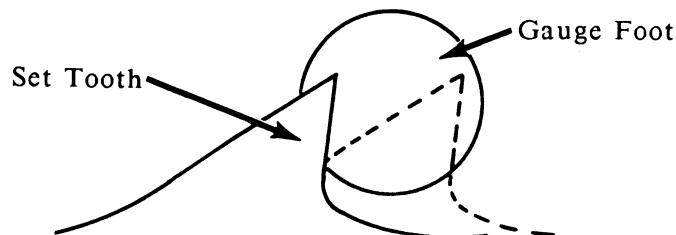
TOOTH SETTER/GAUGE OPERATING INSTRUCTIONS - cont'd

TOOTH SETTER/GAUGE SET UP - cont'd

3. Remove the alignment shim and place a blade in the blade supports so it lies in all three roller assemblies and routes through the clamping fixture of the setter. Readjust the clamp nut so a light push on the clamp handle holds the blade firmly. Adjust the blade rest screws up or down so that the gullet of the blade is even with the top edge of the clamping plates (See Figure 6). During the actual setting operation, the blade rest screws will be adjusted according to tooth height (See Tooth Setter/Gauge Operation). The blade support tubes may need to be bent down in order to prevent them from raising the blade off of the rest screws.



4. Rotate the blade around the supports until a tooth set toward the dial indicator is positioned in front of the gauge foot. Clamp the blade so the tip of the tooth is located to one side of the gauge foot (See Figure 7). Note the reading on the dial indicator, unclamp the blade and move so the tip of the same tooth is located on the other side of the gauge foot. Reclamp the blade and check the dial reading again. When the gauge foot is properly aligned in the horizontal plane, these two readings will be identical (± 0.0005). If adjustment is necessary, realign the gauge per the following instructions.



SECTION 2.3

TOOTH SETTER/GAUGE OPERATING INSTRUCTIONS - cont'd

To realign the gauge:

NOTE: The following adjustments require good lighting and eyesight to achieve the required alignment. It is also recommended that a second person be present to help lock down the gauge while you make sure the gauge remains aligned. This alignment is critical for proper operation of the setter and particular attention should be directed toward achieving exact alignment of the gauge assembly.

1. The gauge assembly is mounted to the setter in such a way as to provide four separate adjustments (See Figure 8). Loosening Bolt 'A' allows you to adjust the vertical angle of the indicator. Loosening Bolt 'B' will allow you to slide the gauge assembly forward and back. Loosening Set Screw 'C' will allow you to pivot the indicator horizontally and raise or lower the indicator. Adjustments of the gauge are explained in the following steps.

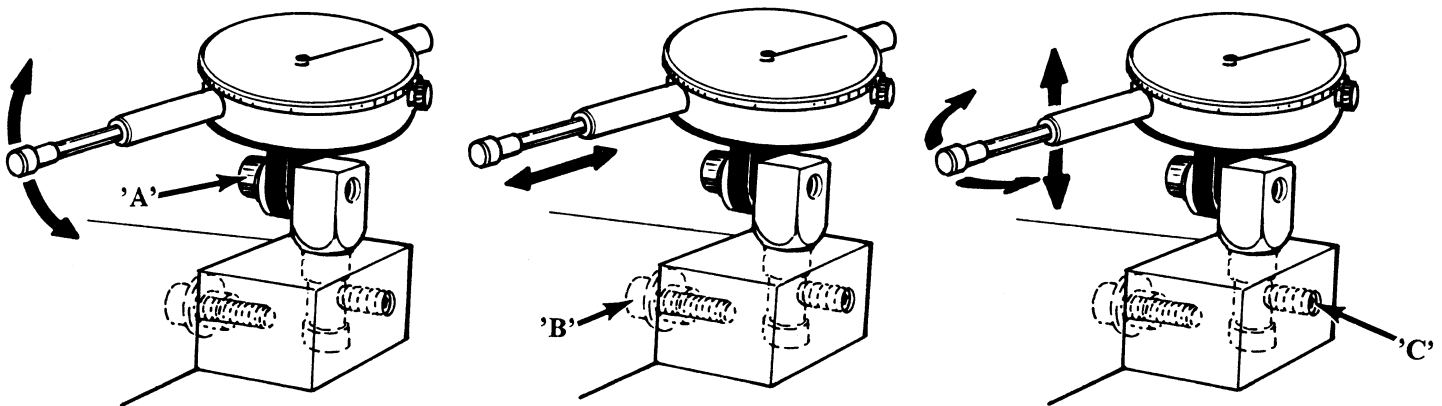


FIGURE 8

2. Clamp the alignment shim in the clamping fixture as described previously.
3. Adjust the face of the dial indicator so the '0' is at approximately the 12 o'clock position. Tighten the dial lock to maintain this adjustment. Hold a light behind one side of the setter and look in from the opposite side to check that the gauge foot is **completely** flat against the shim. There should be **no** light showing between the shim and the foot. If the gauge foot is not completely flat against the shim, loosen Bolt 'A' and adjust the vertical angle of the indicator so that no light shows between the foot and the shim. Retighten Bolt 'A' and check the reading of the dial indicator. If the indicator reads '0', go on to the next step. If not, loosen Bolt 'B' and slide the gauge assembly forward or back until the indicator reads '0'. Be sure the gauge foot remains flat against the shim and retighten Bolt 'B'.

SECTION 2.3

TOOTH SETTER/GAUGE OPERATING INSTRUCTIONS - cont'd

TOOTH SETTER/GAUGE SET UP - cont'd

4. Remove the alignment shim and mount a blade in the blade supports as previously described. Readjust the clamping fixture and blade rest screws as described earlier. Rotate the blade around the supports until a tooth set toward the dial indicator is positioned in front of the gauge foot. Throw the clamp handle to clamp the blade so the tip of the tooth is located to one side of the gauge foot (See Figure 9). Note the reading on the dial indicator, unclamp the blade and move so that the tip of the same tooth is located on the other side of the gauge foot. Reclamp the blade and check the dial reading again. When the gauge foot is properly aligned in the horizontal plane, these two readings will be identical ($\pm .0005$).

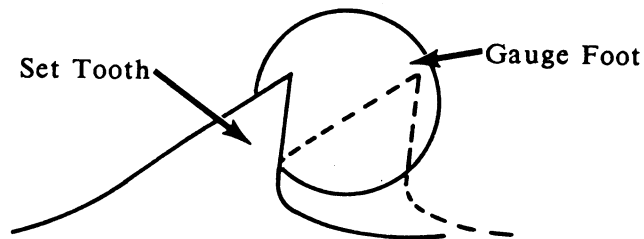


FIGURE 9

5. If adjustment of the gauge in the horizontal plane is necessary, loosen Set Screw 'C' and pivot the gauge slightly. Recheck with a set tooth on both sides of the gauge foot again. Adjust until the same reading occurs with the blade clamped so the tooth is at either side of the gauge foot (within .0005). Loosening Set Screw 'C' also allows you to raise and lower the gauge assembly. The gauge should be adjusted so that the tip of the teeth of a blade are positioned above the center of the gauge foot.

The gauge assembly is properly aligned in the vertical plane when the dial indicator reads '0' while the gauge foot is completely flat against the alignment shim. The gauge assembly is aligned in the horizontal plane when the dial indicates the same measurement of set when a set tooth is clamped on either side of the gauge foot. Time should be taken to accurately achieve both the vertical and horizontal alignments. Once the gauge assembly is aligned, it should not need readjusting although periodic checking is recommended to be sure the alignment has not been lost due to jarring or use of the tooth setter.

TOOTH SETTER/GAUGE OPERATION

Once the tooth setter/gauge alignment has been checked and necessary adjustments made, it can now be used to measure and reset blades.

It is recommended that the setter/gauge be used to measure new blades to check for inconsistent set teeth. It should also be used to check a used blade to see if it requires resetting. A maximum set of .017" (for .035" blades) or .021" (for .042" blades) is recommended for most cutting applications. When a blade is sharpened, the amount of set is reduced. The set should not be allowed to fall below .011" (for .035" blades) or .015" (for .042" blades). The set should not vary more than .001" (\pm) from one tooth to the other.

SECTION 2.3

TOOTH SETTER/GAUGE OPERATING INSTRUCTIONS - cont'd

TOOTH SETTER GAUGE OPERATION - cont'd

To measure the set of a blade:

NOTE: The tooth setter/gauge sets and measures the teeth that are set away from the operator toward the dial indicator. The blade will need to be inverted (inside-out) to set/measure the teeth set in the opposite direction. There are two ways to measure tooth set in a blade:

1. Mount a blade in the setter as previously discussed in the alignment portion of this section. Adjust the blade rest screws so the point of the tooth will lie approximately at the center of the gauge foot. Adjust the setting point back away from the blade and gauge foot until there is no contact with the blade when the clamp handle is thrown. Simply rotate the blade around, checking at random some of the teeth on that side of the blade. After you have a good idea of how much set there is on that side of the blade, remove it from the unit, invert it and check the other side in the same manner. If the average of set is within 1 or 2 thousands from one side to the other, the blade should perform very well (assuming that the set on both sides falls within the limits previously discussed). If the average is off by 3 or more, then the blade should be reset according to the standards for that particular blade.
2. If you have already completely set up your tooth setter, and don't want to change the adjustment of the setting point, follow this method of checking the set in your blade. If the blade is mounted in the setter with the teeth pointing to the right, you will be measuring the set of the tooth from the left side of the gauge foot. (Make sure the setting point is not touching the blade in any way). When you invert the blade to check the other side of the blade, you will be gauging the set from the right side of the gauge foot, again making sure the setting point does not contact the blade while you are checking the set.

The reading on the dial indicates the amount the tooth is set beyond the body of the blade. The teeth of a new blade should have approximately .017" (.035" blades) or .021" (.042" blades) set. If you find a few teeth that are bent too far, they will have to be bent back with pliers and reset. If an entire side of the blade has been set too heavily, the tooth setter can be used to push the set out of the teeth. This will allow you to reset the teeth to the setting you desire. If it is not set enough, the setting point should be adjusted out to bend the tooth more (See tooth resetting instructions). Check every third tooth for proper set until you reach the weld again, resetting those teeth that have too much or too little set. Remove the blade and invert it. Again, check the teeth that are bent back toward the gauge starting at the weld, resetting as necessary.

SECTION 2.3

TOOTH SETTER/GAUGE OPERATING INSTRUCTIONS - cont'd

TOOTH SETTER/GAUGE OPERATION - cont'd

After a blade has been sharpened two or three times, enough material has been removed from the face of the tooth to reduce the set to a point where the blade will not cut efficiently. The set in the teeth should not be allowed to fall below .011" (.035" blades) or .015" (.042" blades).

Blades should always be reset BEFORE sharpening. The setting process actually bends the FACE ANGLE of the tooth as much as 10 degrees from 90. Sharpening after setting will square the teeth back to the proper face angle.

Be sure the blade is clean before placing it in the setter. Sap buildup on the blade or tooth will give false set readings. Metal burrs created by sharpening may also cause false readings. These burrs usually are removed while sawing and should only present a problem if you try to measure the set directly after sharpening without using the blade first.

To reset the teeth of the blade:

1. Place the blade in the setter and rotate the blade to bring the weld (or of one the welds) into the clamping/setting assembly, making sure the teeth are pointing to the right. You will be starting with the first tooth to the right of the weld that has been set back toward the dial indicator. Position that tooth in front of the gauge foot on the dial indicator. Adjust the clamp nut so a light push on the clamp handle will lock the blade firmly in position.
2. Adjust the blade rest screws so the setting point will contact the proper point on the tooth (See Figure 10). As tooth height varies due to "gumming out" of the gullet during sharpening, the rest screws will need to be adjusted to ensure the setting point contacts the tooth at the midpoint of its height. Slide the blade to the left or right so the setting point contacts the tooth as close to the front edge of the face as possible. Lock the blade in position with the clamp handle.

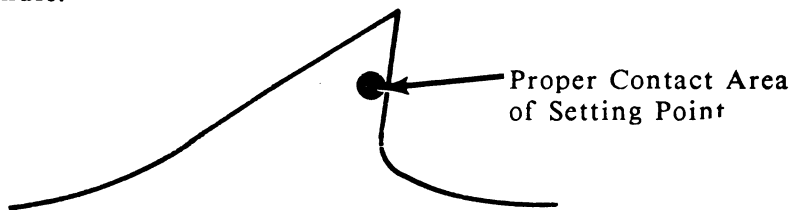


FIGURE 10

3. Adjust the right side index pawl firmly against the tooth two teeth to the right of the one being set. Lock the pawl in position with the allen wrench provided. (If you are like most customers, the tooth spacing in your blades is probably not very accurate in the first couple of teeth. If this is the case, you will be better off adjusting the indexing pawl on a set of teeth 1/2 way around the blade, then come back to the weld. You may have to lift the pawl out of the way and locate the teeth by eye, until the tooth spacing becomes more regular).

SECTION 2.3

TOOTH SETTER/GAUGE OPERATING INSTRUCTIONS - cont'd

TOOTH SETTER/GAUGE OPERATION - cont'd

4. Loosen the setting point lock nut and adjust the setting point with the allen wrench until it begins to bend the tooth against the gauge foot of the dial indicator.

Example: If you are setting an .042 blade and you want to set it from .015 set up to .020 set, you will need to bend the tooth to approximately .040 as the "memory" of the tooth will cause it to spring back to approximately .020 set. The .040 dimension may need to be adjusted up or down depending on where the tooth bends back to. To check the amount of set in the tooth, release the clamp handle and move the blade slightly to the left so the tooth is still in front of the gauge foot but is not contacted by the setting point when the clamp handle is thrown. Push the clamp handle forward to lock the blade in position, making sure the setting point does not contact the tooth. The reading on the dial is the amount of set the tooth now has. If it is too much, bend the tooth back with pliers and readjust the setting point back. If the set is not enough, readjust the setting point forward. Repeat the setting procedure for the first tooth until the desired set has been obtained.

5. Unclamp the blade, loosen the lock nut on the setting point without changing the adjustment of the setting point, then turn the setting point 1/4 to 1/2 turn clockwise, then tighten the lock nut again. This adjustment will cause the setting point to bend the tooth to the .040 dimension before the clamp reaches its fully closed and locked position. By doing this, you can visually bend each tooth to the .040 dimension. Due to variable tooth heights, variable tooth spacing, and different steel structure in every tooth, you will get more consistent results by visually bending each tooth to the .040 dimension than you will letting the clamp bottom out every time.
6. Slide the blade to the left until the third tooth from the one just set comes in front of the gauge foot. Push the blade to the right to place a tooth against the index pawl. Throw the clamp handle slowly, being sure the setting point will contact the tooth in the proper spot. (Adjusting the indexing pawl may be necessary every time you set a different blade). Push on the clamp handle until the tooth has been set at the pre-determined dimension, and then check the set in that tooth. You may check every tooth if you want to be positive that every tooth has been set to the dimension you want or you may spot check every fourth or fifth tooth to make sure you are still setting the teeth to the proper dimension. Repeat for every third tooth until the weld is reached. Remove the blade and invert it. Reinstall the blade in the tooth setter and repeat the above steps to set the teeth bent in the opposite direction, using the left side index pawl assembly. The amount that you have to bend the teeth to end up with the same set as the first side of the blade will, in all probability, differ (i.e., You may have to bend the teeth on the inverted side of the blade to .045 to end up with a .021 set when you only had to bend the teeth on the other side of the blade to .040 to end up with a .021 set).

SECTION 2.4

LTADS SHARPENER ASSEMBLY/OPERATING INSTRUCTIONS

The Model LTADS Blade/Chain Saw sharpener is shipped completely assembled except for the grinding wheel installation, blade support assembly, and wet-grind system.

ELECTRICAL HOOK-UP

The Model LTADS Sharpener can be powered in three different ways:

1. 115V AC
 2. 12V DC (From Wood-Mizer, LT30 & LT40 series only)
 3. 12V DC (From Battery)
1. Using the AC/DC converter provided, plug the standard power cord into a grounded, 15 amp 115 volt receptacle protected by a fuse or circuit breaker. Mount the grinder per mounting instructions. Plug the Model LTADS sharpener into the pigtail socket of the AC/DC converter. The switch on the sharpener head will start and stop the motor.
 2. When using the LTADS in the field with a LT30 or LT40 Wood-Mizer, use the provided socketed pigtail with battery clips. Attach the clips to the back of the power feed control as shown in **Figure 1**. The positive lead (red) should be clipped to the longer of the two power feed posts. Ground the negative clip (black) to the short power feed post.
 3. The LTADS sharpener can also be powered directly by a 12 volt DC storage battery. Use the provided socketed pigtail with the clips as before, but attach the clips to the terminals of a car or truck battery (See **Figure 1A**). Plug the grinder lead into the pigtail socket. Check the motor shaft rotation. Rotation of the shaft should be counter-clockwise when viewed from the end of the motor shaft. If direction is wrong, reverse the two clips on the battery terminals.

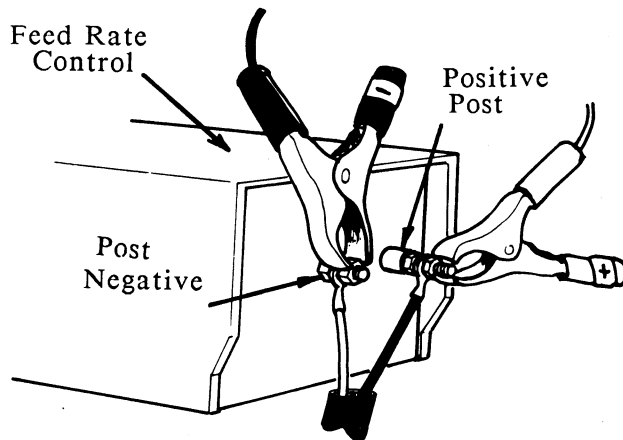


FIGURE 1

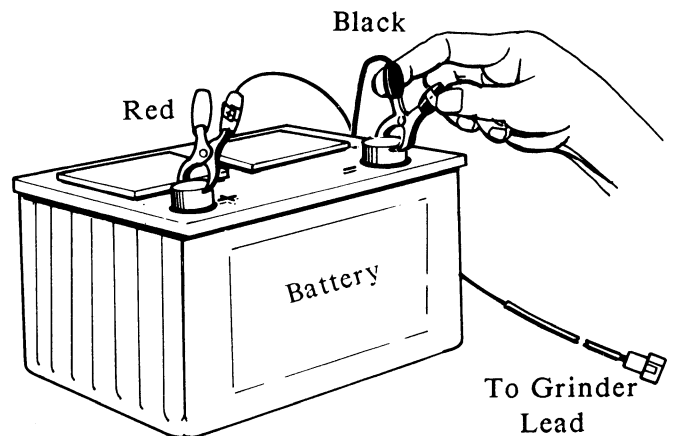


FIGURE 1A

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

MOUNTING INSTRUCTIONS

The LTADS Sharpener can be mounted either on a bench or table, or on the LT30 or LT40 Wood-Mizer.

1. For use where 115 volts is available, mount the grinder solidly on a bench or table using the two mounting holes in the grinder base. The mounting holes should be no more than 1" back from the front edge of the bench to allow mounting of the wet-grind catch tray. Mount the grinder so there is at least 32" clearance to the rear and to each side of the grinder to allow enough room for the blade supports. Use the "J" hooks, steel and rubber washers, wing nuts, and wet-grind catch tray to mount the sharpener to the bench top as shown in Figure 2.

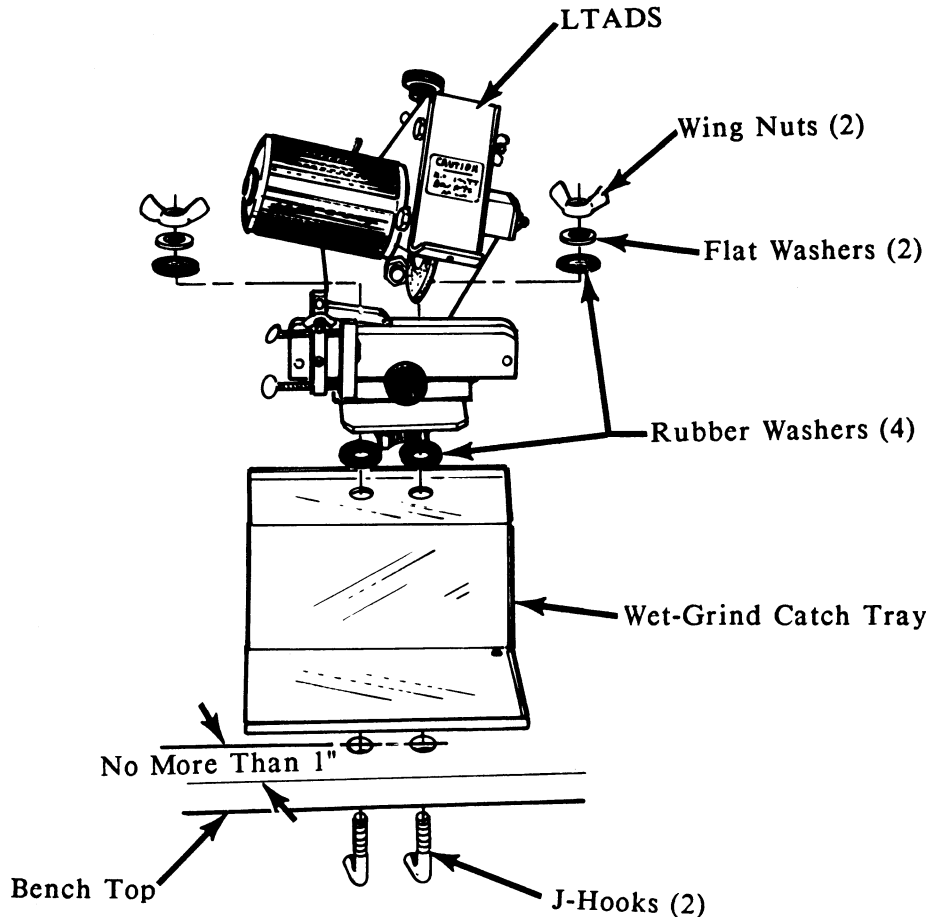


FIGURE 2

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

MOUNTING INSTRUCTIONS - cont'd

- For use in the field with the LT30 or LT40 Wood-Mizer mill, move the carriage forward to allow a 32" clearance for the blade. The grinder can be mounted at the end of the bed rail as shown in **Figure 2A**. The two "J" hooks provided can be used to lock the grinder to the bed rail by simply hooking them under the ramp mounting pin and securing with two flat washers and wing nuts.

Thread the three blade support tubes into the tapped holes located near the bottom of the sharpener base. Be sure the support tubes are seated against the base plate. Slide the blade support roller assemblies onto the tubes as shown in **Figure 2B**. The blade rollers should be 1" from the ends of the right and rear tubes, and 2 1/2" from the end of the left tube (minor adjustments may be necessary for maximum freedom of circular travel of the bandsaw blade).

Chainsaw blades can be sharpened in either of the above set-ups. If additional portability is required, the grinder can be mounted by the user to suit his application.

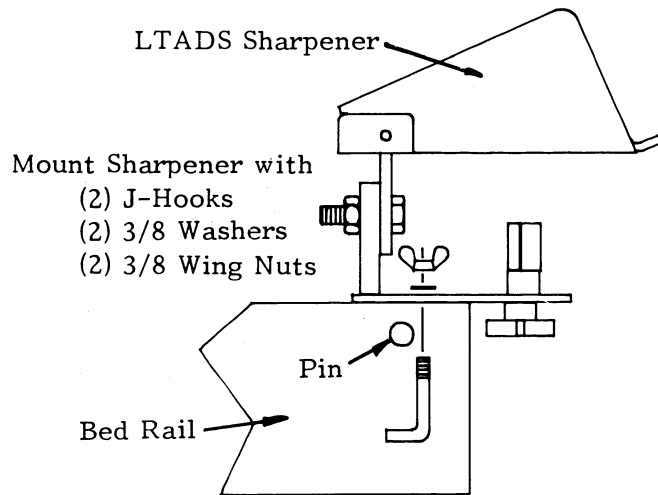


FIGURE 2A

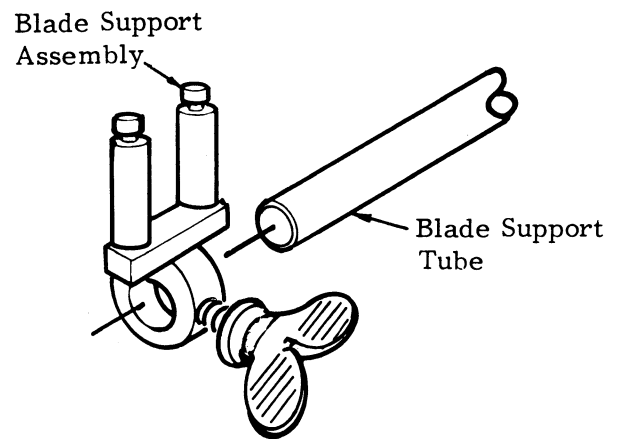


FIGURE 2B

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

WET-GRIND SYSTEM INSTALLATION

The LTWG Wet-Grinding System is simply a system to cool the blade during the blade sharpening process. Cooling the blade during grinding will assure you that the teeth will maintain the hardness that is so critical to maximizing cutting time between sharpenings.

1. With the LTADS Sharpener and wet-grind catch tray already mounted, assemble the mist guard to the tapped hole in the sharpener handle with the 1/4-20 x 1/2" bolt as shown in Figure 3.

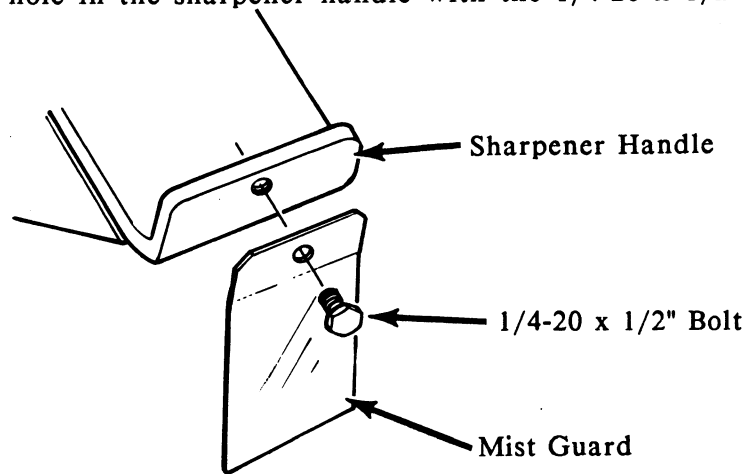


FIGURE 3

2. Apply silicon caulk to the eight corners, bends, and grain hole in the catch tray to stop any potential leaks. Only a small amount of caulk is necessary at the exposed bends in the catch tray, as there is very little water that drains from the upper level of the catch tray.
3. Assemble the three pieces of the adjustable coolant hose as shown in Figure 3A. The pieces simply push together. After assembling the hose, fasten it to the water jug by screwing the threaded end of the hose into the valve of the jug. A thread sealer may be necessary to prevent leakage.

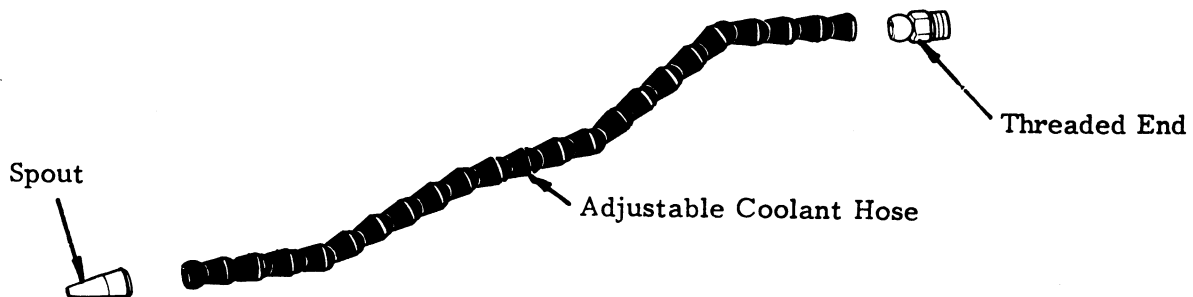


FIGURE 3A

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

WET-GRIND INSTALLATION - cont'd

4. **COOLANT MIXTURE:** Fill the five-gallon jug with approximately 4 gallons of water. Add to the water about 1/3 of a bottle of coolant concentrate provided. Set the jug to left and behind the sharpener (See Figure 3B). Lay the jug on its side so that the valve is at the lower front. Elevate the jug so that the bottom of the jug is no lower than the top of the blade set in the sharpener. Assemble the drainage hose to the valve underneath the catch tray. Drain the coolant into a bucket as it can be reused several times.
5. **USING THE WET-GRIND DURING SHARPENING:** Use the valve on the water jug to control the flow of coolant to the blade. Adjust the coolant hose so a steady stream of coolant flows on the tip of the tooth to be sharpened. As you sharpen and the water level in the jug goes down, water pressure will drop also. Adjust the jug valve as necessary to maintain a consistent flow onto the tip of the tooth. Allow used coolant to stand for a period of time so that the residue can settle to the bottom. Pour off reusable fluid, avoiding the sediment.
6. After the blade has been sharpened, let the grinding wheel spin freely for 15 seconds to dry any excess fluid from its surface.

NOTE: If circumstances require that plain water be used for coolant, clean the grinding unit with a light oil (WD-40) to prevent the assembly from rusting when not in use.

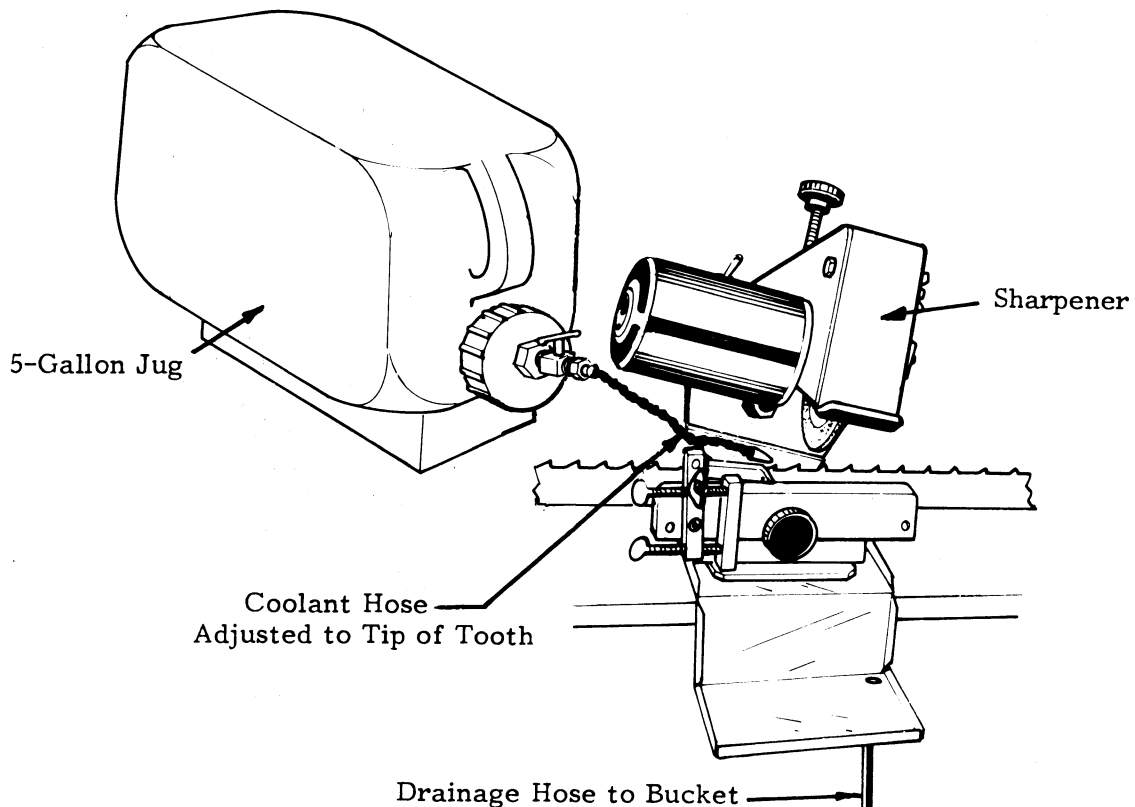


FIGURE 3B

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

GRINDING WHEEL INSTALLATION

1. Select a 5" diameter, 3/16" wide grinding wheel with a 1/2" bore for sharpening Wood-Mizer blades.

CAUTION: Check the grinding wheel for cracks or chips before using it. If the wheel is cracked or chipped, **DO NOT USE IT**. Do not use the wheel after it wears to the edge of the blotters. Remove the grinding wheel while transporting the sharpener to prevent cracking or breakage due to jarring or bumping of the unit.

2. Remove the right side cover from the grinder head by removing the wing nut. Remove the knurled knob from the motor shaft. Slide a wheel blotter on the shaft, then slide the selected wheel in place. Slide a second wheel blotter on the shaft and replace the knurled knob, flanged side towards the grinding wheel and hand tighten. Replace the cover and wing nut. Prior to grinding, check that the grinding wheel rotation is counter-clockwise when viewed from the shaft side.

SHARPENER SET-UP

Once the sharpener has been mounted and the grinding wheel installed, adjustments need to be made to ensure proper grinding of the particular blade being sharpened. The following adjustments should be made when sharpening Wood-Mizer® blades. Set-up for chainsaw blades is described later in this section under saw chain sharpening instructions.

REFER TO SECTION 2.1 OF MANUAL FOR SPECIFIC INFORMATION ON BLADE TERMINOLOGY

1. Set the tooth face angle scale at 0 (See Figure 4). The zero on the scale should also line up with the 0 mark that has been punched into the base plate. As the wheel wears, the blade clamping fixture may be moved away from the operator to keep the blade directly under the center of the grinding wheel. (The other marks are for grinding Micro or Super [Round File] Chisel type saw chain).

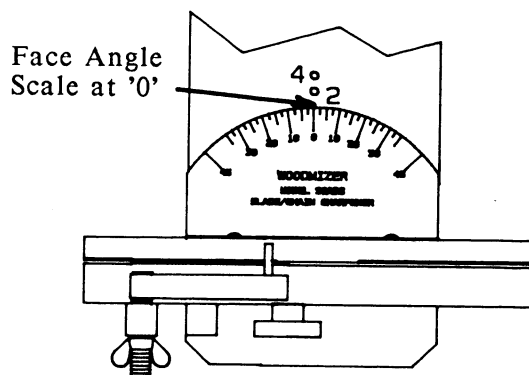


FIGURE 4

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATION INSTRUCTIONS - cont'd

2. Set the hook angle by using the indicators at the back of the throat (See Figure 5). The numbers and hash-marks indicate how many degrees the grinding head is tilted for hook angle. Set the hook angle gauge with the rivet head at the back of the throat. As a general rule, this angle should be set at $12\frac{1}{2}$ degrees for most woods. The hook angle can range from 10 to $12\frac{1}{2}$ degrees for hardwoods and $12\frac{1}{2}$ to 15 degrees for softwoods.

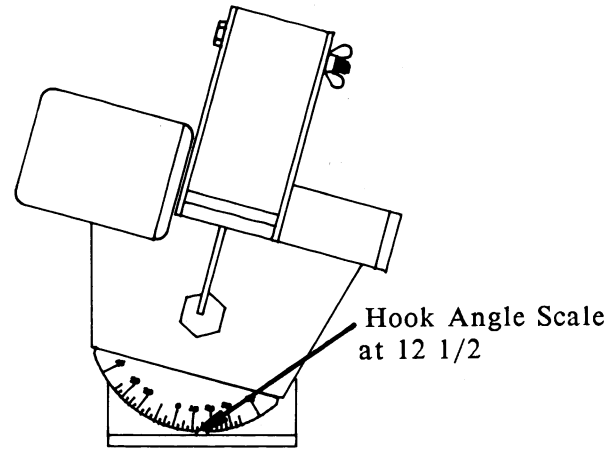
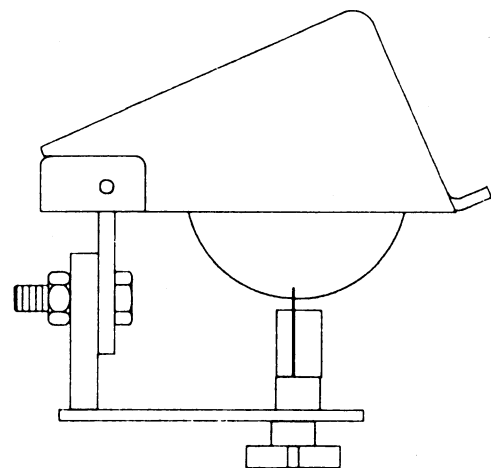


FIGURE 5

INSTALLING THE BLADE

1. Remove the 16 gauge shim from between the clamping plates during set-up steps. Set the blade into the clamping plates with the teeth of the blade facing to the right. Lay the blade in the three roller supports.
2. Position the blade so the first tooth right of the weld is positioned at the front of the machine. Position blade clamping fixture so that the wheel's lowest point contacts the blade gullet. To adjust, loosen the star screw knob underneath the unit (See Figure 6).
3. Turn the clamping knob so that the fixture holds the blade straight, yet still slides easily right to left.



CENTER WHEEL OVER BLADE

FIGURE 6

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

CAUTION: ALWAYS WEAR EYE PROTECTION WHEN OPERATING THIS EQUIPMENT

DRESSING THE GRINDING STONE

1. Position the first tooth right of the weld so the wheel will lightly touch new metal on the length of the tooth face. Before sharpening a new blade, dress the wheel to match the shape of the tooth. There are three areas of the wheel that need to be dressed to ensure proper sharpening. (See Figure 7). Dress Section "C" first by holding the dressing stone horizontally and dress a flat surface on the bottom of the grinding wheel (See Figure 8). This is the area that will grind the gullet base.

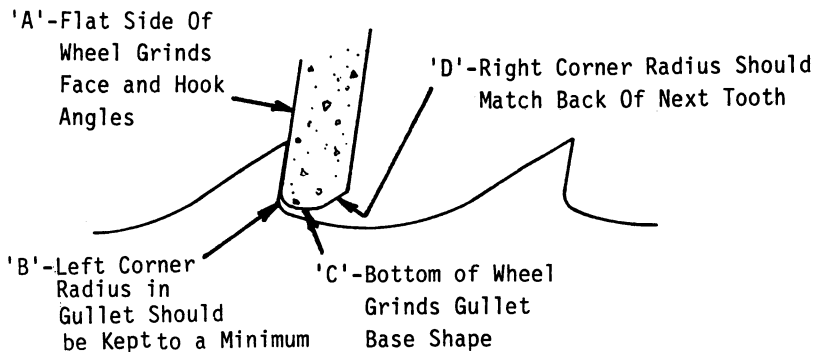


FIGURE 7

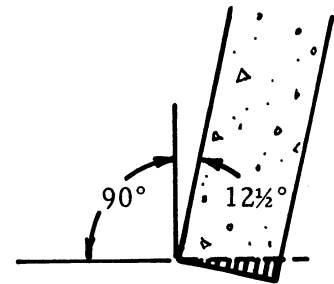


FIGURE 8

2. After obtaining the results shown in Figure 8, dress a small radius on Section "B" of the grinding wheel as shown in Figure 9. During sharpening, this is the section which does most of the grinding and therefore requires the most maintenance. As you sharpen, Section "B" will wear into a larger radius and start wearing into Section "A" as shown in Figure 10. The result will be little or no hook angle left in the tooth. The straight portion of the tooth (Section "A") should extend approximately 3/4 of the way down the tooth height (See Figure 11). If Section "A" is 2/3 of the tooth height or less, the wheel needs to be redressed. Recommended procedure for re-dressing the wheel is to take the grinding wheel off, turn it around and dress the other side of the wheel as described earlier. NEVER attempt to dress the wear area by using dressing stone on side surface (Section "A") of the wheel.

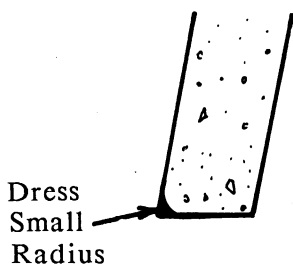


FIGURE 9

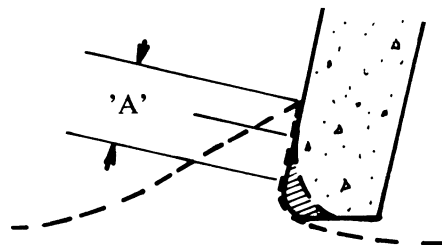


FIGURE 10

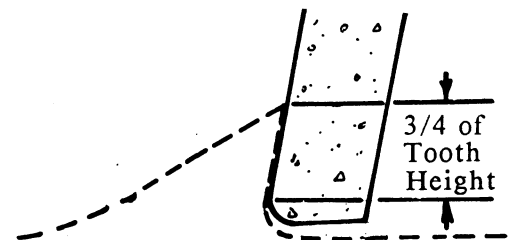


FIGURE 11

3. Section "D" of the grinding wheel is only needed when "gumming out" the gullet as described later in this section. Section "D" needs to be dressed so that it doesn't contact the gullet of the tooth.

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

SHARPENING THE BLADE

NOTE: Sharpening procedures are the same for .035" and .042" blades. The grinding of the .042" blade should SEEM heavier because of the extra .007" being removed.

1. It is recommended that new blades be sharpened before using. When the blades are manufactured, they are sharpened and then set. The setting process twists the face angle out as much as 7 degrees. Sharpening a new blade with the face angle scale set at '0' will true up the face angle of all the teeth to 90 degrees. You should not have to grind any material from the gullet on the first sharpening.
2. With the sharpener properly assembled, the blade inserted, and the grinding wheel dressed, you are ready to sharpen your blade. Locate the first tooth right of the weld and position in the clamping fixture so that the grinding wheel lightly grinds against the face of the tooth when lowered. Clamp the blade firmly and set the depth adjustment on the sharpener so that the grinding wheel will grind only the straight portion of the tooth. You will not enter the radius of the tooth until subsequent sharpenings. Again, the goal of sharpening a new blade is to square the face angle to 90 degrees.
3. Turn the sharpener on and GRADUALLY lower the head until the wheel contacts the tooth. Do not "chop" the grinding wheel into tooth. This will cause the grinding wheel to wear prematurely and grind improper hook angles into the teeth. (NOTE: The spring action of the grinder head may be made stiffer by tightening the nut on the back side of the machine, and vice versa.
4. Turn off the sharpener and check the tooth just ground. Check to see that the face of the tooth has been ground from the tip down to the end of the straight section. Redress wheel if necessary and recheck tooth face.

5. Now that the first tooth is ground properly, you may index off of this tooth to sharpen the remaining teeth. Flip the index pawl into position in front of the tooth just sharpened. See Figure 12. The index pawl should be in the lower pivot hole. The upper hole is used when sharpening chain saw blades. Adjust the thumb bolt adjusters so that when the sharpened tooth is pushed against the pin, the grinding wheel lightly grinds the second tooth as it did the first.

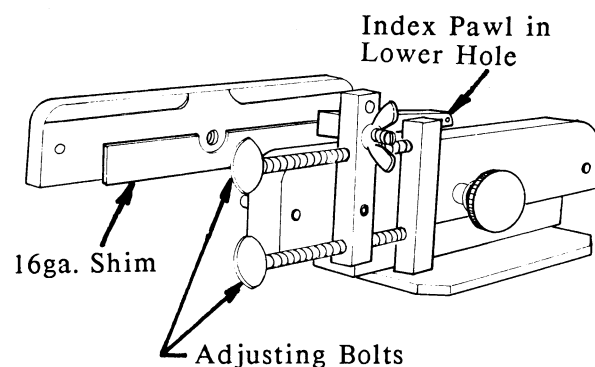


FIGURE 12

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

6. Replace the shim between the clamping plates. This will allow you to completely tighten the fixture, yet still let the blade slide freely. Sharpen each tooth by sliding the blade to the left until the indexing pin falls in front of the tooth just ground, pull (or push) the blade to the right against the pin and grind the tooth by pulling down the sharpener head. Continue around the blade until you reach the weld. Some blades have more than one weld. Never index across a weld, use the freehand method for the tooth right of a weld and then continue to use the index.

NOTE: SOME BLADES DO NOT HAVE CONSISTENT TOOTH SPACING. If, while grinding, you notice the grind starting to become heavy, simply slide the blade slightly beyond the index pawl to re-establish a proper grind of the tooth. Then proceed as normal. Also, adjusting the index too often will result in uneven pitch.

7. As you sharpen a blade and the face of the teeth recede, the tooth height (tip down to gullet) will get shorter. For this reason, it is recommended that from the second sharpening on, you start grinding into the gullet. A good rule of thumb is to grind as much out of the gullet as you grind off the face of the tooth (See Figure 13). When grinding into the gullet, be sure to maintain a smooth radius into the gullet. An inconsistent gullet (See Figure 14) can cause premature blade breakage. Subsequent sharpenings will require a larger amount of the gullet to be ground, until you get to approximately the fourth sharpening. At that time, it will be necessary to gum across the entire gullet (explained later). A tooth height of not less than 3/16" is recommended.

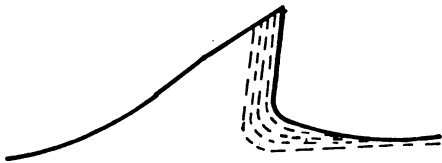


FIGURE 13

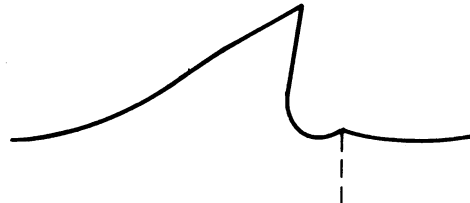


FIGURE 14

8. When a blade becomes dull from cutting, the tips of the teeth become rounded and shiny. To regain a sharp tooth, they must be ground back enough to regain a new edge. If the teeth aren't ground back far enough, they really aren't sharp and the time invested will be wasted because the blade will need to be re-sharpened shortly.

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

GUMMING OUT THE BLADE

At approximately the fourth sharpening of a blade you will need to grind the gullet out to regain at least a 3/16" tooth height. This process is referred to as "gumming out" the blade. Dress the wheel to match the tooth characteristics as before. Dress the lower right corner to match the angle of the back side of the teeth. Find the first tooth right of the weld and sharpen as normal except leave the head down and drag the gullet across the wheel. Raise the head as the next tooth approaches the wheel, leaving a smooth gullet with no sharp breaks. Continue for the remaining teeth until you return to the weld.

TROUBLESHOOTING

1. Improper Hook Angle:

-Worn grinding wheel. Caused by normal wear or heavy "chopping" action down on tooth. Bring grinder head down with a gradual motion to deter premature wearing of wheel.

-Grinding head set at wrong angle. Check indicator at rear of sharpener throat for proper setting.

-Blade being tilted while sharpening. Keep left hand close to clamping fixture to avoid tilting blade at an angle.

Hint: Turn the blade support roller on the right side of the sharpener towards you slightly. Turn the roller on the left side slightly away from you. This will cause the blade to pull down into the clamping fixture while sharpening.

2. Improper Face Angle:

-Base plate set at wrong angle. Check indicator gauge is set at '0'.

-Sharpening before setting the teeth. You should always set and equalize before sharpening. Sharpening will square the teeth back to 90 degrees

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

TROUBLESHOOTING - cont'd

3. Short Time Between Sharpenings:

-Not sharpening teeth enough. If a new edge is not formed on dull teeth when sharpening, the blade is not very sharp to begin with.

-Worn grinding wheel. A worn wheel can cause you to dull a blade worse than it was to start with. Flip the wheel and dress the other side of the wheel.

-Heating the temper out of the teeth. Sharpening a blade causes the teeth to heat up and lose their hardness. When this occurs, the teeth become dull very quickly. Use of the LTWG Wet Grind System (See Section 2.5) eliminates this problem.

-Dirty logs. Mud, sand, rocks, and other foreign matter can cause a blade to dull very quickly. The best way to clean a log is with a high pressure water spray. If this is not available, use a wire brush to clean the side of the log that the blade enters. You may also debark logs if they are the type that will allow this. Another recommendation would be using an old blade to square up the log where fencing, nails, or other debris is suspected inside.

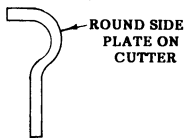
SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

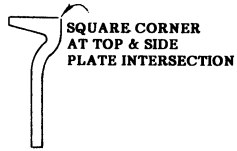
SHARPENING INSTRUCTIONS FOR SAW CHAIN

BEFORE GRINDING SAW CHAIN THERE ARE SEVERAL IMPORTANT POINTS THAT ARE OUTLINED IN THE FOLLOWING PAGES, PLEASE READ THEM BEFORE USING YOUR CHAIN GRINDER.

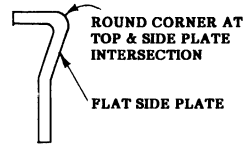
1. Saw Chain Types



A. Chipper Type Chain

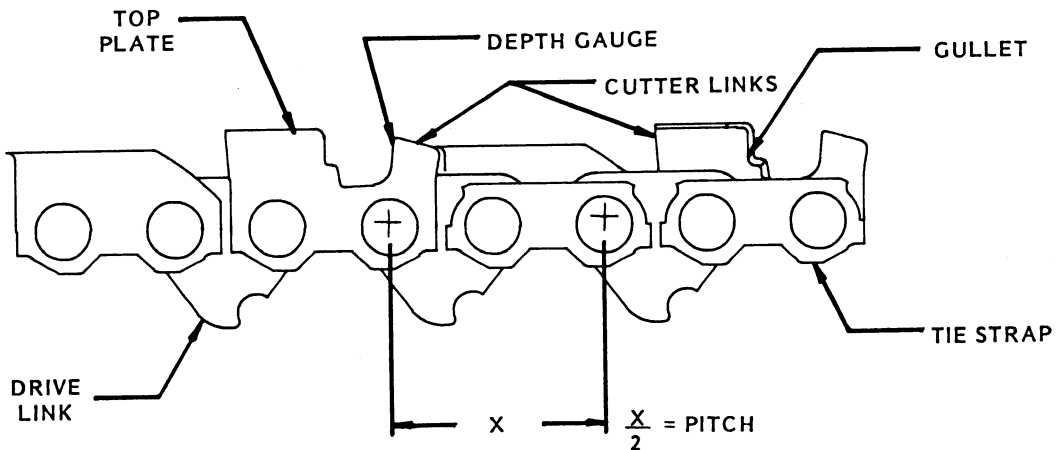
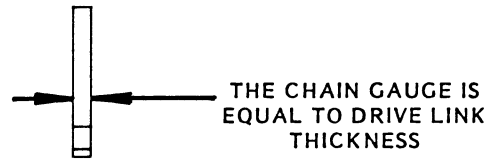
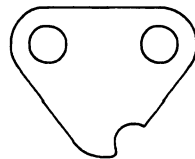
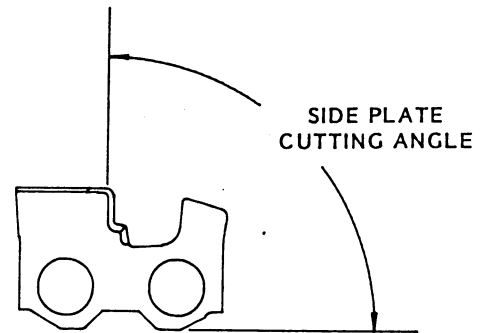
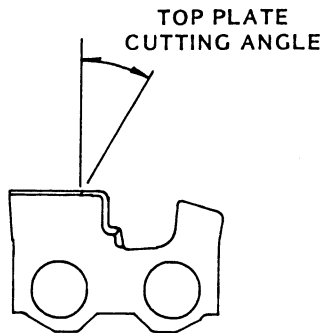
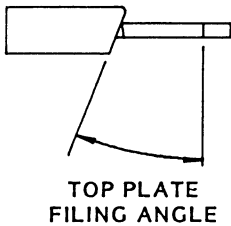


B. Chisel Type Chain



C. Semi-Chisel & Micro Chisel

2. Saw Chain Terminology



SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

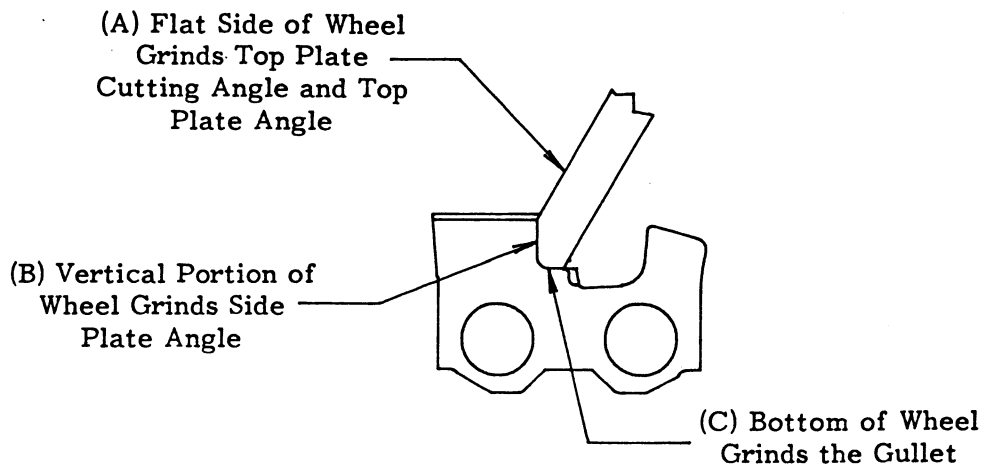
SHARPENING INSTRUCTIONS FOR SAW CHAIN - cont'd

3. Grinding Wheel Dressing (Shaping)

The importance of the grinding wheel form as dressed can only be appreciated when cutting with a saw chain that has been sharpened with a properly dressed grinding wheel versus a saw chain that has merely been ground with an improperly dressed grinding wheel.

The grinding wheel thickness should be approximately the same as the chain manufacturer's recommended chain file diameter.

4. Dressed Grinding Wheel Functions



5. Prepare Saw Chain for Sharpening

- A. Remove Saw Chain from bar.
- B. Clean Saw Chain in solvent to remove pitch and resin.
- C. Inspect Saw Chain for:

Abrasive damage to side plate and top plate cutting edges. The damaged cutting edges should be ground back to completely eliminate damaged portion.

Top plate angle excessively blunt or feathered.

High and low depth gauges and square leading edge of depth gauge.

Side plate angle excessively hooked or backsloped.

6. Select the grinding wheel to be used. The grinder uses a 5" diameter wheel by a 1/2" bore. As a general rule the grinding wheel thickness should be that thickness nearest to or less than the recommended file size.

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

SHARPENING INSTRUCTIONS FOR SAW CHAIN - cont'd

7. The bolt that the pawl pivots from should be in the upper hole for sharpening saw chain. (See Figure 15.) The pawl should be located directly over the chain, and locked in place with the jam nut provided.

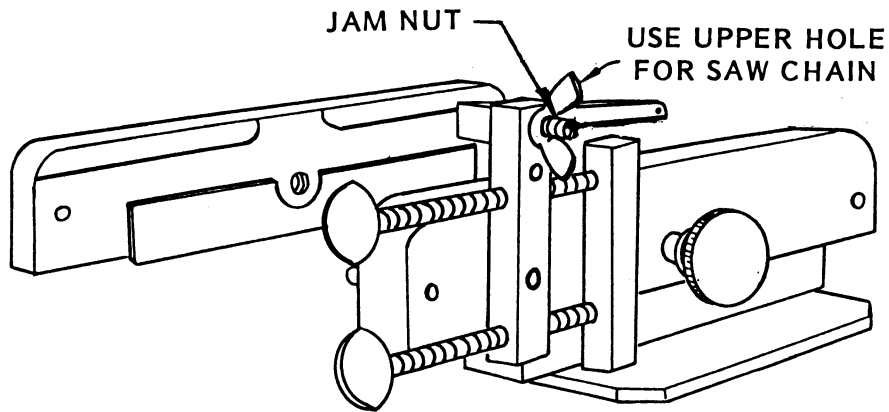


FIGURE 15

8. Make sure the 16 gauge shim is in place between the clamping plates. (See Figure 15.)
9. Place the saw chain in the clamping plates with the cutting edge facing to the right.
10. Set TOP PLATE ANGLE by setting the protractor of the clamping plate assembly to the desired angle. (See Figure 16.) (We will use 30° for an example.) The clamping plate assembly will be moved from front to back as the wheel wears, to keep the blade in proper placement with the wheel.

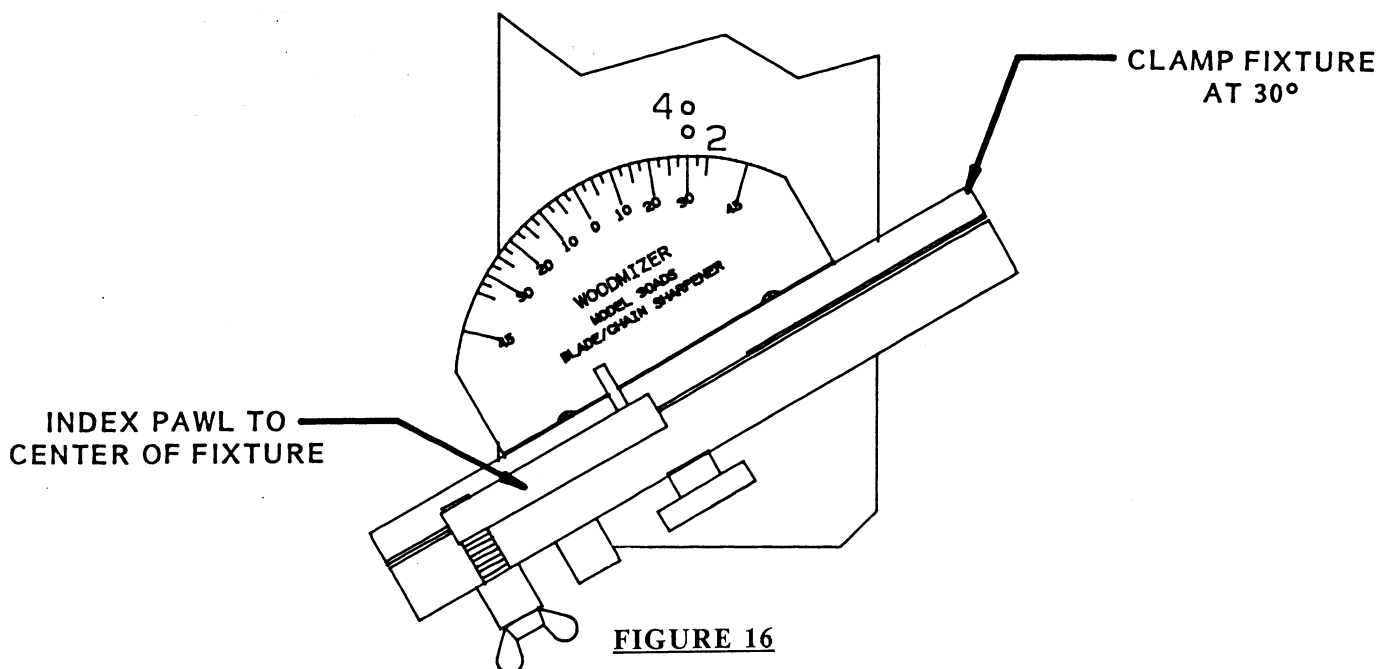


FIGURE 16

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

SHARPENING INSTRUCTIONS FOR SAW CHAIN - cont'd

11. Set TOP PLATE CUTTING ANGLE by setting the scale on the back of the throat to desired angle. (See Figure 17.) (Again we will use 30° for an example.) Follow manufacturer's specifications for recommended angles. This represents degrees this angle tilts past 90° .

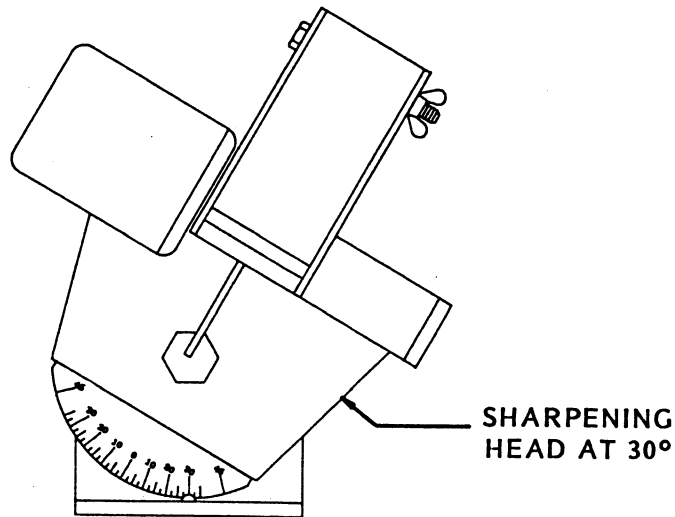


FIGURE 17

12. SETTING OFFSET. The offset allows for the proper Top Plate Cutting Angle to be ground across the full width of the Top Plate of a cutter link. To set offset, move the clamping plates so the cutter link will be located properly under the grinding wheel. (There are offset marks punched in the baseplate of the grinder to be used for reference purposes.) A properly placed cutter link under a grinding wheel is shown in Figure 18. (There will be final adjustments of the offset after the grinding wheel has been dressed.)

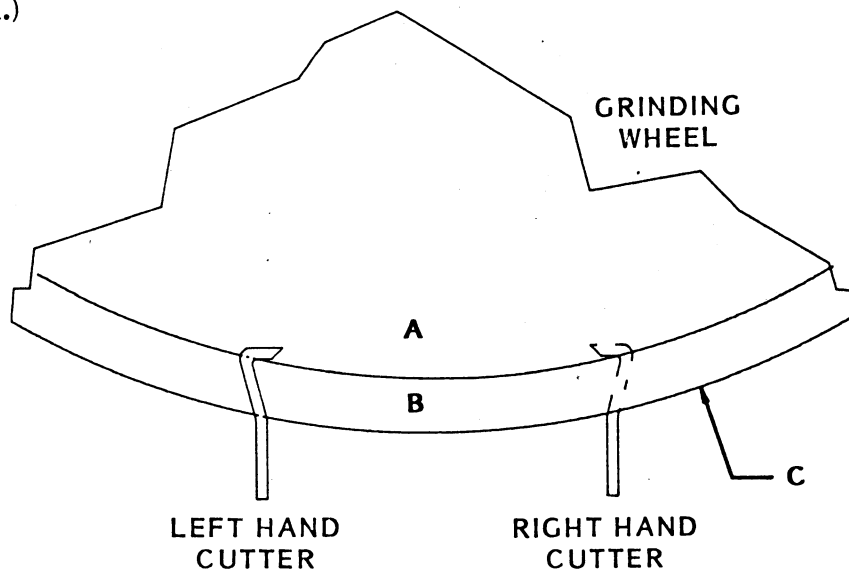


FIGURE 18

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

SHARPENING INSTRUCTIONS FOR SAW CHAIN - cont'd

13. Set **DEPTH OF GRIND**. After setting the Top Plate Angle and Offset, set depth of grind. With the chain securely clamped and the motor turned off, pull the motor down until the grinding wheel sets down in the cutter link to the desired depth. Adjust the depth setting to that depth and lock in place with the jam nut. Depth setting knob located on top of the machine. (There will be final adjustments of the depth setting after the grinding wheel has been dressed.)
14. Dress the **GRINDING WHEEL**. This is one of the most important steps in chain grinding, as the form or shape of the grinding surface of the wheel determines the cutting angles of the chain. (See Figure 19). **READ THIS ENTIRE STEP BEFORE DRESSING THE GRINDING WHEEL!**

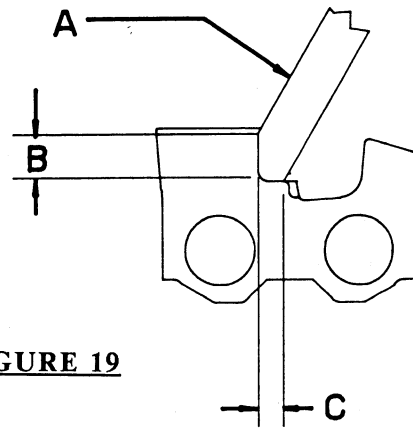


FIGURE 19

Portion "A" grinds the Top Plate Angle and Top Plate Cutting Angle.

Portion "B" grinds the Side Plate Angle.

Portion "C" is used to grind the gullet and to keep it smooth and flat.

To dress a grinding wheel properly, the results and remedies of improper wheel dressing must be known. Using the popular Chisel-type saw chain as an example, Figure 20 shows the proper angles.

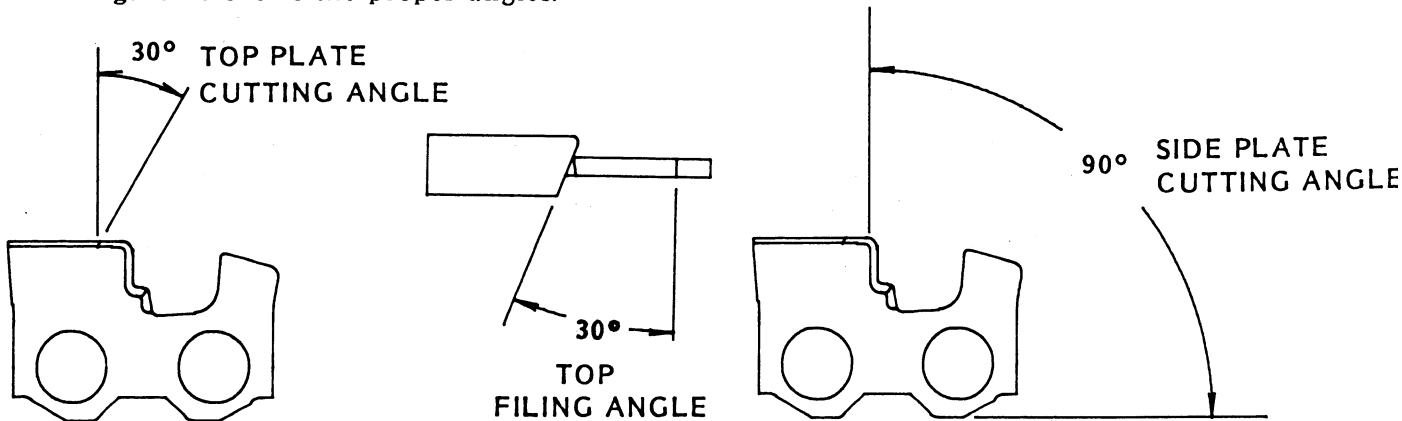


FIGURE 20

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

SHARPENING INSTRUCTIONS FOR SAW CHAIN - cont'd

RECOMMENDED PROCEDURE FOR DRESSING THE WHEEL:

- A. Tilt the cutting head to 30 degrees.
- B. Dress section "C" of the wheel by holding the dressing stone horizontal and dress a flat on the bottom of the grinding wheel (See Figure 21). This is the portion that will grind the gullet area.

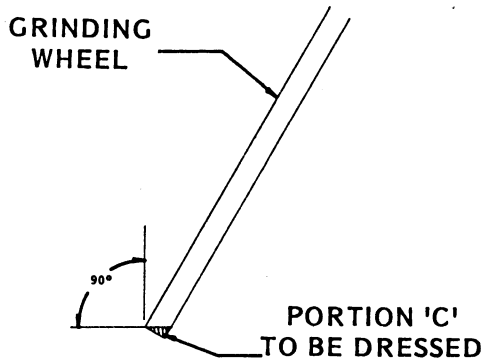


FIGURE 21

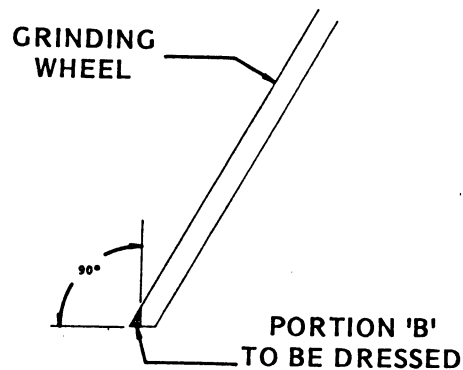


FIGURE 22

- C. After obtaining the results shown in Figure 21, hold the dressing stone vertical and dress the vertical portion "B" which grinds the side plate angle of the cutter link (See Figure 22). If you dress the wheel too far at this point, the portion "B" will be too large and will cause the side plate angle to run into portion "A" and "C" during the grinding process.

Figures 23 through 25 show results and remedies of improper wheel dressing.

Curved or blunt Top Plate Angle caused by worn wheel (See Figure 23). The radius of portion "B" has worn into the "A" region. To correct, redress the wheel to decrease the size of area "B" on the wheel.

Positive Hook on Side Plate Angle (See Figure 24). Make sure that portion "A" is grinding only the Top Plate Cutting Angle and not the Side Angle. Make sure portion "B" of the grinding wheel has been dressed vertically.

Negative Hook on Side Plate Angle (See Figure 25) caused by the portion "B" of the grinding wheel being dressed with a negative angle. Make sure portion "B" of the grinding wheel has been dressed vertically.

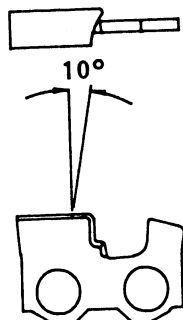


FIGURE 23

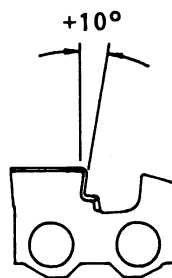


FIGURE 24

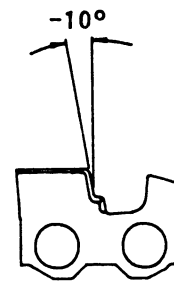


FIGURE 25

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

SHARPENING INSTRUCTIONS FOR SAW CHAIN - cont'd

15. SET THE INDEXING PAWL. Using the thumb bolt adjuster (front left of the machine), set the indexing pawl to the back side of the cutter that is being sharpened (See Figure 26), to a position that will sharpen just enough cutter to regain a new, clean edge. After setting the indexing pawl, return to steps 12 and 13 and Figure 18 to make the final offset setting and also the correct depth setting to leave a clean, flat gullet.

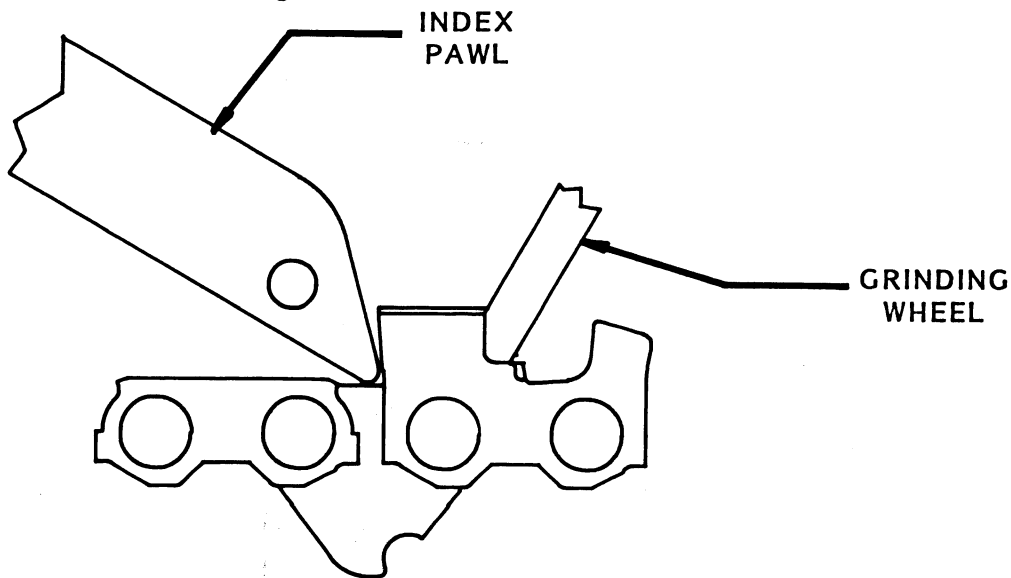


FIGURE 26

16. CLAMPING THE CHAIN. Make sure the shim between the clamping plates is in place. The chain should be clamped when grinding each tooth and released when indexing or when adjusting the indexing pawl.
17. INDEXING THE CHAIN. To index chain (move chain to next cutter to be sharpened), loosen the clamping knob about a 1/4 turn, pull chain to the right until the Index Pawl drops in back of the next similar cutter link to be sharpened. Then pull chain to the left to seat the back of the cutter link against edge of Index Pawl. Clamp the chain into position, grind and repeat until all the right (or left) hand cutters have been ground and then reset the clamping plate angle for the left (or right) hand cutters and repeat. (A small amount of adjustment of the index pawl may be necessary when changing from the right hand cutters to the left hand cutters.)
18. GRINDING THE DEPTH GAUGES. The depth gauges are the part of the chain that regulate how deep each tooth bites into the wood. If the depth gauge is not ground deep enough, the chain will cut slower than it should. If the depth gauges are ground too deep, the chain will become too aggressive. An aggressive blade will tend to get stuck in the cut and also overwork the engine. A blade with properly-ground depth gauges and properly sharpened teeth will actually self-feed into the wood.

SECTION 2.4

MODEL LTADS ASSEMBLY/OPERATING INSTRUCTIONS - cont'd

SHARPENING INSTRUCTIONS FOR SAW CHAIN - cont'd

Depth gauges should be maintained at the saw chain manufacturer's recommended setting (X). Use a 1/4" grinding wheel with the bottom of the wheel ground flat. Position the clamping plate line directly under the center of the wheel and set the depth of grind to grind the depth gauge level to manufacturer's specifications. Position the depth gauge directly under the grinding wheel and then adjust the pawl to the back side of the tooth. Grind the depth gauges by clamping and indexing as you would during the sharpening process.

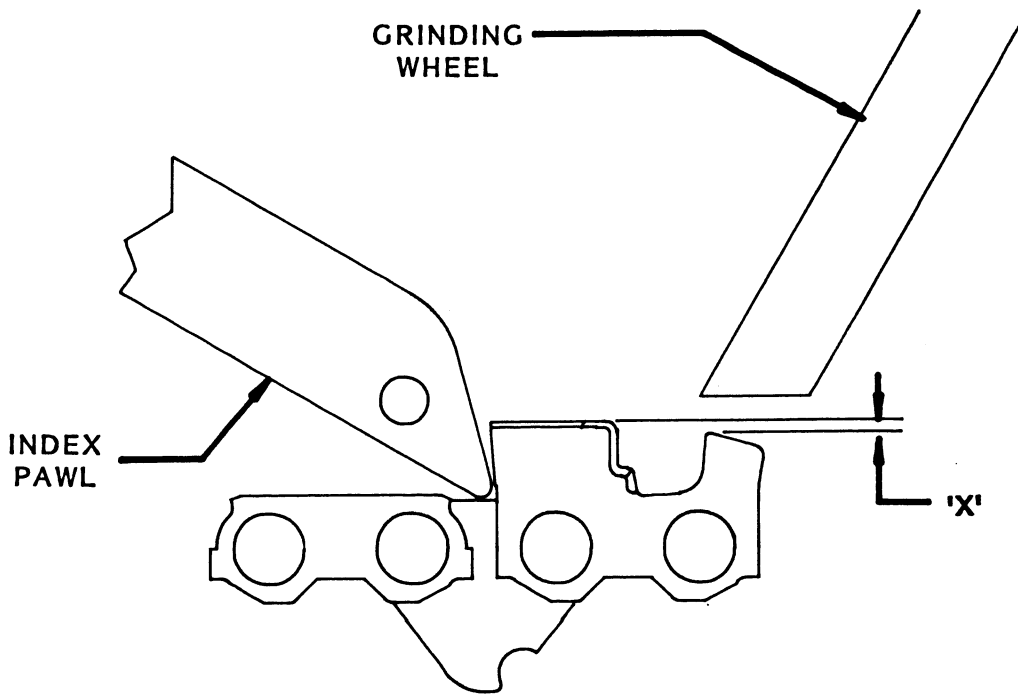


FIGURE 27

When grinding the depth gauge, there must be a radius on the right side of the gauge or the top of the gauge should be ground with a downward angle to the right to prevent the depth gauge from hanging up in the cut by a sharp leading corner.

NOTE: The procedure outlined in this chain saw sharpening manual is just one of many ways to sharpen a chain saw blade. Individual requirements may call for changes to some of the basics of this instruction.

SECTION 2.5

BLADE MAINTENANCE AND CARE

The Wood-Mizer® cuts with a 1 1/4" x 158" band with 3/4" tooth spacing. This band will give you 15 to 30 hours cutting life if properly used and maintained. Follow the guidelines below to get the most out of each blade.

The best indicator of blade condition is the quality of its cut. IF THE BLADE DIPS OR CLIMBS, IT IS CAUSED BY SOME FACTOR IN THE BLADE 99.9% OF THE TIME, NOT BY MACHINE ALIGNMENT. THE BLADE CAN LOOK SHARP, FEEL SHARP, AND STILL NOT CUT RIGHT.

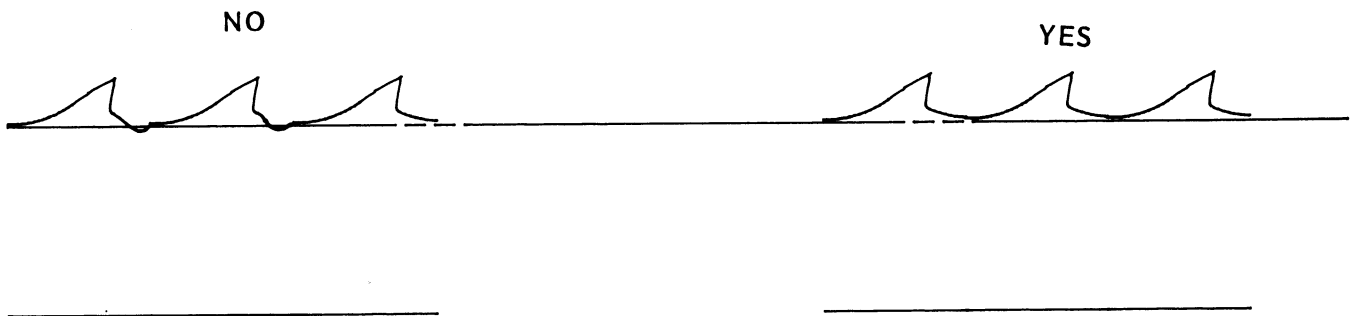
As the blade gets dull, gets loaded with build-up between tooth set or loses set of the teeth, the quality of the cut will deteriorate. A dull blade will typically start to wave as it cuts and overload the engine. When this happens, you should:

Check to see if the blade is loaded with sap build-up. This problem is almost nonexistent with some woods but can ruin the quality of the cut when it occurs. The build-up fills the set of the teeth creating friction which causes the blade to burn its way through the wood. (See **Water Lube Instructions.**) (Water Lube System reduces or prevents sap build-up.)

Check the edge of the teeth to be sure that they are sharp. If not, remove the blade and sharpen with the optional sharpening fixture. (See **Sharpening Instructions.**)

Check the set of the teeth. Your best indication is the quality of cut you are getting. If cuts are wavy, chances are the blade is dull or the teeth need to be reset. If they need to be set, remove the blade and set the teeth with the optional setting fixture, then resharpen. (See **Tooth Setter Instructions.**)

Always keep a consistent gullet. (See **Figure Below.**)



SECTION 2.6

CHANGING THE BLADE

CAUTION: WEARING GLOVES AND EYE PROTECTION IS RECOMMENDED WHENEVER HANDLING BANDSAW BLADES

CHANGING BLADES IS SAFEST DONE BY ONE PERSON

DO NOT CHANGE THE BLADE WITH THE ENGINE RUNNING. Remove the blade housing cover(s) that cover the drive wheels. Release the blade tension by turning the tension control (See Figure 1 or Figure 2) until the wheel is pulled in and the blade is lying loose in the C-frame housing. Lift the blade out of the C-Frame.

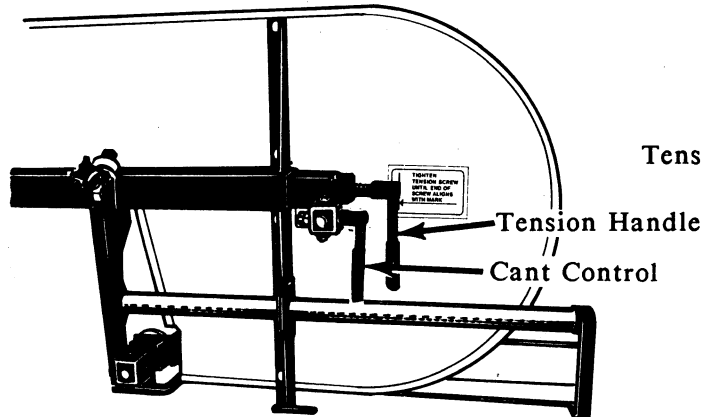


FIGURE 1
LT20 TENSION ASSEMBLY

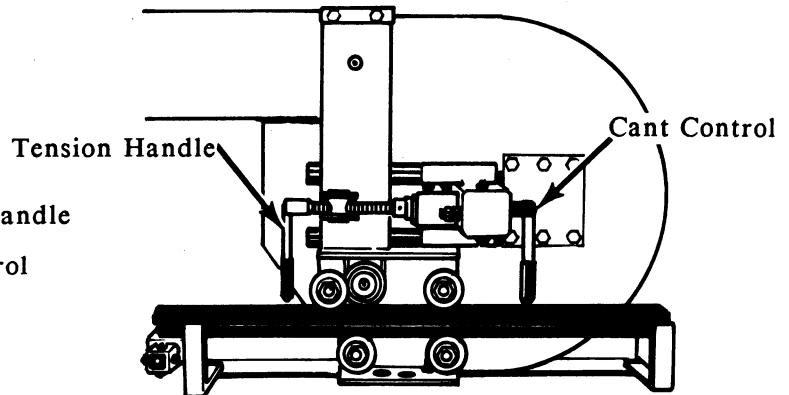


FIGURE 2
LT30/40 TENSION ASSEMBLY

When installing a sharp blade, make sure the teeth are pointing the correct direction. (The teeth should be pointing toward the operator side of the mill.) Install so the blade is roughly lying around the wheels with the gullet of the teeth even with the front edge of the wheels. The next step is to tension the blade by turning the tension handle until the die spring is compressed properly.

PROPER BLADE TENSION FOR LT20 SERIES MILLS

For .035" blades, tension the blade until the back edge of the tension handle is even with the gauge line as shown in Figure 1. For .042" blades, tension 1/2 a turn past the line.

PROPER BLADE TENSION FOR LT30 AND LT40 SERIES MILLS

For .035" blades, tension the blade until the tension spring is compressed to the outside edge of the spring housing (See Figure 3). For .042" blades, tension further until back face of washer lines up with the housing.

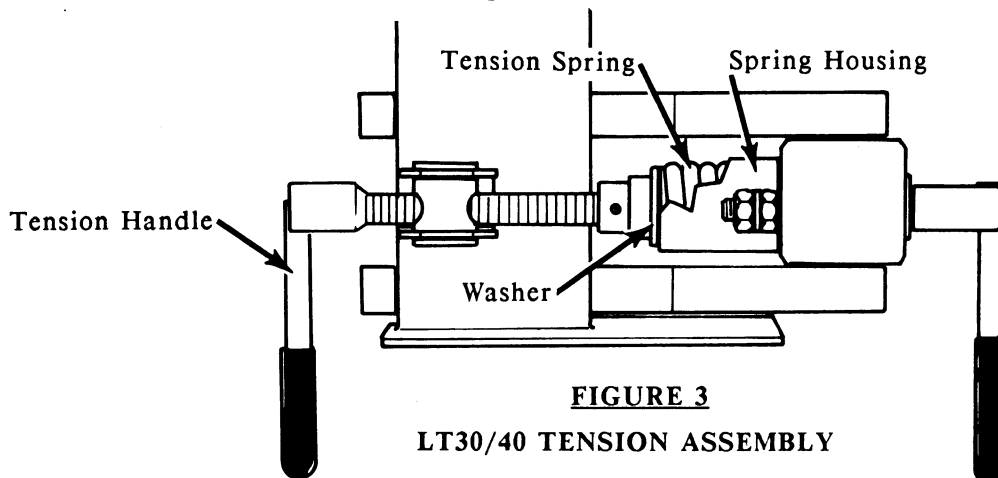


FIGURE 3
LT30/40 TENSION ASSEMBLY

SECTION 2.6

CHANGING THE BLADE - cont'd

The gullet of the blade should ride even with the front of the wheels. Do not let the teeth ride back on the wheel so that the gullet is past front edge of wheel (See Figure 4).

Adjustment of the free running wheel is made with the cant control handle shown in Figures 1 and 2. Start engine and pull lightly on the clutch handle, rotating the blade, until blade locates itself. If the blade is too far forward on the idle side wheel, loosen the cant control; too far back, tighten the cant control. **SOME ADJUSTMENT IN SPRING TENSION WILL BE NECESSARY TO COMPENSATE FOR ANY ADJUSTMENT IN THE CANT CONTROL.** Replace covers.

IMPORTANT: after lining the blade on the wheels, always double check the blade guide spacing and location (See Section 5).

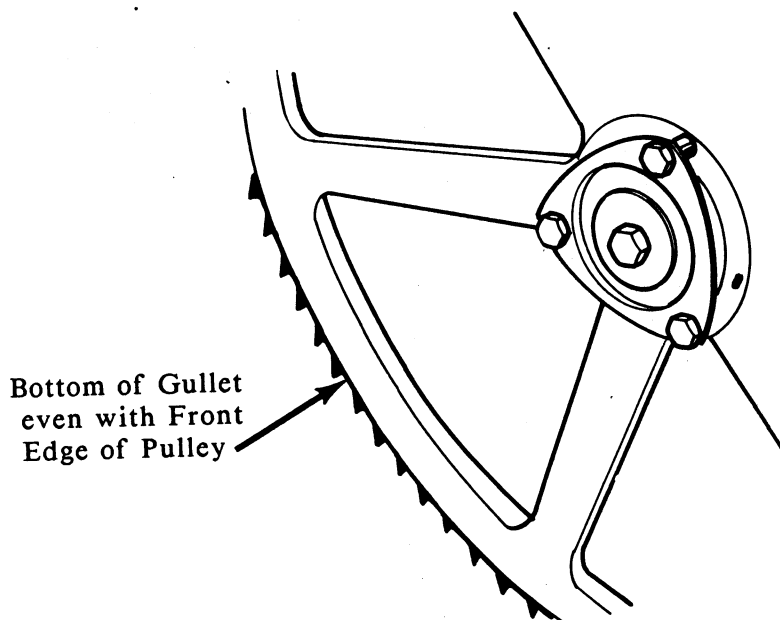


FIGURE 4

SECTION 3.1

SETUP AND OPERATION

1. READ ENTIRE OPERATING MANUAL BEFORE OPERATING YOUR WOOD-MIZER MODEL LT20 LUMBERMILL.
2. Set up mill on level, relatively firm ground. If you are setting up in long grass, either cut a path or lay down a ground cover beneath the main track assembly as the grass will get tangled in the lower rollers. If you are setting up on soft ground, it will help to set planks or boards under the front and rear log beds to keep the machine from settling down into the ground, causing misalignment.
3. For assembly purposes, each of the seven main components have been given the following numbers (Refer to Figure 1):

1. Front Track Assembly
2. (2) Log Decks
3. Middle Track Assembly
4. Rear Track Assembly
5. Carriage Assembly
6. Cutting Head
7. Gas Engine*
8. (2) Loading Ramps (Optional)
9. (2) End Jacks

* Removal of the Gas Engine (#7) is optional. The Cutting Head (#6) can be stored in the crate with the engine attached. We recommend the engine be removed when the mill is being assembled or disassembled by one person.

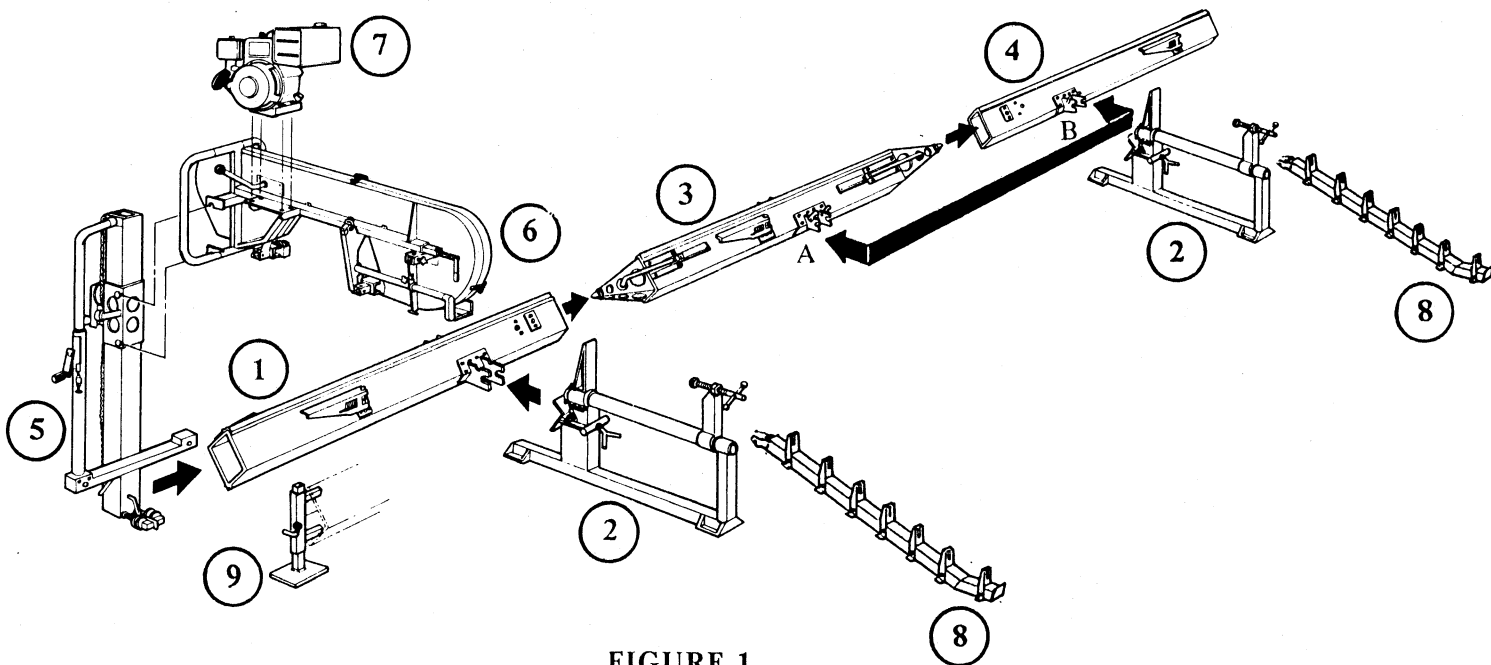


FIGURE 1

4. Assemble (#1) to (#2) as shown in Figure 1. Turn the T-handle located in the body of the Log Deck clockwise until the Log Deck is clamped firmly to the Track Tube. Make sure there is no sawdust in the junction between any of the pieces.
5. Assemble (#3) to (#1) as shown in Figure 1. Clamp into place with the quick clamp.
6. Assemble (#4) to piece (#3) as shown in Figure 1. Fasten in place with the quick clamp.

SECTION 3.1

SETUP AND OPERATION - cont'd

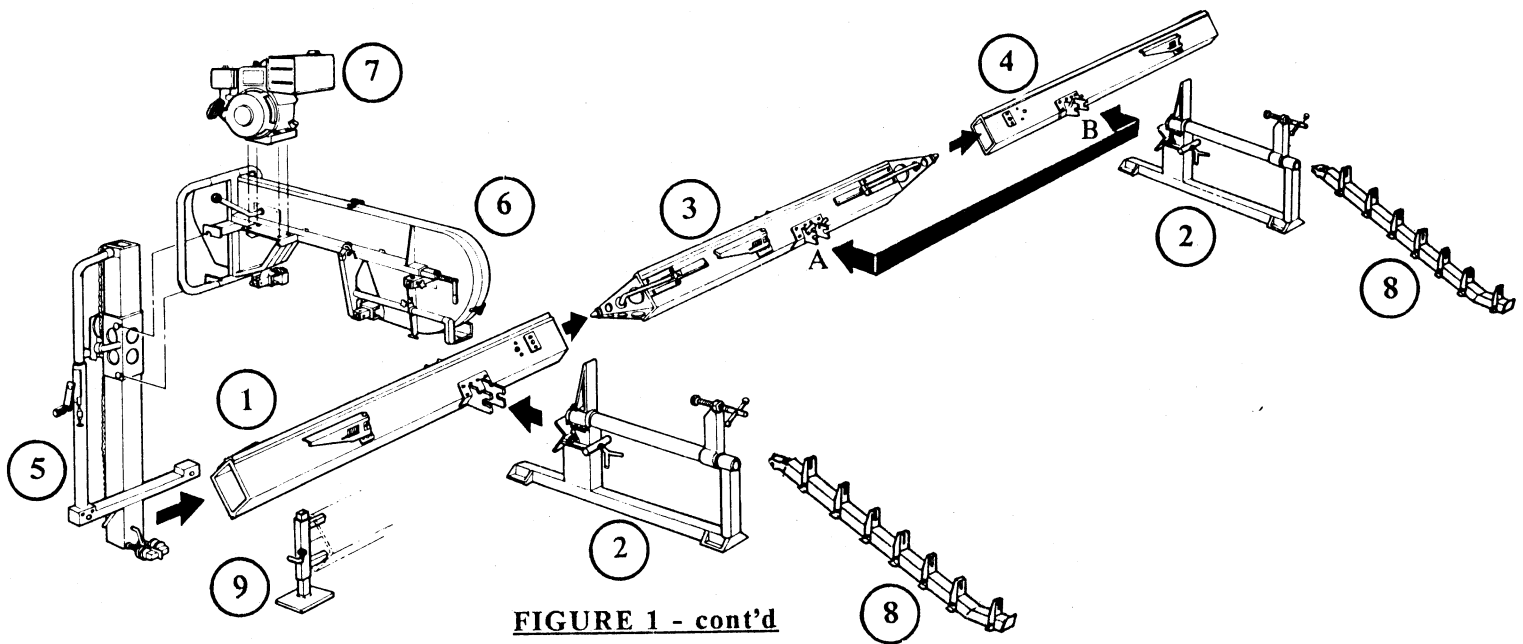


FIGURE 1 - cont'd

7. Before assembling the remaining Log Deck (#2), notice that there are two places it can be attached to the main track. If you are sawing logs eight (8) feet or less, use position (A) (See Figure 1). If you are sawing logs longer than eight (8) feet, use position (B). Repeat Log Deck assembly as described in Step 4.
8. Assemble the Carriage Assembly (#5) to the track assembly by simply lifting it onto the track so the upper and lower rollers will run on the replaceable stainless steel upper and lower tracks (See Figure 1).
9. Assemble the Cutting Head (#6) to the Carriage (#5) as shown in Figure 1. There are four "hooks" on the Cutting Head that will slide over the four "posts" on the Carriage Assembly. The Cutting Head weighs over 170 pounds (with motor) and it is awkward for one person to carry alone. It is **not** recommended that the Cutting Head be mounted on the Carriage Assembly by one person. **NEVER** assemble or disassemble the Cutting Head with a blade installed.
10. If the Engine (#7) is removed from the Cutting Head (#6), Re-attach it by placing the engine so that the shaft with pulley goes through the blade housing and the four mounting bolts underneath the engine seat in the motor mount plate. Slide the engine back as far as it will go and tighten the four locknuts on the mounting bolts. Attach the throttle spring to engine and engage the drive belt properly.
11. When installing the optional Loading Ramps (#8), simply set in place over the pins on the front and rear Log Decks (See Figure 1).
12. Place an End Jack (#9) on each end of the track tube as shown in Figure 1. Move the Cutting Head over the front Log Deck. Use slight pressure to raise up on the front end of the track assembly and adjust the front End Jack up and tighten jack handle. Release end of track to let it rest on End Jack. Repeat for other end of mill with the Cutting Head over the rear Log Deck.
13. Every time the LT20 is moved, double-check the alignment (See Alignment Section 5.2).

SECTION 3.1

SETUP AND OPERATION - cont'd

14. Move the Cutting Head to the front of the mill with the hand crank or by simply pushing or pulling the Carriage Assembly along the track.
15. Load log onto the Log Decks. When loading logs, always have the side supports at their highest position to keep the log from rolling off the operator side of the lumbermill. Also, slide the clamping dogs completely to the outside edge of the log decks so they will not be pinned underneath the log once it is rolled into position. The auxiliary log supports (See Figure 2) are not designed to be used when squaring up the log. The auxiliary log supports are intended for use under cants that have a tendency to sag and should be folded out of the way when squaring a log.

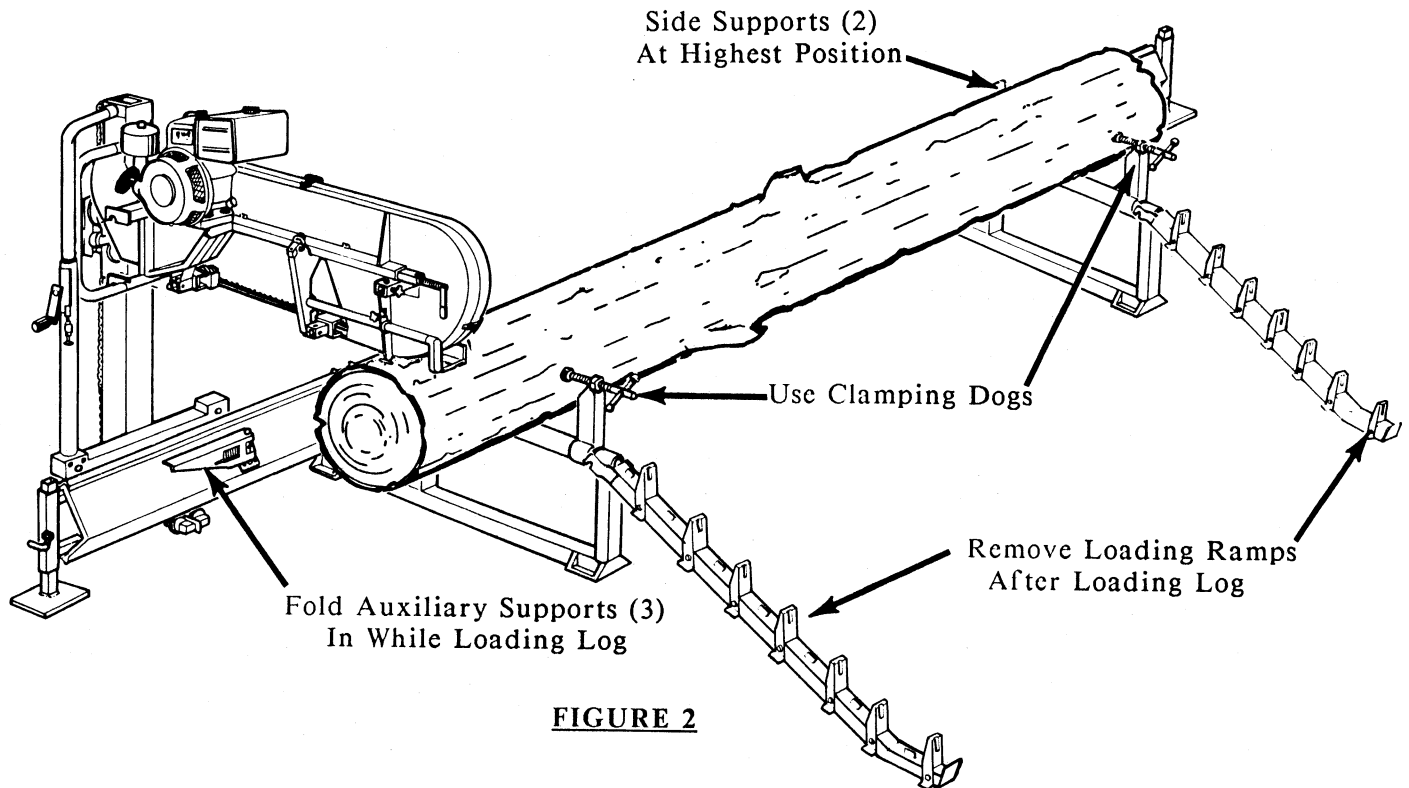


FIGURE 2

When using the optional Loading Ramps, it is recommended the log be rolled up the ramps by two people, each with a cant hook or peavey.

To avoid injury, neither person should stand directly behind the log in case it rolls back down the ramp. These ramps are equipped with special flip-up stops that are designed to assist in the loading of the log. The loading ramps will have to be removed during the actual cutting of the log, or the ramps will interfere with the cutting head.

16. Rotate the log to desired angular position by spinning it against the side supports.
17. Secure the log to desired angular position by clamping it in place with one or both of the clamping dogs located on the log deck (See Figure 2). The clamping dogs are typically required only when the log is resting on a rounded portion.
18. Check the tension gauge for proper blade tension (See Section 2.7).

SECTION 3.1

SETUP AND OPERATION - cont'd

19. Set the Cutting Head to desired height. The ruled gauge and indicator represents the distance between the log bed and the bottom of the blade.

The cutting head is raised and lowered by the hand crank on the front of the carriage assembly (See Figure 3). There are 16 holes in the face plate of the up/down crank assembly. Each hole represents an adjustment in the blade height of 1/16 of an inch. One full turn of the crank is one (1) inch.

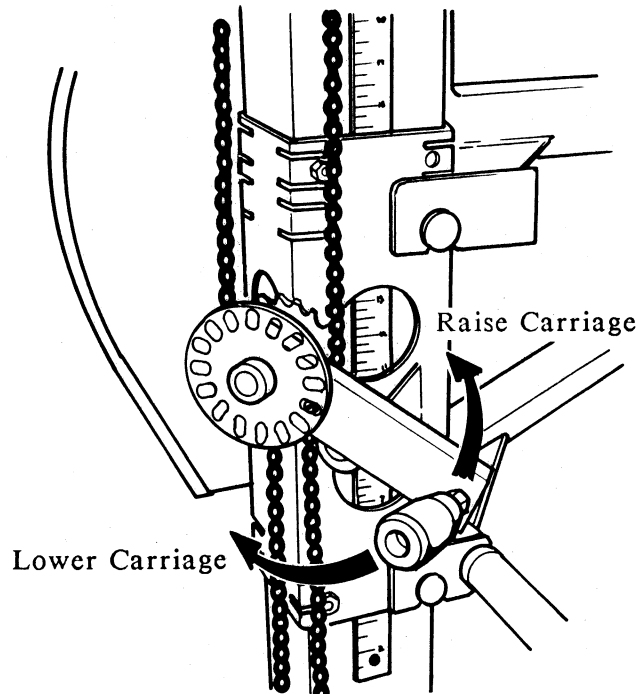


FIGURE 3

20. Adjust the width of the throat by sighting down the log to determine its maximum width. The movable blade guide should be adjusted to clear the widest section of the log by less than one (1) inch. This is done by loosening the clamping knob and sliding the movable blade guide horizontally in or out as necessary (See Figure 4). **NEVER** adjust the throat width while the blade is moving.

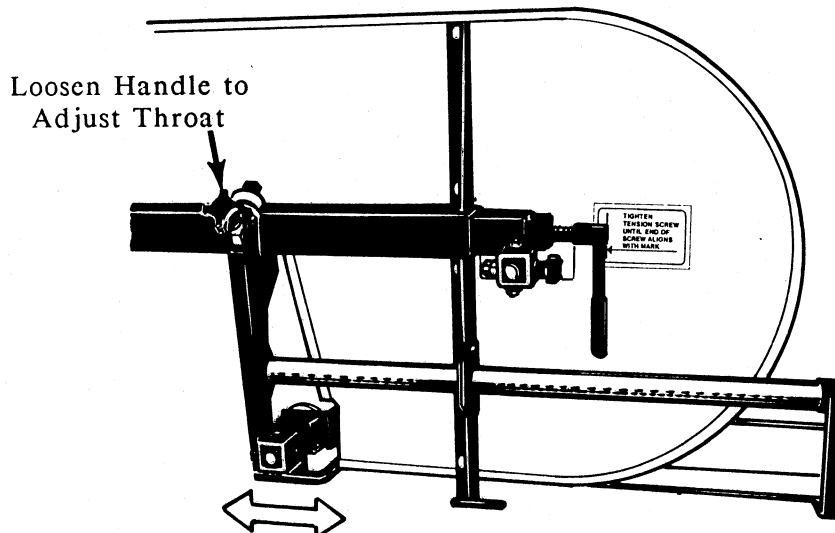


FIGURE 4

SECTION 3.1

SETUP AND OPERATION - cont'd

21. Make sure the clamping dogs and side braces are adjusted below the cutting plane of the blade.
22. Start engine per instructions found in engine manual. See Section 4.5 for throttle adjustment.
23. Pull down slowly on clutch/brake lever found below the engine until it locks into the run position.
24. Feed the carriage into the wood at a slow speed. Let the blade contact the wood slowly and then feed at a rate that will not overload the engine or force the blade to wander. Maximum feed rate will vary with width, hardness of wood, and sharpness of the blade. Overfeeding will result in excessive engine and band wear and will produce a wavy cut.
25. Stop the carriage at the end of the cut. If you stop the carriage while the back of the blade is still on the log, you will not have to worry about the blade catching on the log when you pull the carriage back for another cut.
26. Lift clutch/brake lever to stop blade and drop engine to idle. Failure to stop the blade can cause the blade to be pulled off (while traveling in reverse) by a wood sliver and the blade could be ruined. Stopping the blade also increases its life.
27. Remove board from top of log.
28. Return the carriage back to the front of the machine while making sure that the blade does not catch on the end of the log, (See Step 25), or the carriage can be raised slightly to ensure that the blade clears the log when returned. The carriage is most easily pulled back to the front off the machine. **BE CAREFUL** that the crank handle does not spin into your arm when pulling the carriage back.
29. Rotate the log if you wish to square it after this first cut. Move the side supports to an upright position before rotating the log. We recommend that you use cant hooks to rotate the logs. Typically, the log would be rotated 180 degrees to set the first flat of the log on the bed. If the log is rotated 90 degrees, use the clamping dogs to clamp the first flat against the side supports.
30. Set cut depth per Step 19. Remember that the blade cuts a 1/16" thick kerf, so if you want 1" boards, the carriage should be lowered 1 1/16" (17 notches) for each board.
31. Repeat Steps 19 through 30 until log is cut as desired.

SECTION 4.1

MAINTENANCE SCHEDULE

The procedures listed in this schedule are essential to trouble-free operation of the Wood-Mizer®. The small amount of time required by these procedures is the best time investment in a successful sawing operation.

EVERY TWO HOURS OF OPERATION:

1. Grease the two blade guides (See Figure 1). Do not lubricate until grease is oozing out of the gaps. The purpose of greasing every two hours is to purge the sawdust out of the bearings.

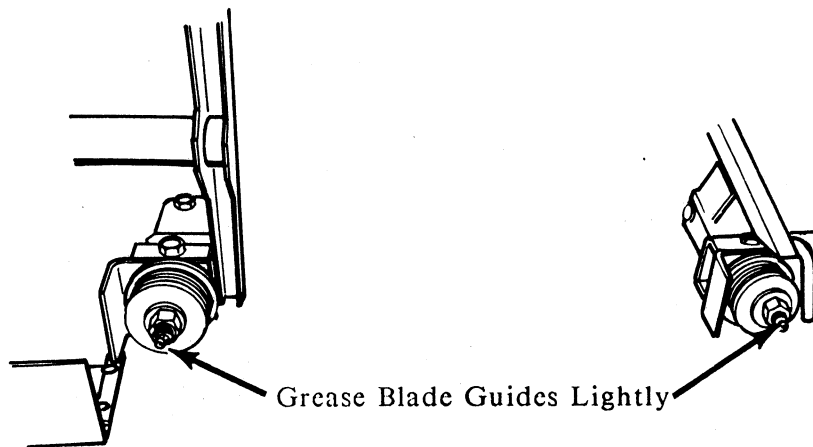


FIGURE 1

EVERY FOUR TO EIGHT HOURS OF OPERATION:

1. Check to see that the blade guide bearings are clean and free-spinning. If not free-running, Disassemble and clean with diesel fuel or equivalent, and re-pack with grease (See Section 4.2). If the bearings need to be replaced, notice that one of the shields on each bearing has been pulled off and notches ground in the inner race to allow grease to get to the ball bearings. These bearings are standard R-8 bearings available at most places that sell bearings.

SECTION 4.1

MAINTENANCE SCHEDULE - cont'd

EVERY FOUR TO EIGHT HOURS OF OPERATION - cont'd:

- Grease the side supports (See Figure 2). Certain woods have high levels of acid in the sawdust that will react with steel, causing excessive wear. The grease is primarily for purging any sawdust out of the critical areas.

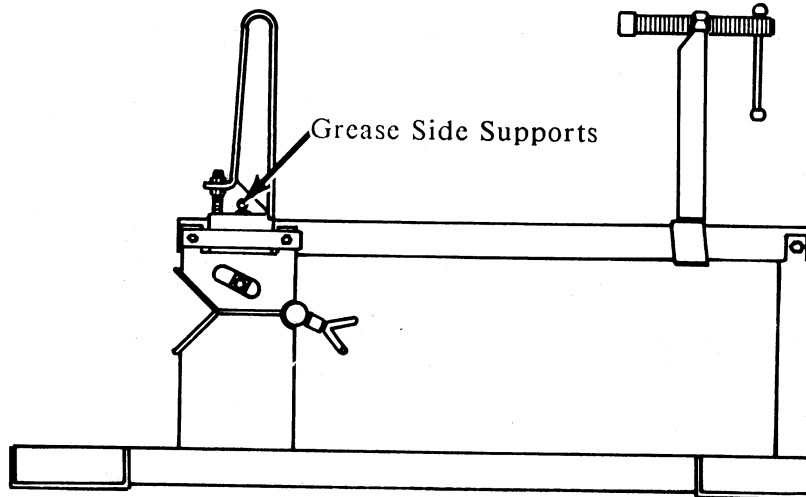


FIGURE 2

- Clean any excess sawdust build-up in blade wheel housings.
- Clean the gas engine air filter daily.

EVERY FORTY HOURS OF OPERATION:

- Lubricate Up/Down chain.
- Check for excessive drive belt wear. If belt is too loose, adjust elbow connection of clutch lever linkage using the slotted hole (See Figure 3). Retighten nut and check belt tension. Readjust elbow if necessary.

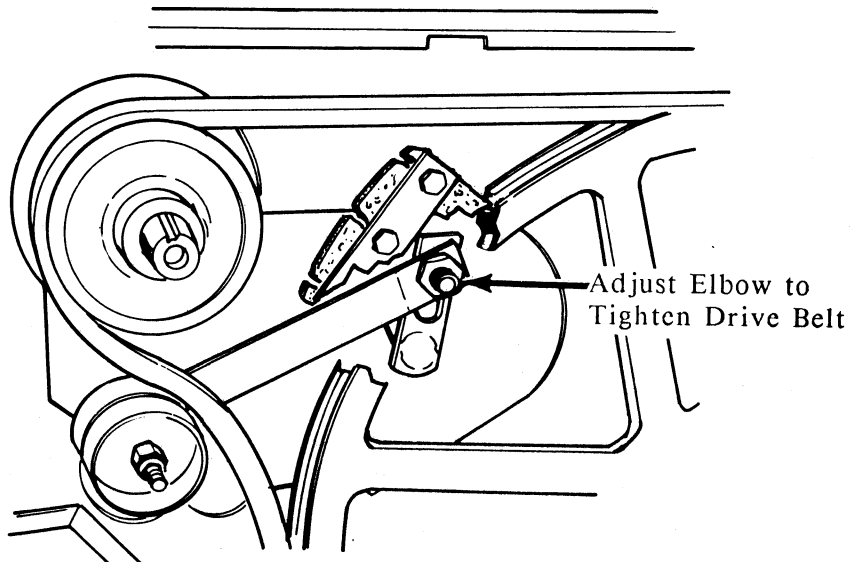


FIGURE 3

SECTION 4.1

MAINTENANCE SCHEDULE - cont'd

EVERY FORTY HOURS OF OPERATION - cont'd:

3. Oil all pivot points, chains, and bearings. Rebuild or replace bearings as needed.
4. If the blade is not coming to a stop rapidly, the brake shoe is probably worn and needs to be adjusted or replaced (See Section 4.6).
5. Adjust the wear pads on the vertical mast if there becomes noticeable side-to-side movement of the cutting head (See Figure 4).

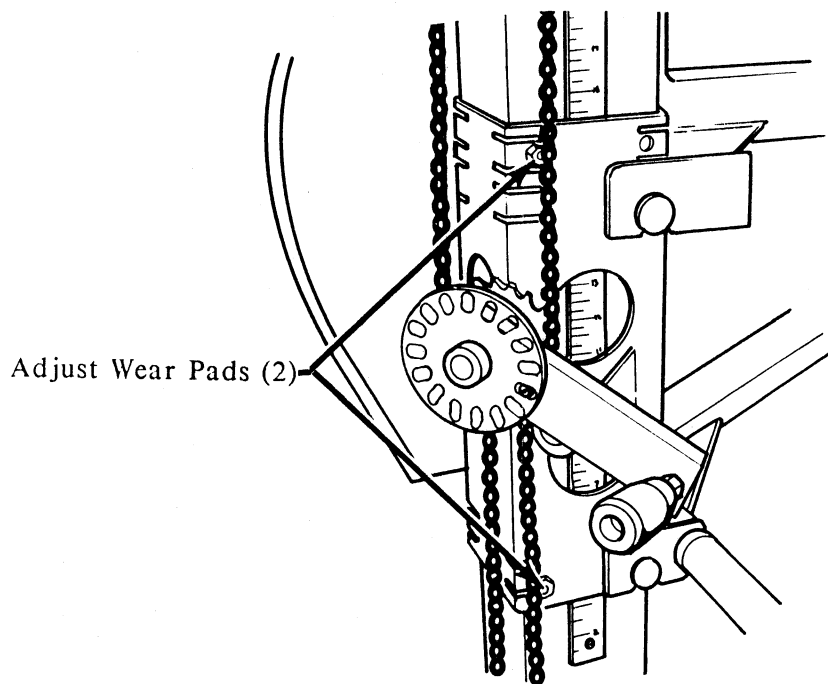


FIGURE 4

6. Check and adjust the main track rollers on the bottom of the main track.

MISCELLANEOUS MAINTENANCE:

Go through alignment procedures per alignment section of manual as often as necessary. Maintain engine or per manufacturer's schedules.

SECTION 4.2

BLADE GUIDES AND CARE

The Blade Guides of the Wood-Mizer are designed to give hundreds of hours of use before needing any servicing.

- A. The only maintenance they require is greasing every 2 hours. Failure to keep the guides well greased will cause premature failure. (Greasing every two hours is primarily to keep the sawdust purged out of the bearings. Do not over-grease or over-tighten blade guides).
- B. Another condition that causes early failure is pre-loading of the guides. Pre-loading is when the blade is riding too far back on the drive wheels which causes the blade to ride the flange of the blade guide roller. There should be a 1/16 inch gap between the back edge of the blade and the flange.

Figure 1 shows how the blade guides are properly assembled. The only parts needed to rebuild the guides are the set of bearings and the felt washers.

- A. The bearings are standard (R-8 Bearings) and are available at most industrial supply companies.
 1. If you buy your bearings locally, they need to have the inner face of one bearing slotted to allow grease to work into the two bearings (See old set of bearings). This can be done using a grinding wheel.
 2. Once one of the two bearings has been slotted, remove the dust shield of the slotted side and either side of the non-slotted bearing. This can be done with a knife or small screwdriver.
 3. These two exposed faces need to face each other when two bearings are pressed into the blade guide roller.
- B. Rebuild kits are available from Wood-Mizer which include the bearings, tru-arc ring, felt washers, and spacers. Complete roller assemblies are also available (See Section 6).

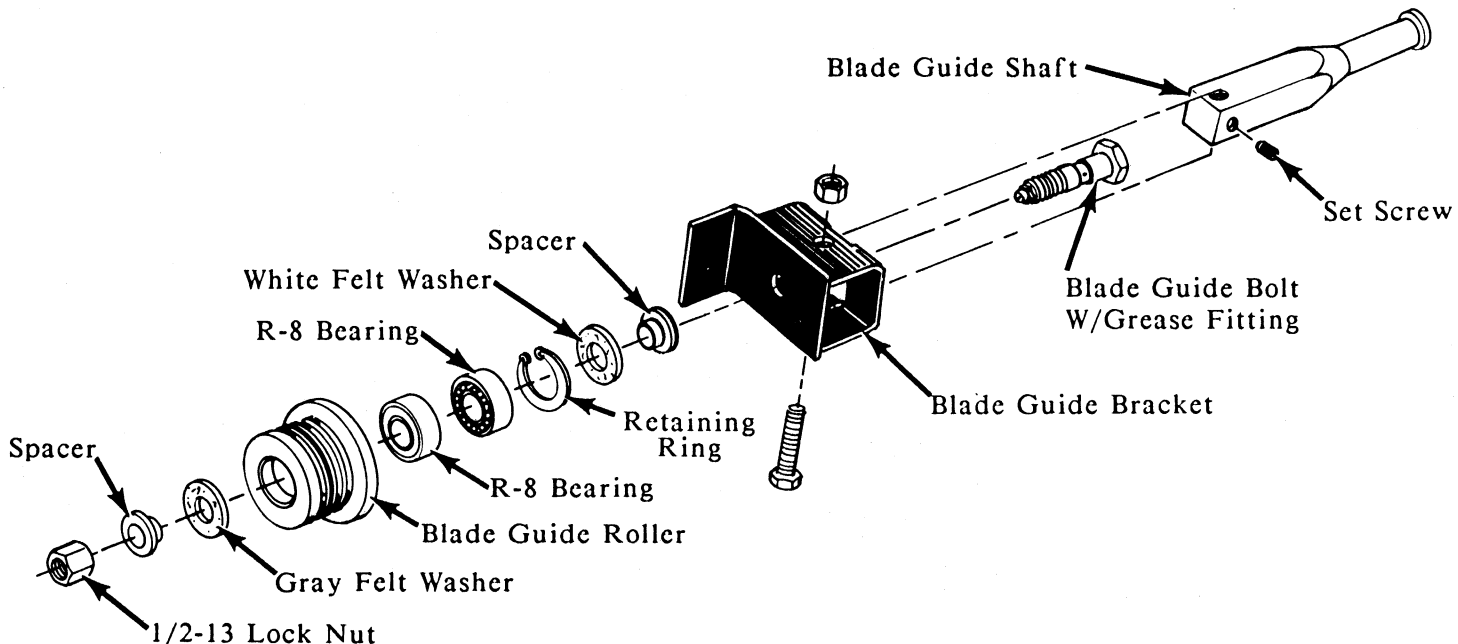


FIGURE 1

SECTION 4.3

CHAIN TENSION ADJUSTMENTS

The mechanism for raising and lowering the cutting head incorporates a chain that will require periodic adjustments. The chain should be lubricated to prevent rust.

To adjust the up/down chain, move the idler bearing up or down as necessary. The idler bearing is located at the bottom of the carriage assembly mast tube (See Figure 1).

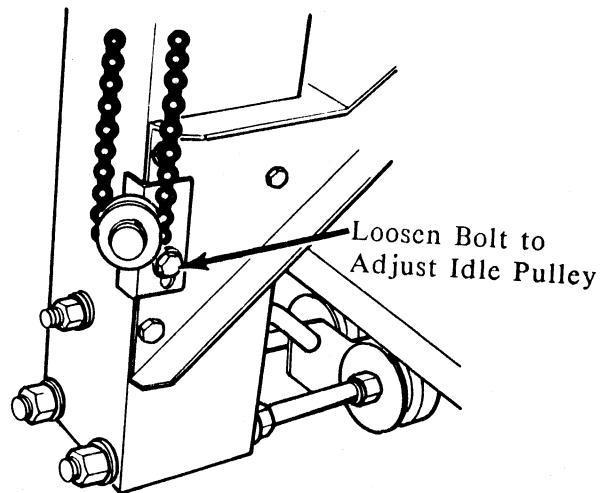


FIGURE 1

SECTION 4.4

DRIVE BELT ADJUSTMENT

If the feed drive belt becomes too loose to move the carriage, loosen the two bolts shown in **Figure 1** and then raise the adjusting bolt just enough to regain a positive drive from the hand crank assembly. If the belt is tensioned too much it will be difficult to move the carriage with the hand crank assembly.

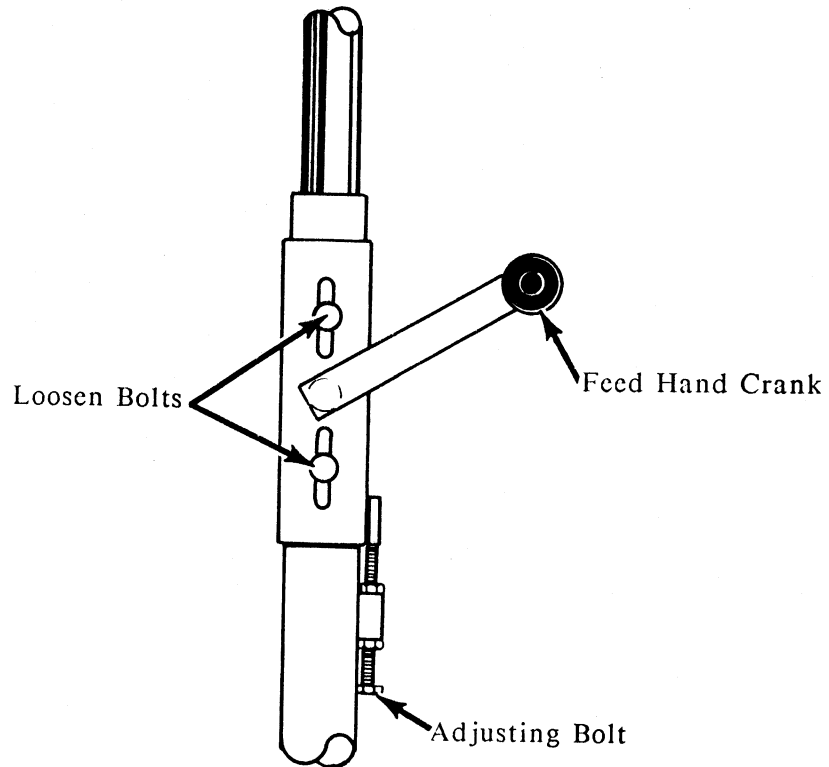


FIGURE 1

SECTION 4.5

THROTTLE ADJUSTMENT

Adjust the engine throttle at idle to approximately 1800-2000 RPM (See Engine Manual for adjustment). After proper idle adjustment is obtained, engage the clutch handle to speed the engine to full throttle. Full throttle should reach approximately 4000 RPM. The blade should not start spinning until the engine picks up in speed. If the blade spins before the engine speeds up, the governor will probably choke the engine and cause it to stop. If this occurs, adjustment of the throttle spring should be made. If adjustment is necessary, move spring shown in Figure 1 one hole over and check throttle again. Adjust until clutch lever can be thrown without stalling the engine.

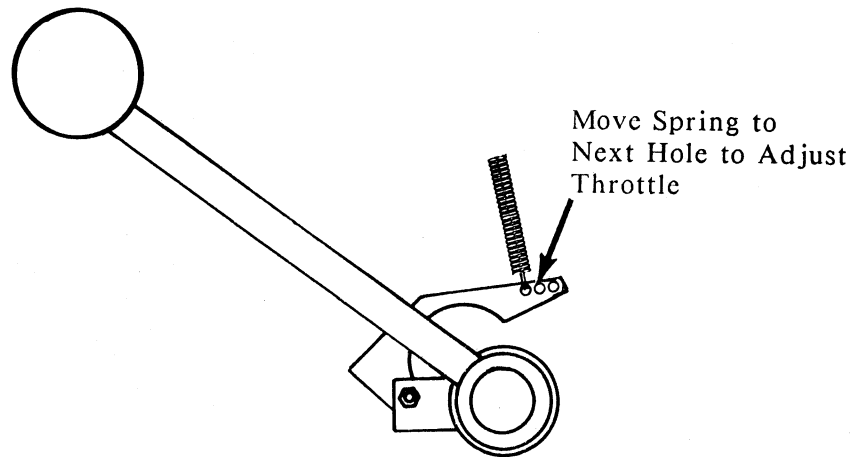


FIGURE 1

SECTION 4.6

BRAKE SHOE ADJUSTMENT

Adjust the brake so that the leather shoe fully contacts the drive wheel when engaged but make sure the metal bracket is no closer to the wheel than $1/8$ " at the nearest point. When disengaged, the brake shoe should not contact the drive wheel at all.

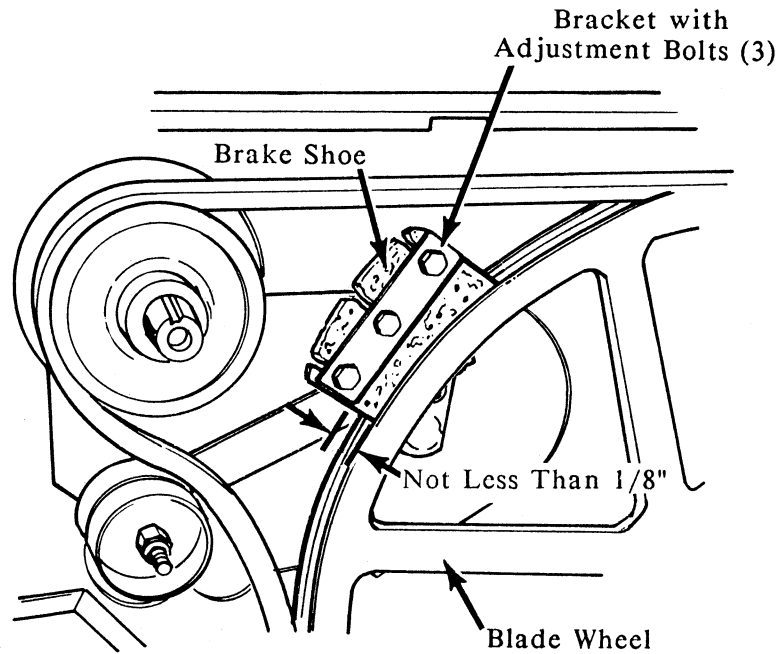


FIGURE 1

SECTION 5

ALIGNMENT INSTRUCTIONS

Portions of the Wood-Mizer® are pre-aligned. This section will show you how to align the entire mill. Care should be taken in these steps as they will determine how accurate and square your lumber is cut. The areas to be aligned are:

1. Blade aligned on the blade pulleys.
2. Blade parallel to the log deck.
3. Blade guide spacing and locations.
4. Side supports square to the log deck.

The Wood-Mizer® LT20 should either be on firm ground or some sort of platform (planks) while aligning soft ground. Every time the mill is moved, the alignment will need to be checked.

In the following steps the blade should be properly tensioned (See Section 2.7). Spring tension is adjusted with the tension control shown in Figure 1. Blade guides should either be removed or adjusted so they will not contact the blade causing improper alignment.

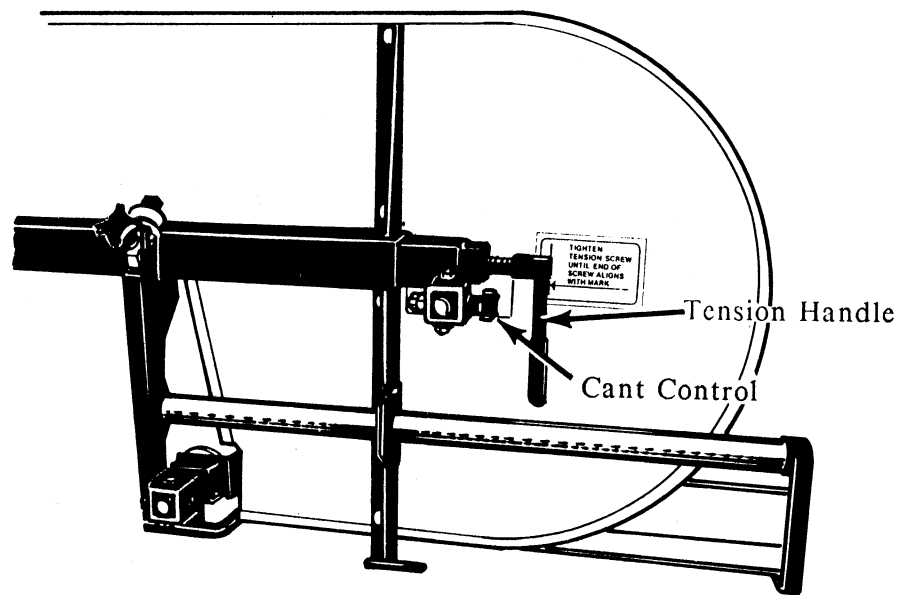


FIGURE 1

SECTION 5.1

BLADE ALIGNMENT ON THE BLADE PULLEYS

The blade pulleys should be adjusted so that the gullet of the blade rides even with the front edge of the pulleys. Do not let the teeth ride on the wheels (See Figure 2).

Adjustment of the idle side wheel is made with the cant control shown in Figure 1. Start engine and pull lightly on the clutch handle to rotate the blade until it locates itself. If the blade is too far forward, loosen the cant control; too far back, tighten the cant control. Some adjustment in spring tension control may be necessary to compensate for adjustments of the cant control.

The drive-side blade pulley will typically not have to be adjusted; however, the adjustment is available. As you look at the drive shaft from the engine side, you will see four set screws that locate the axis of the drive shaft. If you move the drive shaft to the right, the blade will ride further back on the wheel, or vice versa.

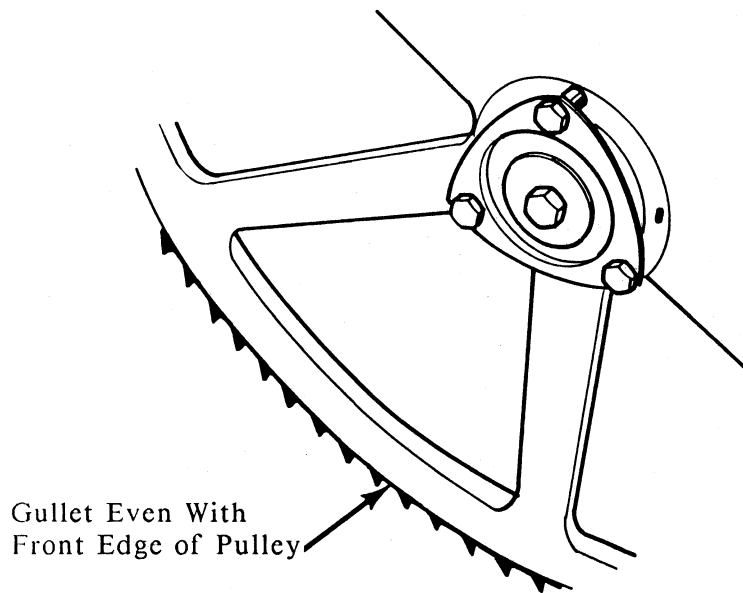


FIGURE 2

SECTION 5.2

BLADE PARALLEL WITH BED

This step will assure you of square cuts and accurate dimensions across the width of your boards. With blade guides removed or adjusted so they do not contact the blade, move the blade directly over the front log deck and open the movable blade guide arm to within 1" of its full open position. Measure from the blade to log deck on both the right and left hand side to see if the blade is parallel to the deck (See Figure 1). The blade will be parallel to the deck when the distance between the blade and the log deck is the same on both the right and left side.

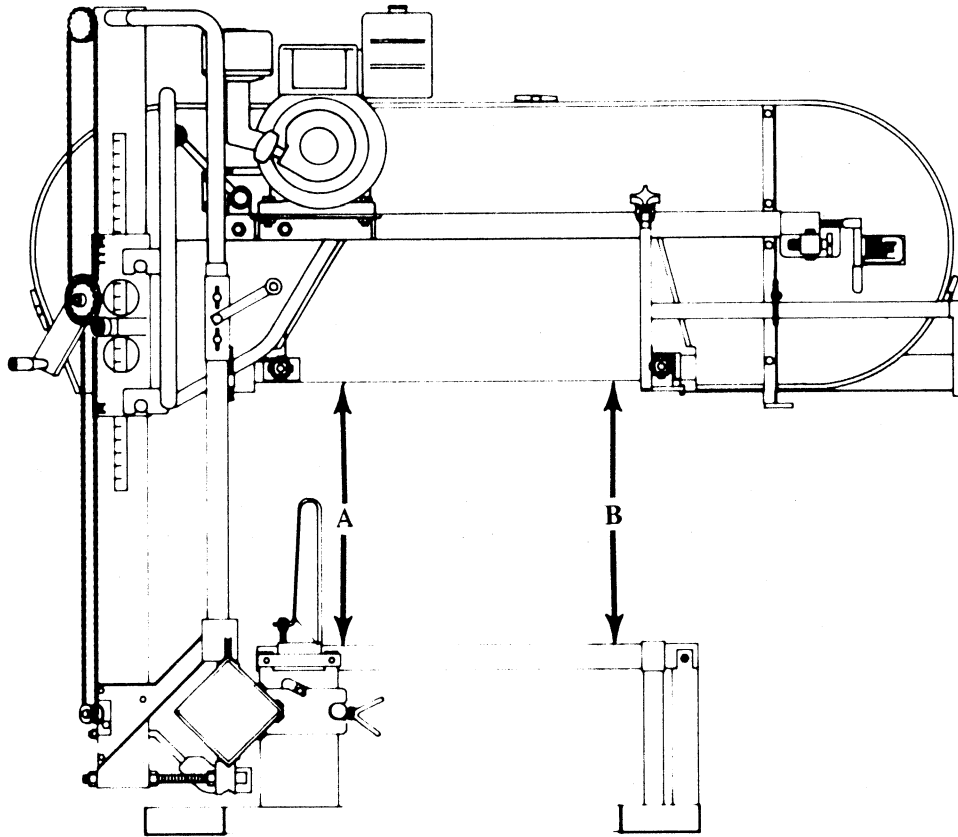


FIGURE 1

BLADE PARALLEL WITH BED - cont'd

The three bolts shown in Figure 2 will be used to align the blade parallel to the log decks. Figure 3 shows the result you are looking for after making this adjustment. There should only be a 1/32" to 1/16" gap between the lower track and the lower rollers.

Example: If the blade is too low on the right side (Figure 4), the two lower sets of nuts need to be adjusted toward the lower rollers. After adjusting the lower nuts to parallel blade with log deck, an adjustment of the upper bolt will be necessary to maintain the proper gap between the lower rollers and the track. Adjust until blade is parallel with the log deck and proper spacing between the lower rollers and track is obtained.

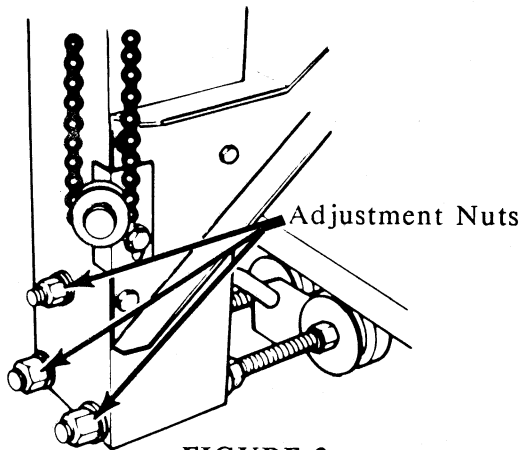


FIGURE 2

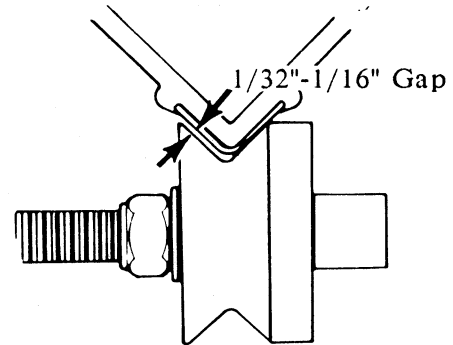


FIGURE 3

After the blade has been adjusted parallel to the front deck, move the carriage towards the back end of the mill and position the blade over the rear log deck. Check to see that the blade is also parallel to the rear log deck. If the blade is parallel to the front log deck but not the rear log deck, adjust the rear log deck parallel to the blade. Use the slotted hole adjustment at the front of the log deck as shown in Figure 5. Once the blade is parallel to both log decks and proper spacing between the lower rollers and the track is obtained, check to see that both log decks are firmly planted on the ground. Shim anywhere necessary to gain firm footing.

CAUTION: If space exists between log decks and ground after alignment has been achieved, you must shim under log deck or irreparable damage will occur to the main track when logs are loaded onto the mill.

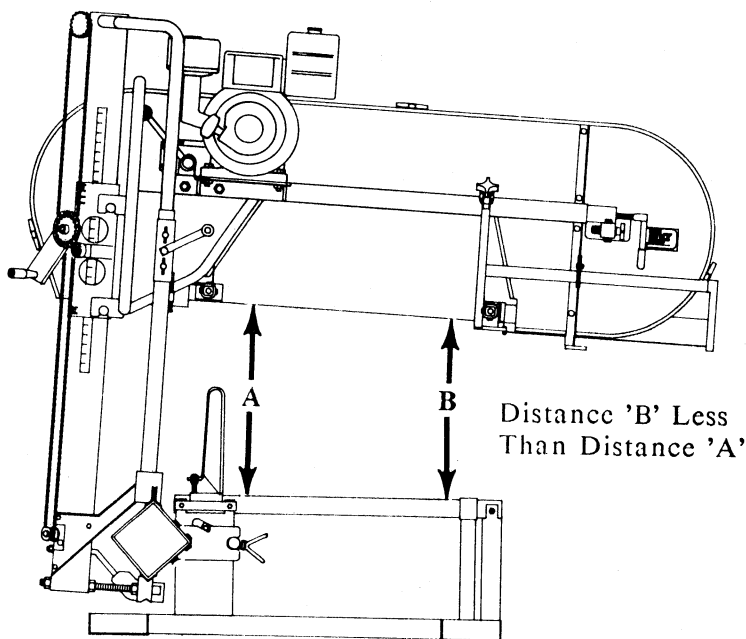


FIGURE 4

Adjust bolt to raise or lower log deck to blade

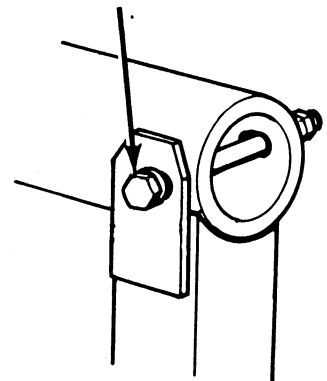


FIGURE 5

SECTION 5.3

BLADE GUIDE ADJUSTMENT

Once the blade has been aligned on the wheels and adjusted parallel to the front log deck, the blade guides must be adjusted horizontally to allow a gap of $1/16"$ to $1/8"$ between the roller flange and the back edge of the blade (See Figure 1). Failure to make this adjustment will decrease the life of the blade and blade guides substantially.

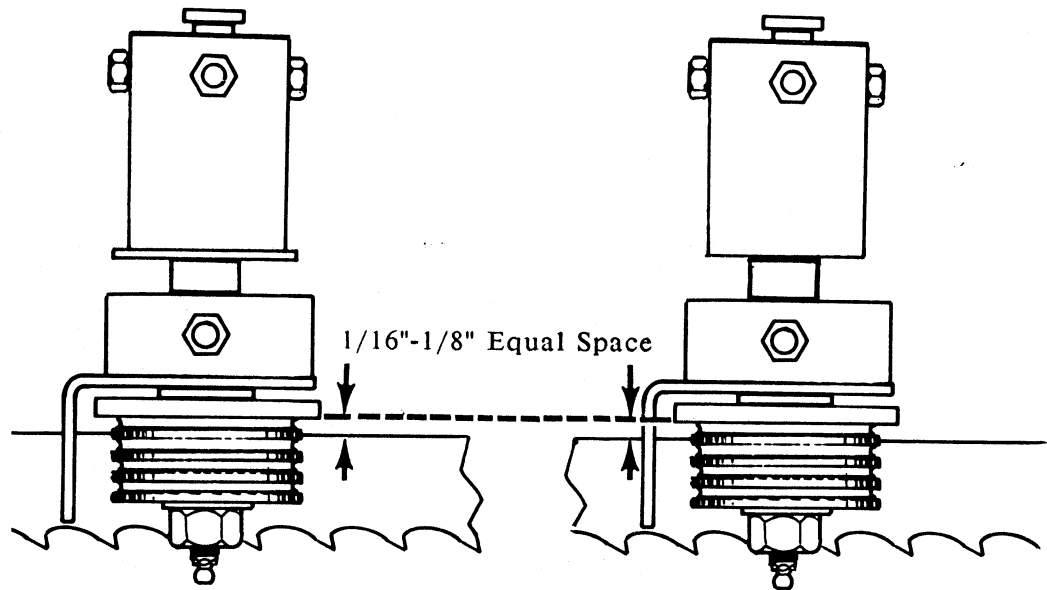


FIGURE 1

The blade guides must also be adjusted to put a $3/16"$ downward deflection in the blade.

Example: Before deflecting the blade in any way with the blade guides, set the distance between the blade and log deck at $10 \frac{3}{16}"$ by actual measurement with a tape measure. Now insert the blade guides and adjust them downward until they hold the blade at $10"$ from the log deck. The upward and downward adjustment of the blade guides is done with the vertical bolt shown in Figure 2. Loosen the set screw and nut at the top and then turn the bolt counterclockwise to lower the blade guide and vice versa. Adjust the depth scale on the vertical mast to read $10"$, if necessary.

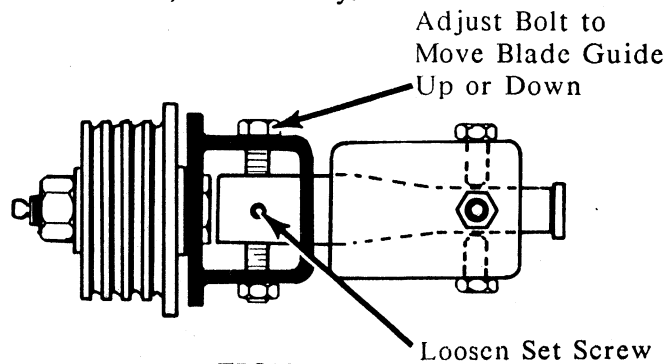


FIGURE 2

SECTION 5.3

BLADE GUIDE ALIGNMENT - cont'd

After making the 3/16" deflection, you must be sure that the blade guides are tilted at the correct angle. If the blade guides are tilted up, the blade will tend to rise in the cut. If it is tilted down, the blade will tend to dive in the cut. One good indication of how the blade guides are tilted is what the blade does as it moves off the end of the log after a cut. If the blade falls off the end of the log, the blade guides are tilted up. If the blade guides are tilted up, adjust the upper and lower set screws upward (See Figure 3). If there is a gap between the blade and the cant when you bring the carriage back, the blade guides are tilted down and need to be adjusted accordingly.

NOTE: The LTBGAT Blade Guide Alignment Tool is available to align the tilt of the blade guides quickly and accurately. See Section 7.4 for proper use of the tool.

Once the blade guides have been tilted to the correct angle, any cutting variances are most likely being caused by the blade maintenance procedures (See Section 2).

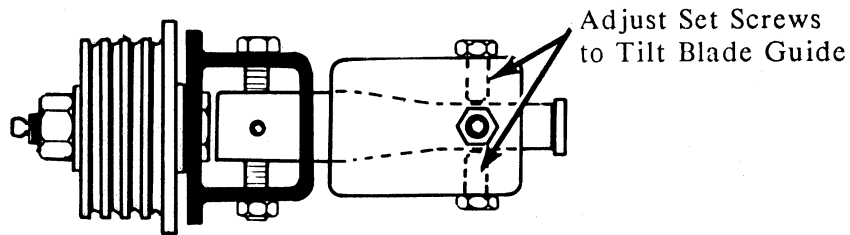


FIGURE 3

SECTION 5.4

SIDE SUPPORTS SQUARE TO BED

The side supports are used to clamp flats on a log to set the squareness of the next cut. The cut will be only as square as the supports. Swing the side supports to an upright position and check the angle with a square. Adjust with nuts shown in **Figure 1** as necessary to bring the side supports to a 90 degree angle.

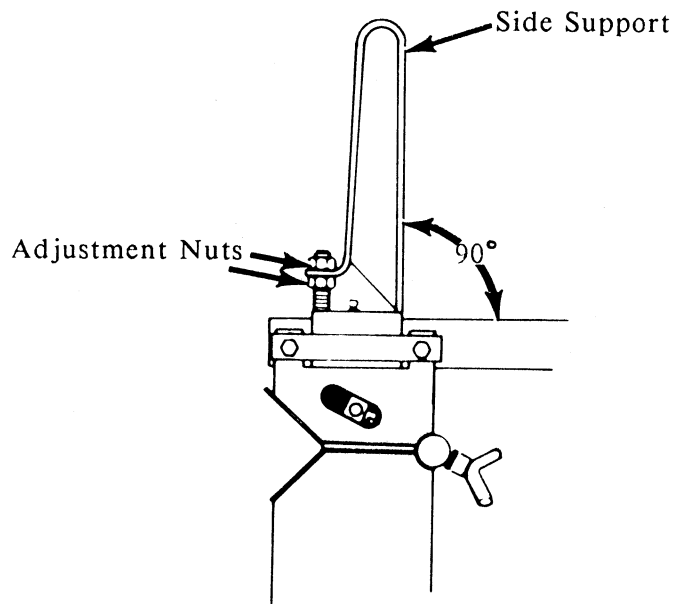


FIGURE 1

SECTION 5.5

MAIN TRACK TUBE ALIGNMENT

If alignment of the main tube ever becomes necessary, follow these steps:

Assemble the mill per Operating Instructions, steps 4 through 7.

Using two equal height blocks (approximately 1/2"), and some string (fishing line or heavy thread), clamp the blocks and string on top of either end of the track tube assembly (See Figure 1). Make sure the string is pulled tight to avoid any sag in the string which will cause inaccurate measurements.

Measure the distance from the track assembly to the string along entire length of the mill. When properly aligned, the track assembly should actually measure 1/16" lower on the ends than in the middle.

If adjustment is necessary, you will find four holes around the four sides in the front track assembly (#1), and four holes in the rear track assembly (#4), near the quick clamps (See Figure 2). If there is a sag in the main tube at the junction between the front track assembly and the middle track assembly, loosen the two upper set screws about 1/2" by turning counter-clockwise, and tighten the lower two set screws clockwise until they are tight. Remeasure the tube and adjust as necessary to bring tube into proper alignment.

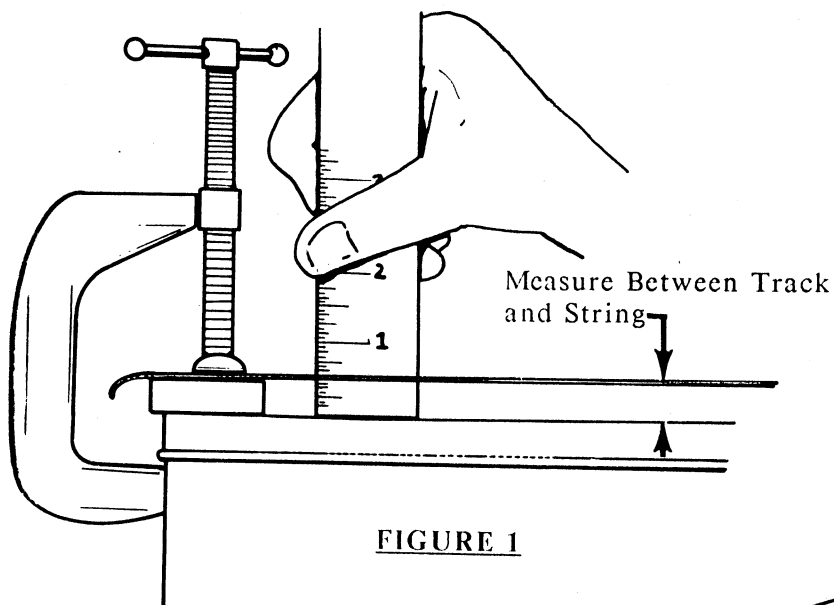


FIGURE 1

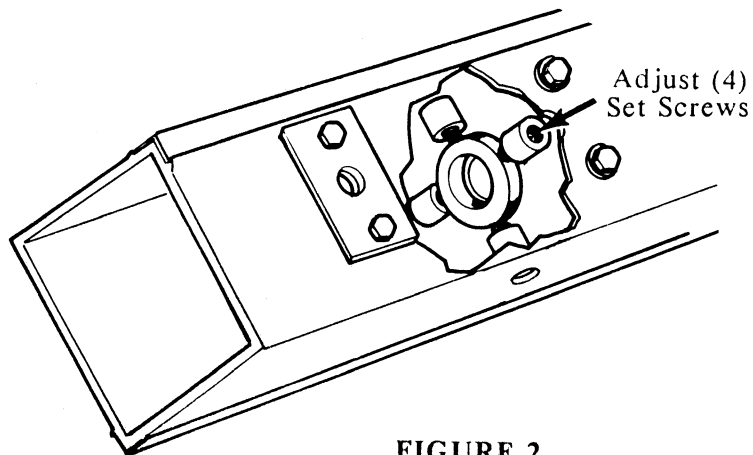


FIGURE 2

SECTION 5.5

MAIN TRACK TUBE ALIGNMENT - cont'd

NOTE: In the event that the male ends of the middle track assembly show wear, thus causing a loose fit when assembled, the posts on either end can be adjusted outward to take up the slack. Loosen the jam nut (See Figure 3) and turn the posts counter-clockwise a small amount to make the junction tight when assembled. Be sure to tighten jam nut.

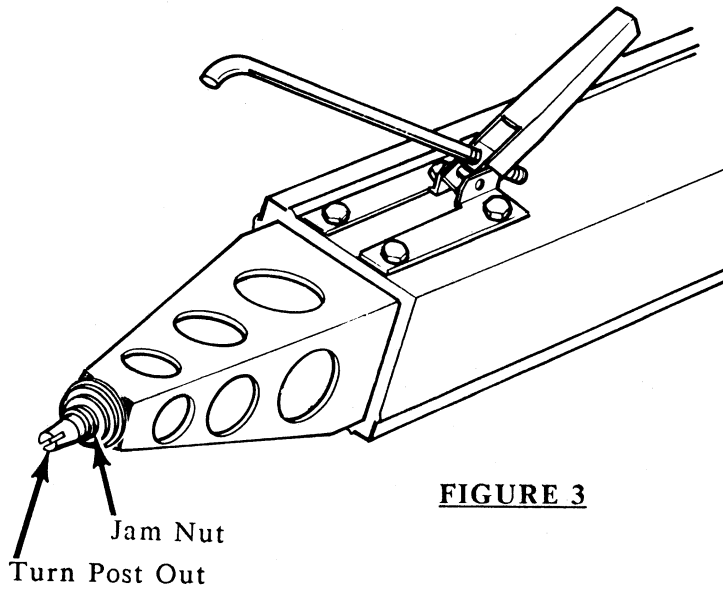


FIGURE 3

SECTION 6.1

PARTS ILLUSTRATIONS

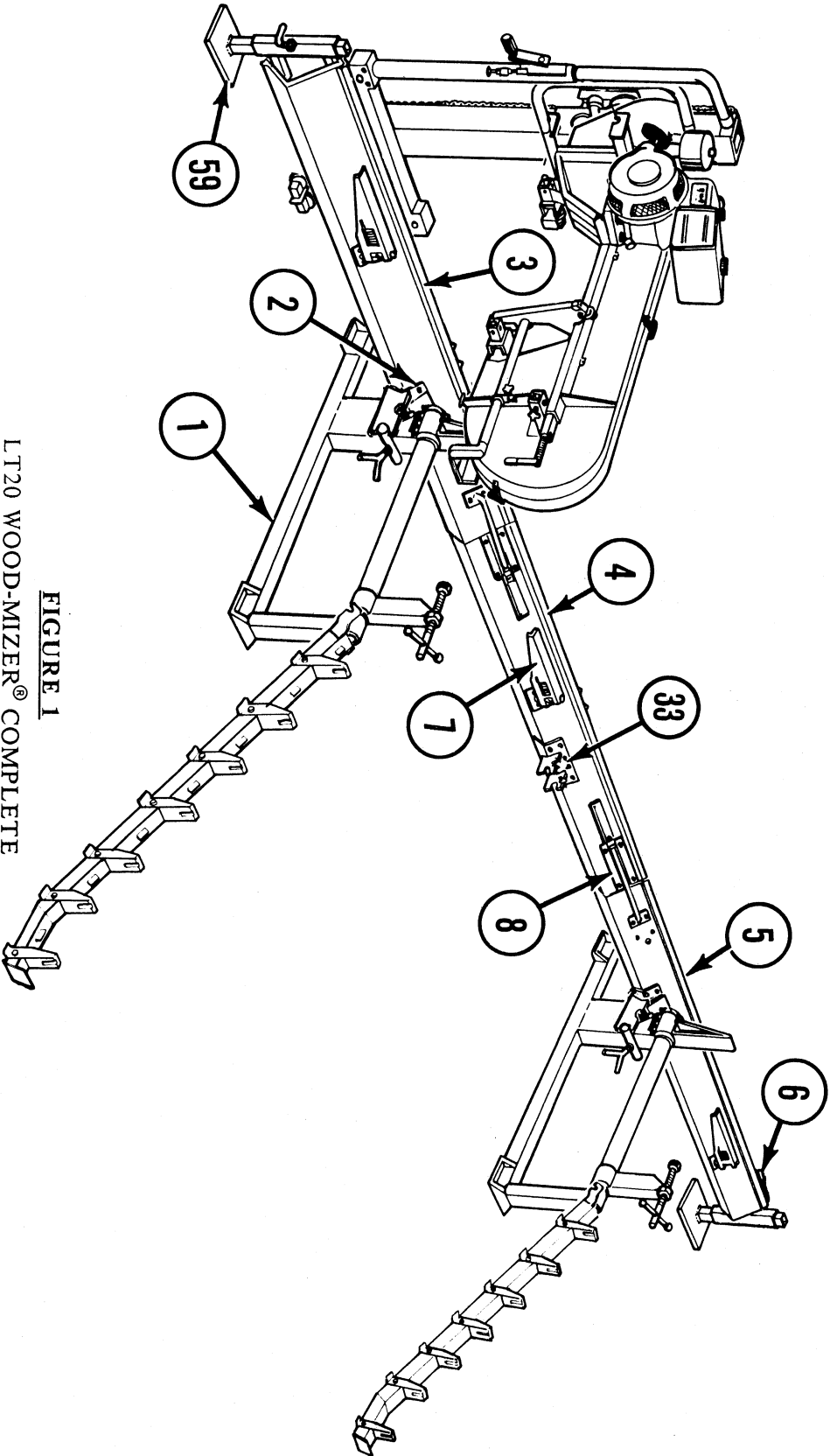


FIGURE 1
LT20 WOOD-MIZER® COMPLETE

SECTION 6.1

PARTS ILLUSTRATIONS - cont'd

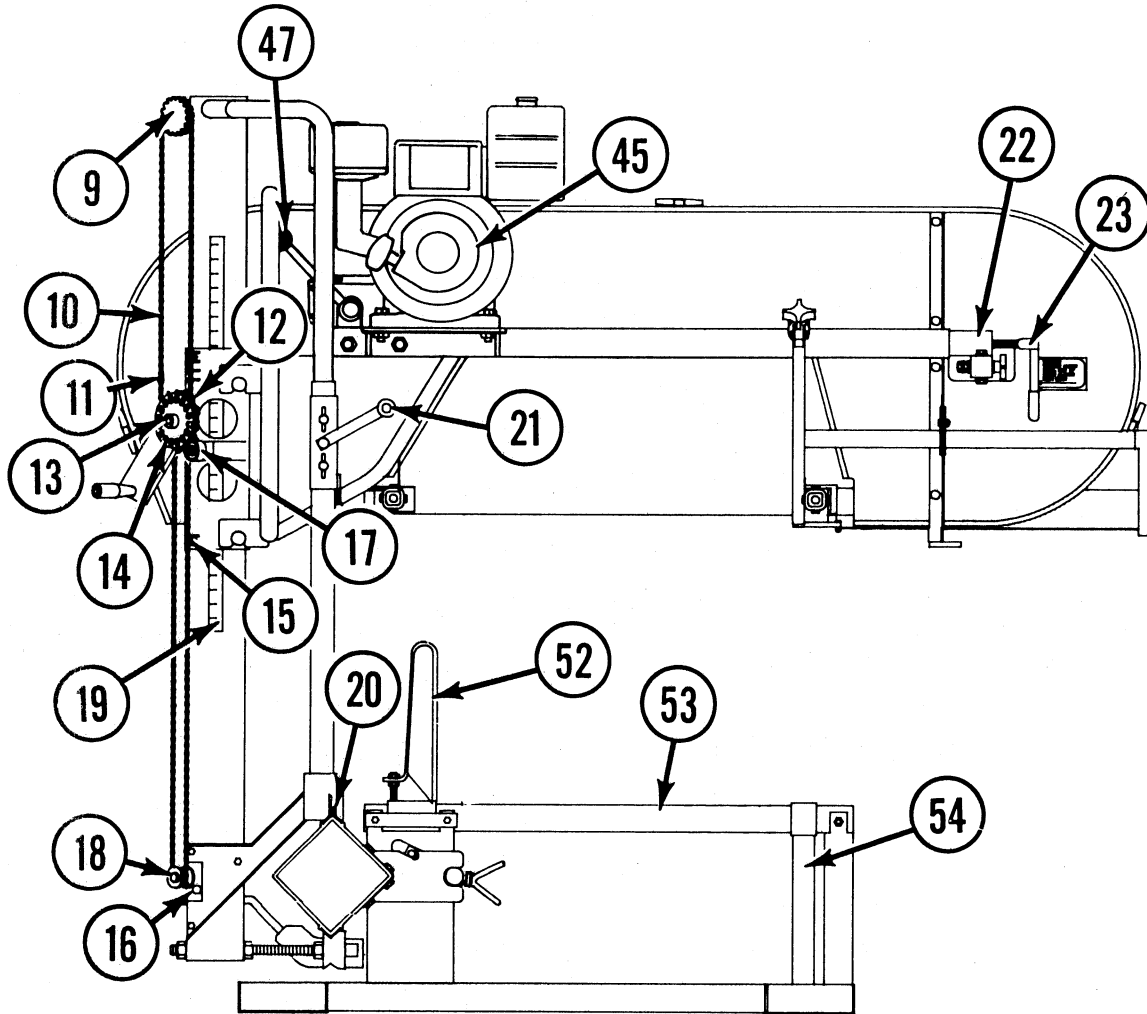


FIGURE 2
FRONT END VIEW

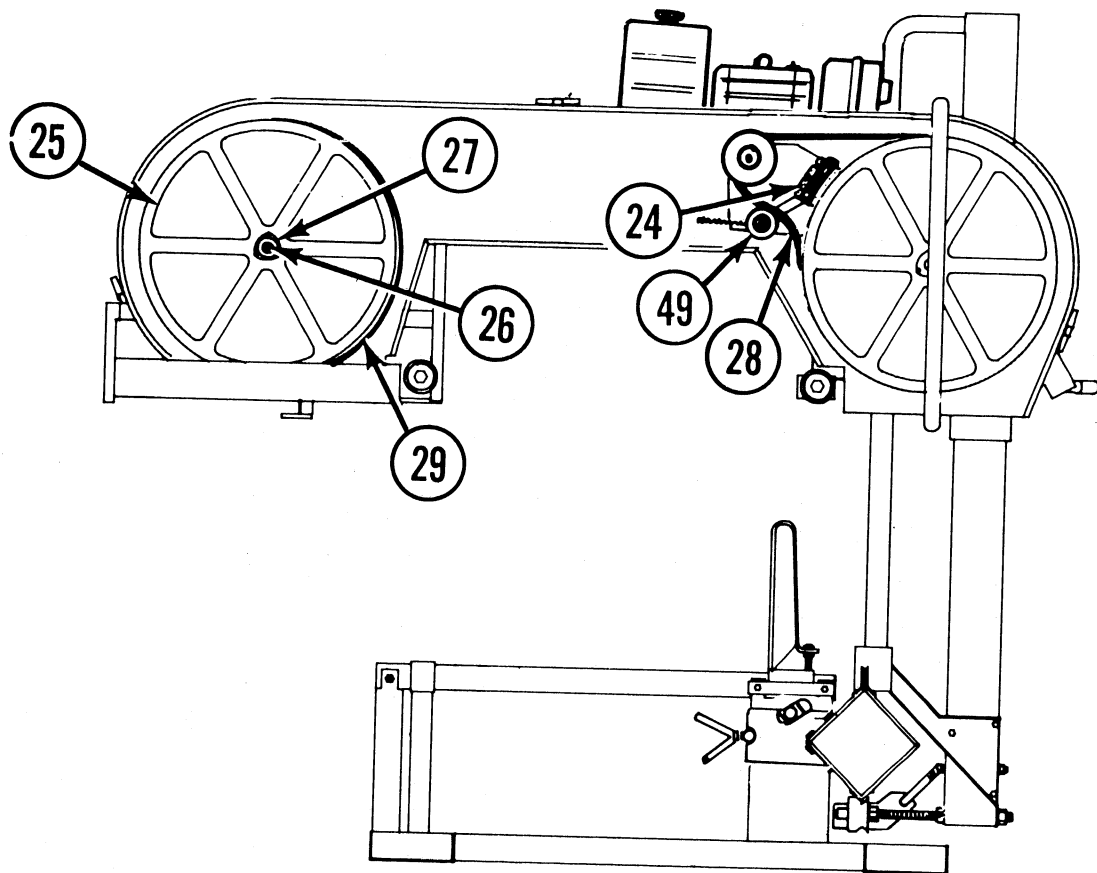


FIGURE 3
REAR END VIEW

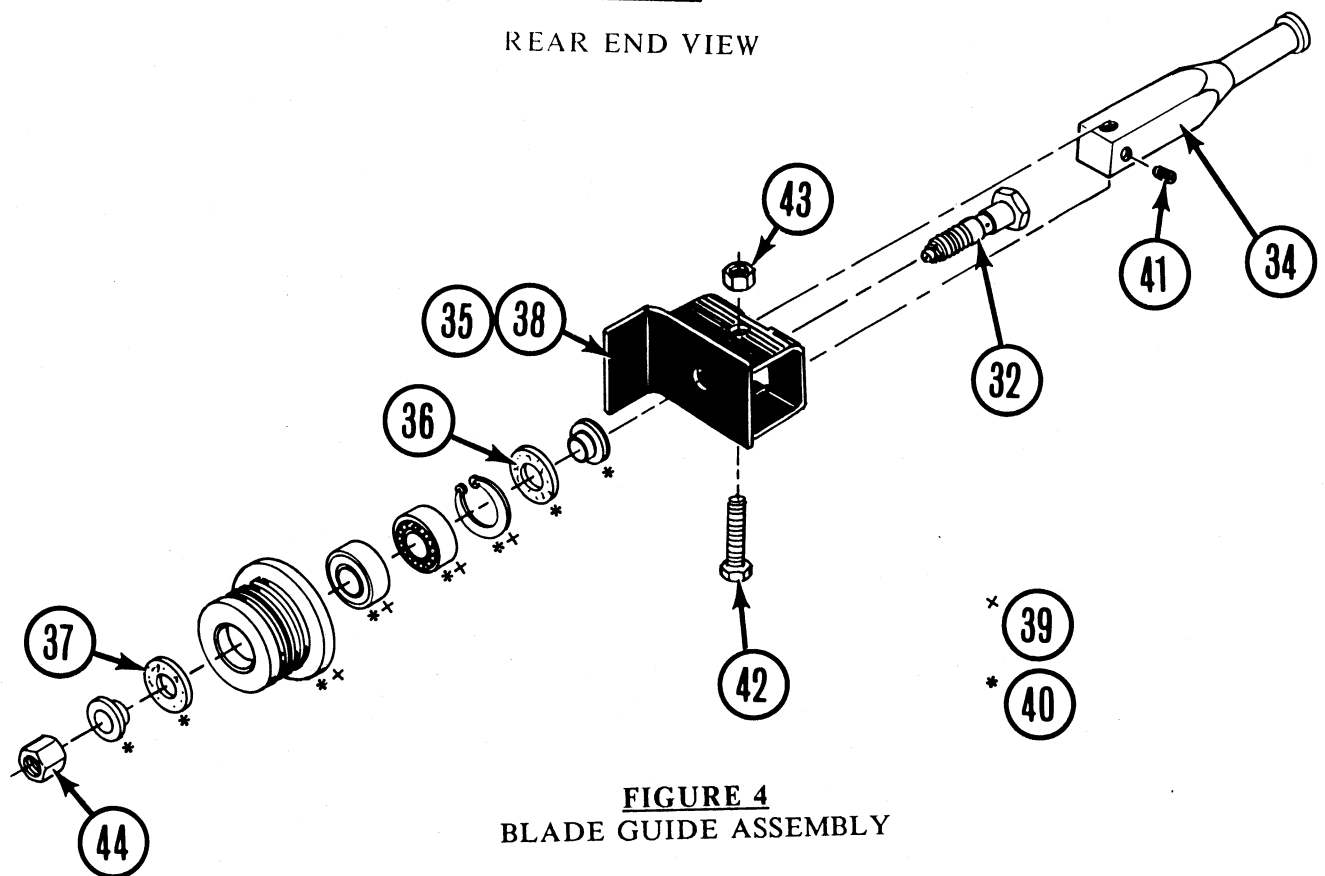


FIGURE 4
BLADE GUIDE ASSEMBLY

SECTION 6.1

PARTS ILLUSTRATIONS - cont'd

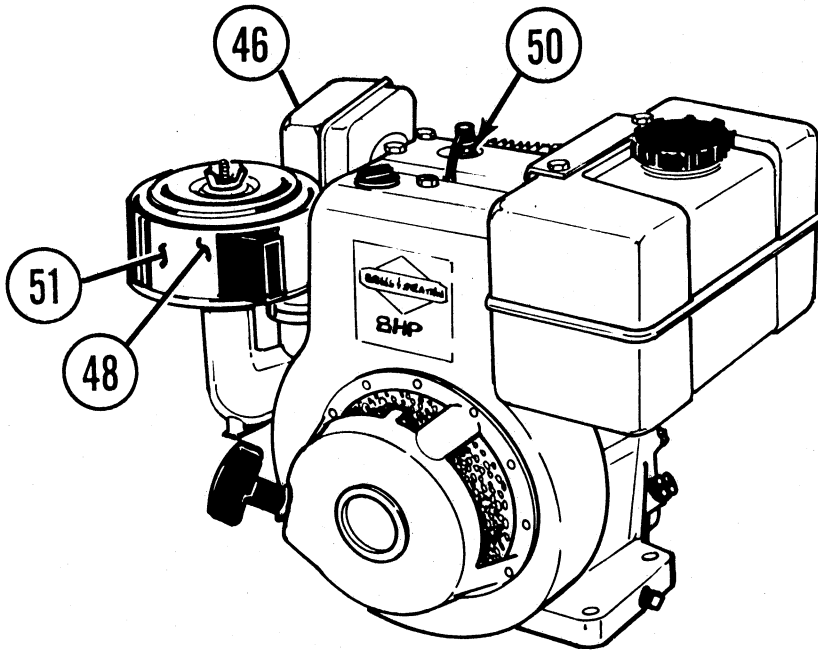


FIGURE 5
ENGINE ASSEMBLY

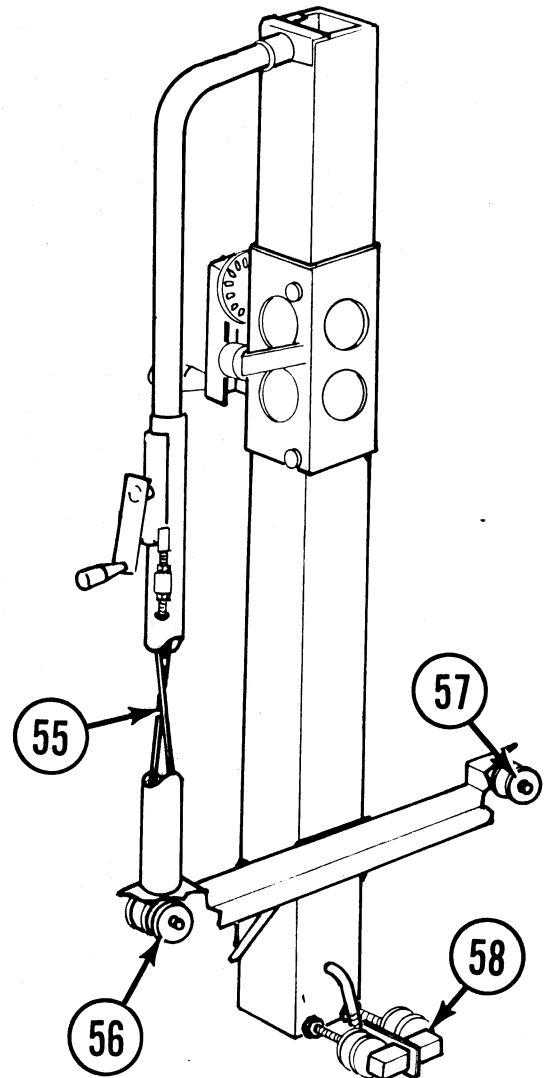


FIGURE 6
CARRIAGE ASSEMBLY

SECTION 6.2

PARTS LIST

Ref. No.	Description	Part No.
1.	Log Deck	A08006
2.	Log Deck Mount	W08486
3.	Front Stainless Steel Track	S08343
4.	Middle Stainless Steel Track	S08102
5.	Rear Stainless Steel Track	S08101
6.	Spring Stop	S08103
7.	Auxiliary Support	A08104
8.	Track Clamping Assy w/Hook	A08472
9.	Upper Idler Sprocket	P08068
10.	Up/Down Chain	P08126
11.	Up/Down Chain Master Link	P08076
12.	Up/Down Sprocket Assembly	A08390
13.	Up/Down Dial Weldment	W08346
14.	Socket Head Bolt w/Locknut	A08477
15.	Slide Pad	P08028
16.	Chain Tensioner Assembly	A08295
17.	6203-10 Up/Down Bearing	P06030-1
18.	Tensioner Roller w/Snap Ring	A08476
19.	LT20 Inch Rule	S08454-W
20.	Track Wiper	M08270
21.	Feed Crank w/Handle	A08388
22.	Tension Spring	P04235
23.	Blade Tension Assy w/Spring	A08165
24.	Brake Pad	S08548
25.	19" Blade Wheel	P08125
26.	Wheel Bearing	P08066
27.	Bearing Retainer Plate	S08221
28.	B-67 Drive Belt	P08063
29.	B-57 Idle Belt	P04185
30.	Blade Guide Assembly (Drive)	A08197
31.	Blade Guide Assembly (Idle)	A08191
32.	Blade Guide Bolt/Zerk Assy	A09417
33.	Adjustable Log Deck Mount	W08683
34.	Blade Guide Shaft	S08196-W
35.	Blade Guide Bracket (Idle)	W08482
36.	White Felt Washer	P04252
37.	Gray Felt Washer	P06455
38.	Blade Guide Bracket (Drive)	W08495
39.	Blade Guide Roller w/Bearing	A04925
40.	Blade Guide Rebuild Kit	K07079
41.	1/4-28 Brass Set Screw	F05005-42
42.	3/8-24 x 2 Hex Head Bolt (FT	F05007-23
43.	3/8-24 Jam Nut	F05010-22
44.	1/2-20 Lock Nut	F05010-12
45.	8HP Engine Assembly	A08584
46.	Spark Arrestor Screen	P08592
47.	Clutch Handle Assembly	W08521

SECTION 6.2

PARTS LIST - cont'd

Ref. No.	Description	Part No.
48.	Air Filter	P08591
49.	Idler Assembly	A08549
50.	Spark Plug	P08590
51.	Air Pre-Cleaner	P08475
52.	Side Support	W08079
53.	Bed Rail	S08048
54.	Log Clamp Assembly	A08282
55.	Hand Feed Belt 3L560	P08064
56.	Upper Track Roller (Drive)	S08255-1W
57.	Upper Track Roller (Idle)	S08255-2W
58.	Lower Roller Assembly	A08248
59.	End Support Jack	A08707-W

SECTION 7.1

WATER LUBRICATION OPTION INSTRUCTIONS

The Water Lube System is primarily a system to keep the blade clean. Water is routed from a 4-gallon bottle to a blade guide bracket. The water flow is controlled from a valve on the side of the bottle.

To install the Water Lube System, install the hanging bracket to the top of the vertical mast (See Figure 1). Simply fill the bottle with water and hang from the bracket as shown. The water bottle must be vented for the water to flow.

Route the hose from the bottle valve between the cutting head and the mast of the carriage assembly, then down to the tube that is welded to the drive-side blade guide bracket (See Figure 2).

Not all types of wood require the use of the Water Lube System, but when it is necessary, use only enough water to keep the blade clean. This conserves water and reduces the risk of water staining the boards.

Average flow rate will be one to two gallons per hour.

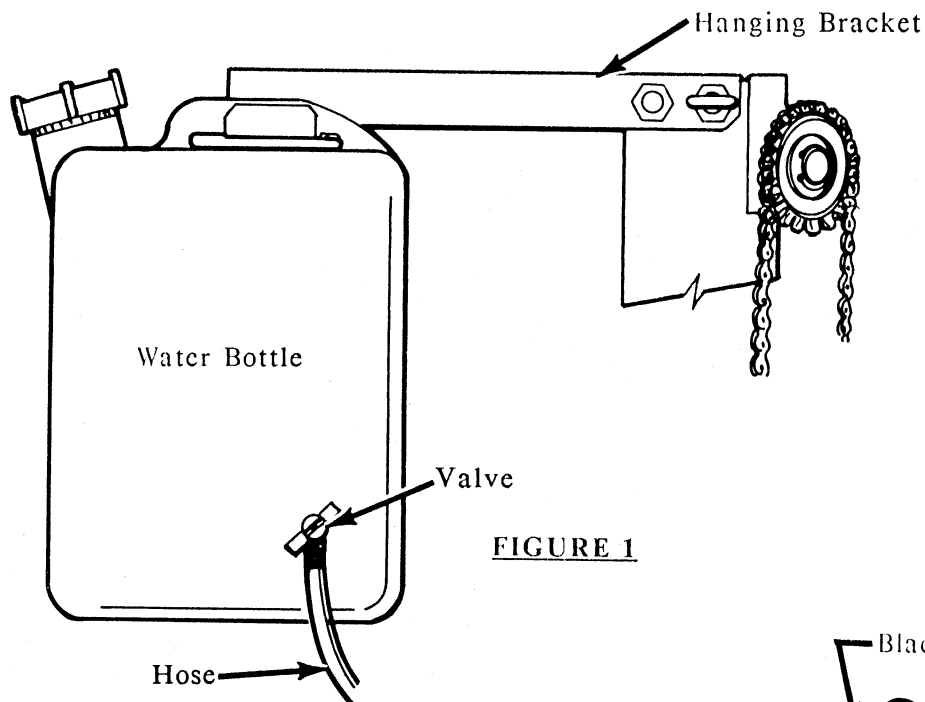


FIGURE 1

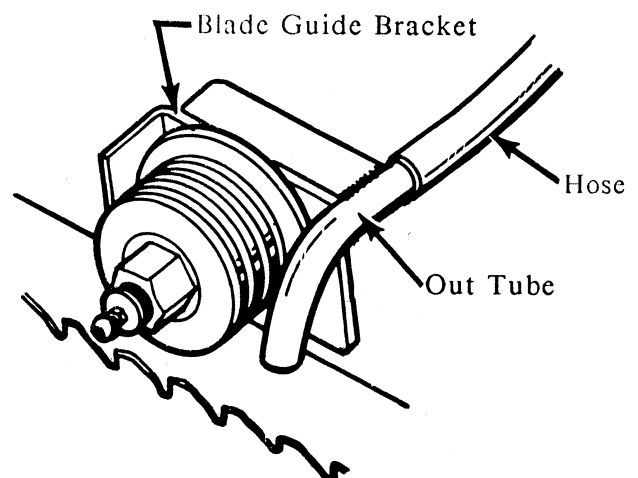


FIGURE 2

SECTION 7.2

LOG-LOADING RAMPS

The loading ramps come completely assembled and need only to be put in place over the loading ramp pins located on each of the log decks (See Figure 1).

It is recommended that two people, using cant hooks or peaveys, roll the log onto the mill with the optional loading ramps. To avoid injury, neither person should stand directly behind the log in case it rolls back down the ramp. These ramps are equipped with spring-loaded stops that are designed to assist in the loading of the log by preventing it to roll backwards down the ramps. The ramps should be removed when sawing to avoid interference with the cutting head.

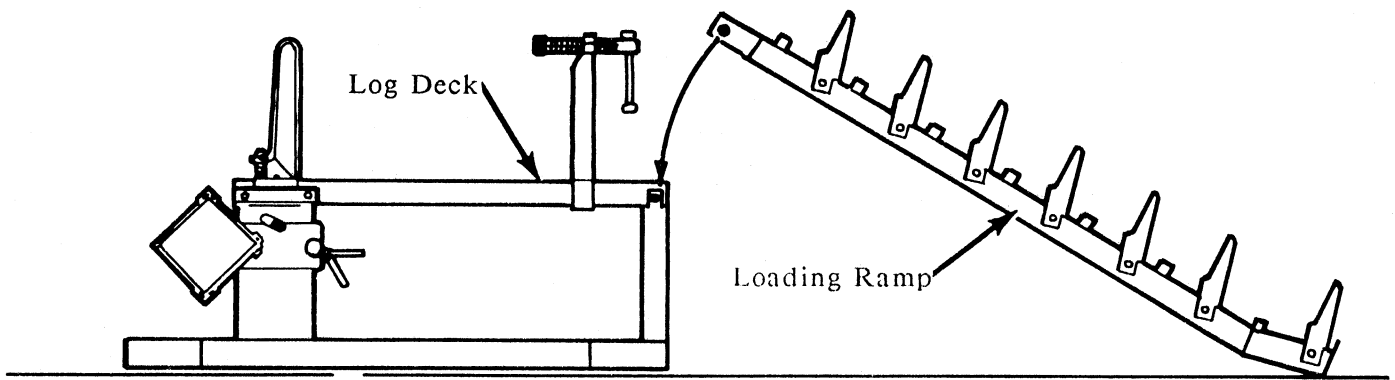


FIGURE 1

SECTION 7.3

SHINGLE/LAP SIDING OPTION

The LTSLR Shingle/Lap siding option is designed to expand the capabilities of the Wood-Mizer® Lumbermill. These instructions will cover assembly of the option to the lumbermill, cutting wood shingles, and cutting lap siding. Please read these instructions completely before operating.

Mounting the LTSLR to the lumbermill:

1. Place the Shingle/Lap siding option on the mill bed with the locating angles around the bed rails (See Figure 1). The shift lever should be at the front end of the mill. Make sure option frame is lying flat on bed rails.
2. When using the option to cut shingles, or as a resaw brace, you will need to align the frame parallel to blade. To do this, move the blade carriage over the front bed rail and lower until the blade touches the frame. Use the adjusting bolt, if necessary, to level the frame to the blade (See Figure 1). Repeat over rear bed rail.

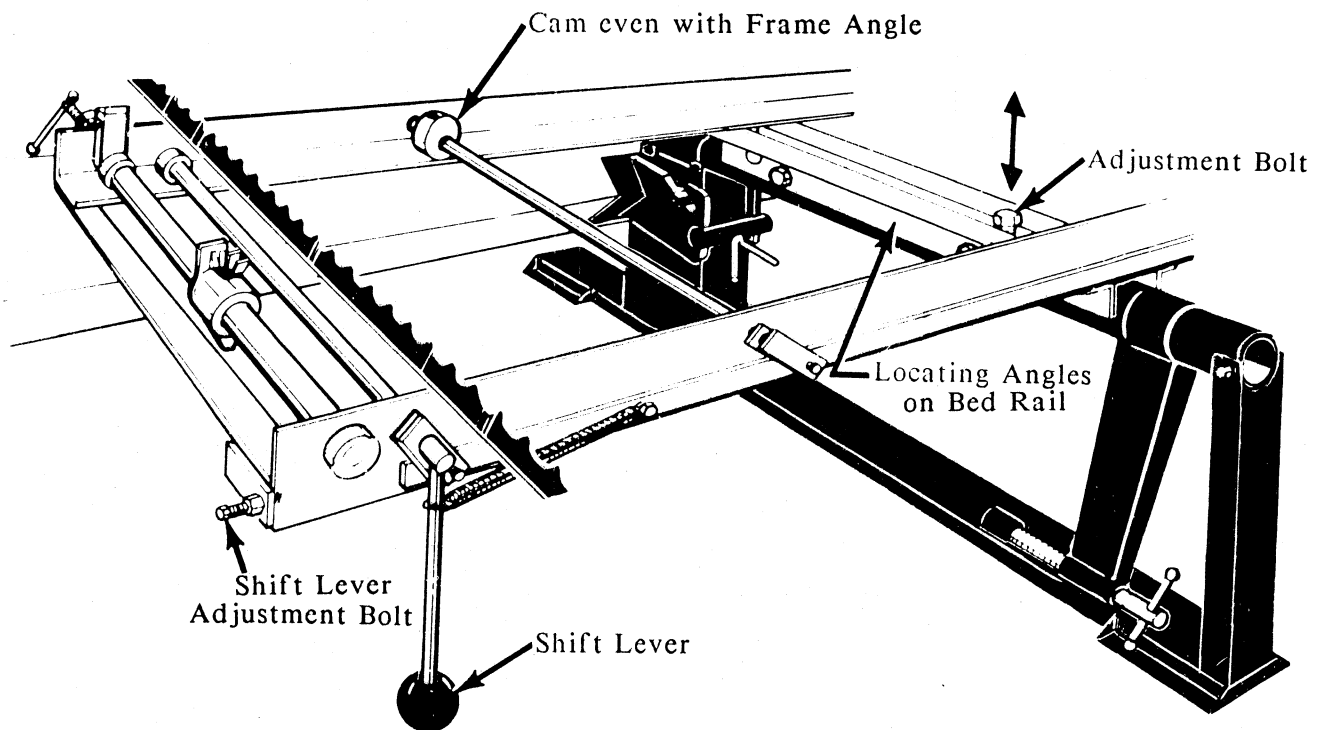


FIGURE 1

SECTION 7.3

SHINGLE/LAP SIDING OPTION - cont'd

Making Wood Shingles:

1. Before cutting shingles, square out a log to 12" or less in width. This beam (or cant) should then be cut with a chainsaw into blocks the length you want your shingles to be. The shortest length you can cut is 14" and the longest is 24".
2. Mount the blocks into the Shingle/Lap siding option by clamping them with the bar clamps. The lead edge of the block should be even with the front edge of the clamp that holds it (See Figure 2).

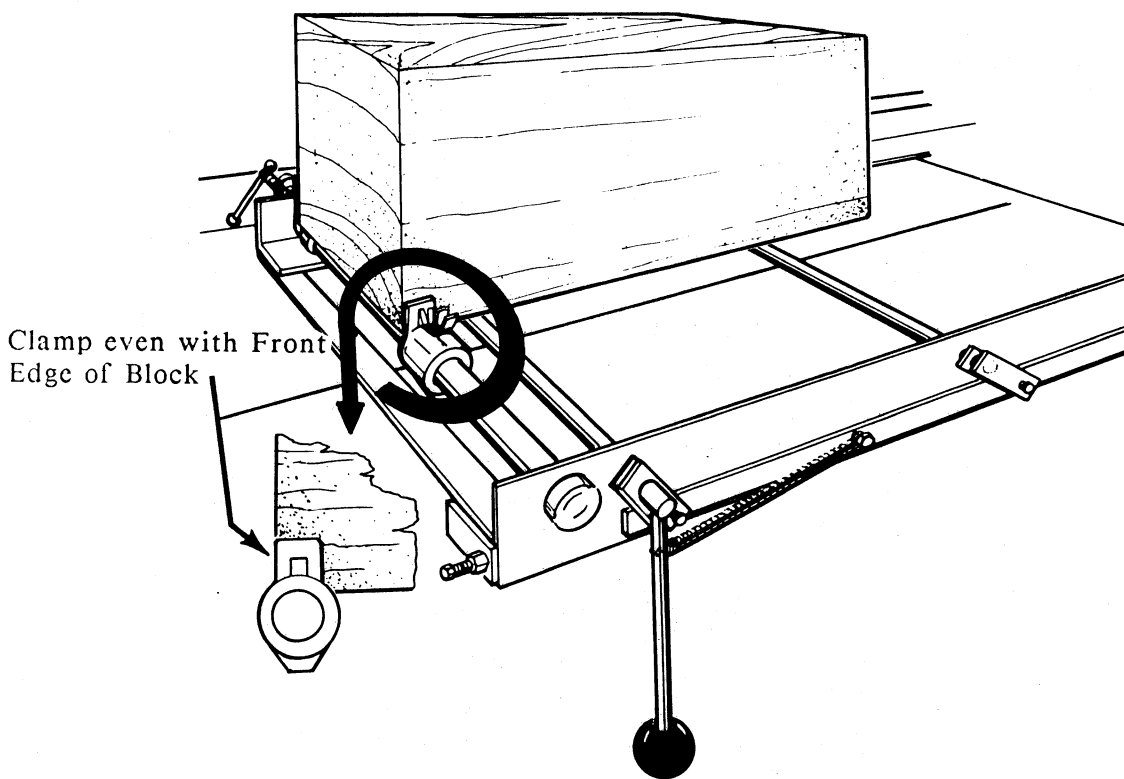


FIGURE 2

3. To adjust the amount of taper on the shingles, push the shift lever down and lower the blade to the top of the back edge of the first block (See Figure 3). Raise the shift lever until it hits the shift adjustment bolt. Measure the amount of drop to determine the taper. Adjust the shift adjustment bolt to change amount of taper (a shorter lever throw produces less taper).
4. Always follow all safety and operating procedures outlined previously in this manual when cutting shingles.

SECTION 7.3

SHINGLE/LAP SIDING OPTION - cont'd

Making Wood Shingles (cont'd):

5. Pull shift lever up and make one trim cut to true up all blocks. Return carriage.
6. Push shift lever down and lower carriage the thickness of the **thin** end of the shingle. Make cut and return carriage. Each shingle should match tapers to the setting you want. If they don't, check steps 1 through 4 of this section.
7. Pull shift lever up and lower carriage the thickness of the **thick** end of the shingle. Make cut and return carriage.
8. Repeat steps 6 and 7 until cant is cut a low as you can go.

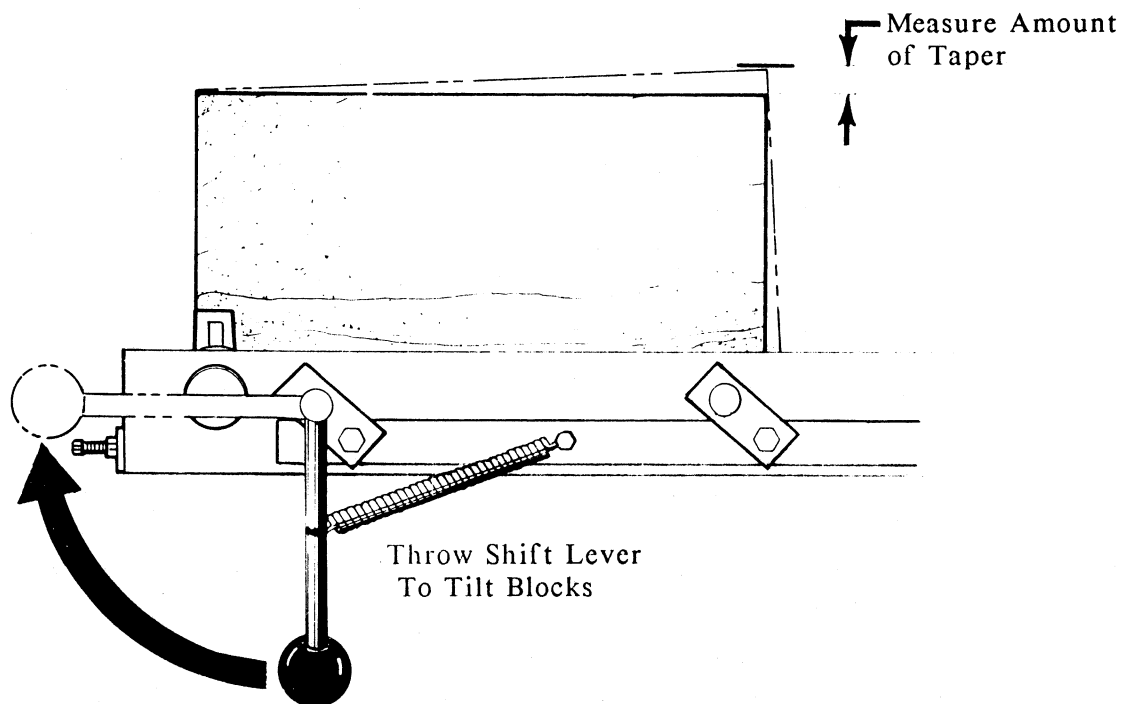


FIGURE 3

SECTION 7.3

SHINGLE/LAP SIDING OPTION - cont'd

Making Lap Siding:

The Shingle/Lap Siding Option is designed to hold cants or beams and can accurately cut tapered weather board or lap siding. Tapers can be in excess of 1/2" from side to side and accurately maintained throughout the length of the beam. Follow the instructions below for operating procedures.

1. Adjust the bar clamps in so they will hold the cant far enough inside the frame so it won't contact the cam rollers. This will keep the cams (used for shingles) from lifting the can when the shift lever is thrown.
2. With the shift lever down, adjust the two lap siding adjuster bolts until the proper taper is achieved. When the shift lever is thrown, the frame tips down on the ramp side of the mill. To check amount of taper, push the shift lever down and move the blade just in front of the cant and even with the top edge. Pull the lever up and measure amount of tilt in relation to the blade. Adjust taper with adjuster bolts, if necessary.
3. To cut siding, push the shift lever down and make a skim cut to true up the cant. Return carriage.
4. Pivot the shift lever and lower the cutting head by the amount needed to cut the **thick** edge of the siding. Make cut, remove board, and return carriage.
5. Pivot shift lever and lower the cutting head by the amount needed to cut the **thin** edge of the siding. Make cut, remove board, and return carriage.
6. Repeat steps 4 and 5 until you have cut as low as the Shingle/Lap Siding Option frame will allow.

SECTION 7.4

BLADE GUIDE ALIGNMENT TOOL

The LTBGAT blade guide alignment tool will assist you in aligning the two blade guides to provide the proper tilt in the blade.

Before using the tool, follow all alignment instructions in your Wood-Mizer manual found in Section 5 through deflection of the blade guides down $3/16"$. To check the tilt of the blade caused by the blade guides, use the following instructions:

With the adjustable blade guide arm open all the way, clamp the alignment tool on the blade, close to the guide. Be sure the tool does not rest on a tooth or burr and is lying flat on the blade. Measure the distance from the bed rail to the top edge of the blade (See Figure 1). Now, move the carriage so that the front end of the tool is positioned above the bed rail. Measure the distance from the bed rail to the bottom edge of the tool. When the blade is properly tilted, the measurement from the bed rail to the tool will equal the first measurement. Use the set screws shown in Figure 2 to adjust the blade guide tilt accordingly.

Move the carriage forward so the back end of the tool is over the bed rail and see that it measures the same as the first measurement. Adjust blade guide accordingly. Move alignment tool close to other blade guide and repeat preceding steps.

If major adjustments of blade guide tilt were made, it is necessary to re-measure the distance between the blade and the bed rails for proper blade guide deflection ($3/16"$).

Continue with alignment procedures as outlined in Section 5.

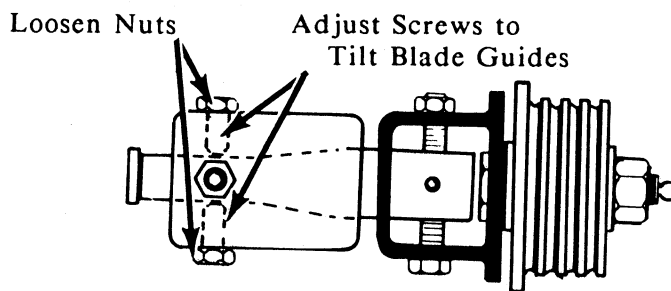
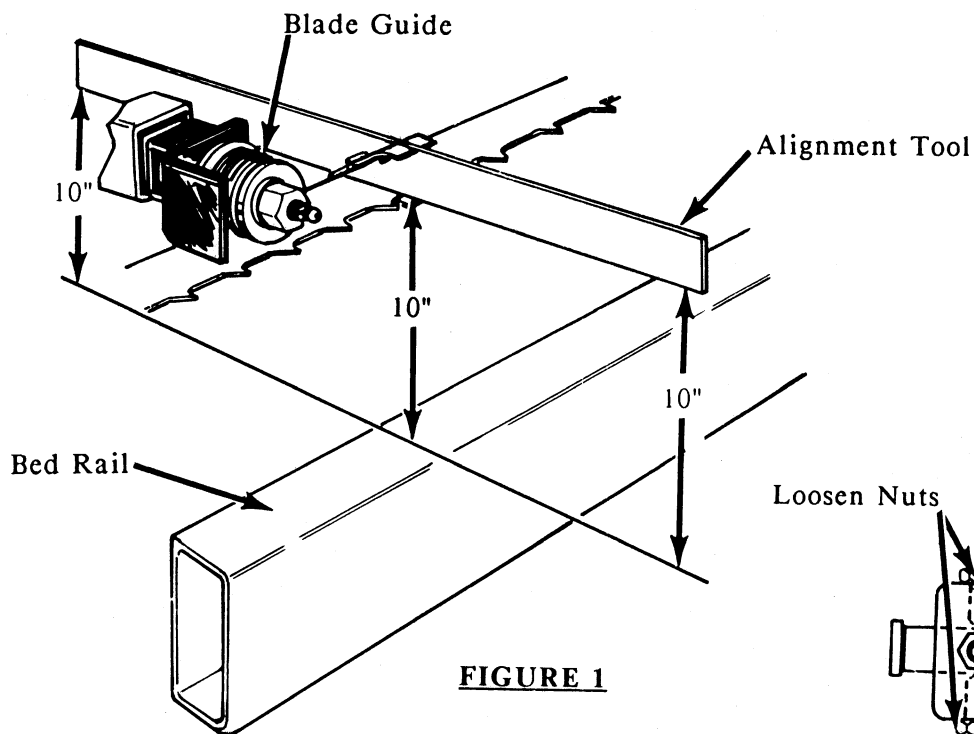


FIGURE 2

SECTION 8

TROUBLE-SHOOTING

PROBLEM	CAUSE	SOLUTION
Blades Dull Quickly	Dirty logs When grinding teeth, taking too much metal will heat up the tooth and cause them to soften. Poor sharpening techniques	Clean or debark logs, especially on the entry side of the cut Grind just enough metal to restore sharpness to the teeth. See Section 2.5 Make sure the tip is being sharpened completely See Section 2.4
Blades Break Prematurely	Rubber tires on drive wheels worn to the point blade contacts metal wheel - look for shiny spots on edge of wheels Poor sharpening techniques Tension too tight	Change Belts (B-57 & B-67 Eaton V Belts) See Section 2.4 See Section 2.7
Blade Doesn't Track Properly On Drive Wheel	Cant adjustment is not correct Flat belts	Re-adjust - See Section 2.7 Replace belts (B-57 & B-67 Eaton)
Blade Guides Don't Spin While Cutting	Frozen bearings Stiff bearings	Replace bearings Grease bearings
Blade Doesn't Stop Immediately After Disengaging	Brake shoe too loose or worn	Adjust brake or replace shoe - See Section 4.6
Boards Thick or Thin on Ends or Middle of Board	Stress in the log, which causes the log to not lay flat in the bed Set in teeth	After the log has been squared, take equal cuts off opposing sides. i.e., Take a board off the top, then turn the log 180° and take a board off. Repeat, keeping the heart in the middle of the cant, and making it your last cut. Re-set, equalize and sharpen

SECTION 8

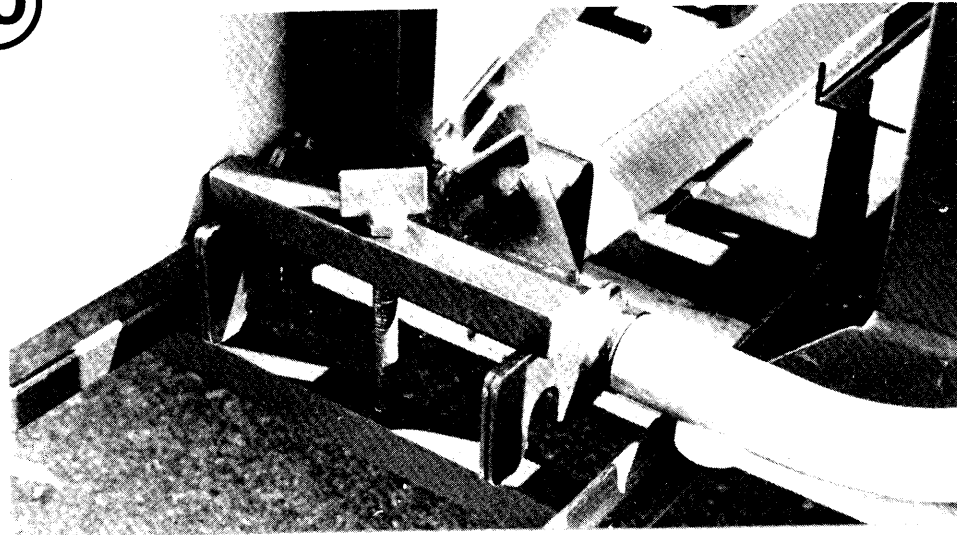
TROUBLE-SHOOTING - cont'd

PROBLEM	CAUSE	SOLUTION
Lumber is Not Square	Vertical side supports not square	Adjust vertical side supports. See Section 5.4
	Blade is not parallel to bed	Adjust blade to parallel - See Section 5.2
	Sawdust or bark between log and log decks	Remove particles
	Tooth set problem	Re-set, equalize and sharpen.
Sawdust Builds Up On Track	Excessive oiling	Track does not need any lubrication
	Rail wipers worn	Adjust wipers to the point where they firmly come in contact with the track
	Track is sticky	Clean track with solvent, apply a coat of standard automotive wax and buff to a hard surface
Wavy Cuts	Excessive feed	Slow feed rate
	Improperly sharpened blade - This will be the problem 99% of the time!	Resharpen blade - See Section 2 - Read entire section
	Blade guides improperly adjusted	Adjust guides - See Section 5.3
	Sap build-up	Water-lube
	Set problem	Re-set, equalize and sharpen

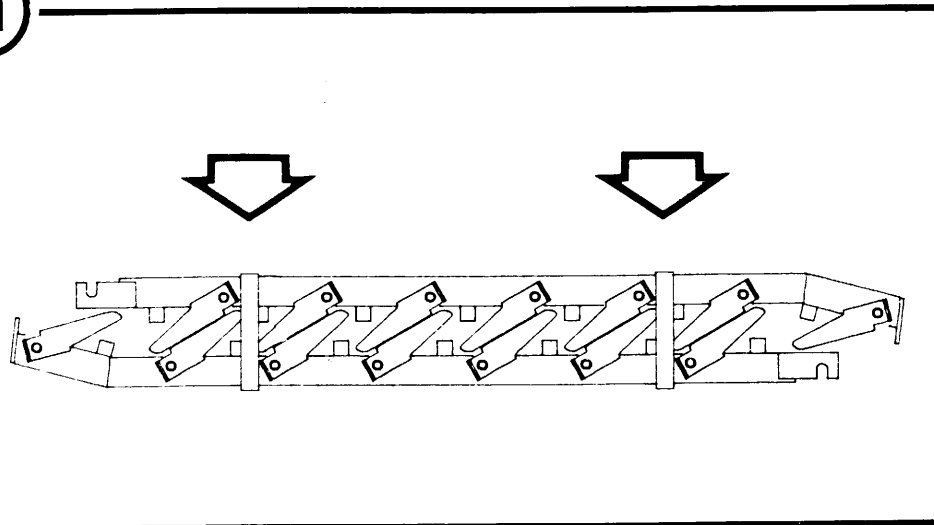
LT20 Crating Instructions

10

10. Place T-bar over hook brackets and thread into tapped hole until carriage is secured.



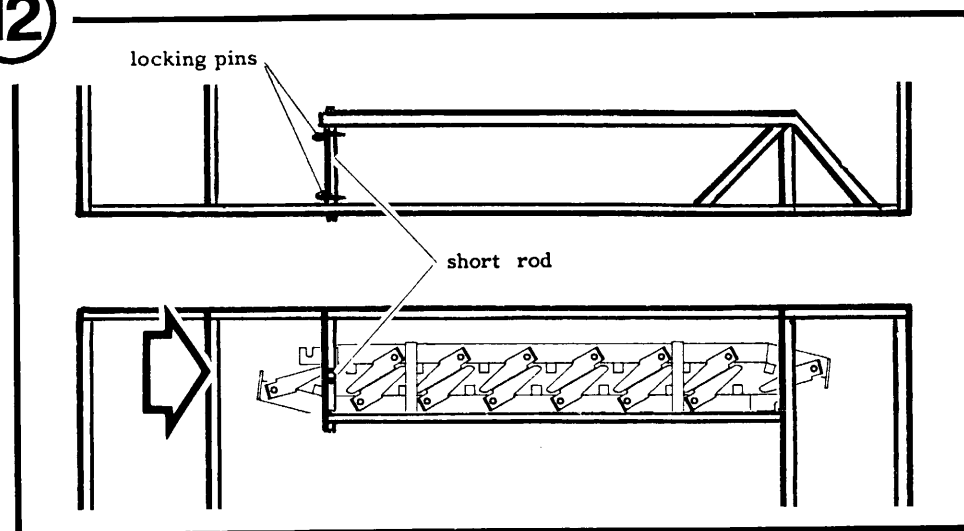
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11. Clamp two ramps (optional) together by placing one on top of the other as shown and press together until you are able to place the two clamps around both ramps.

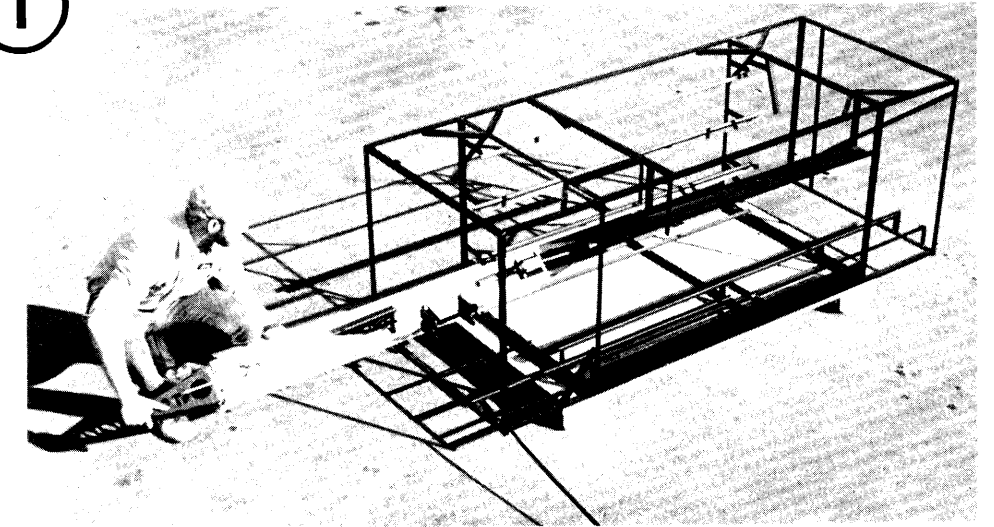
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12. Slide ramps into shelf at top right of crate. Slide until ramps are approximately centered on shelf and use short rod with two locking pins to hold in position.

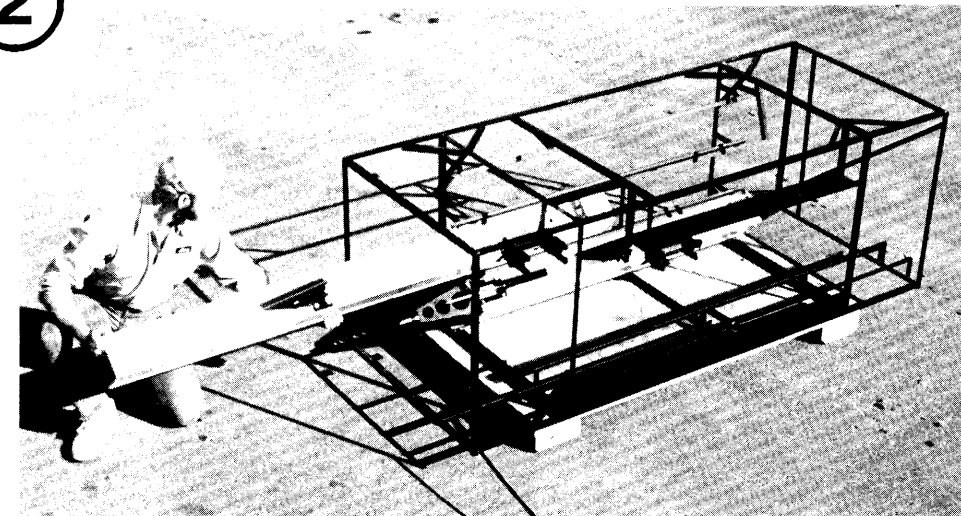


1

1. Load middle track section into lowest guide on left hand side of crate. Slide in all the way to rear of crate.



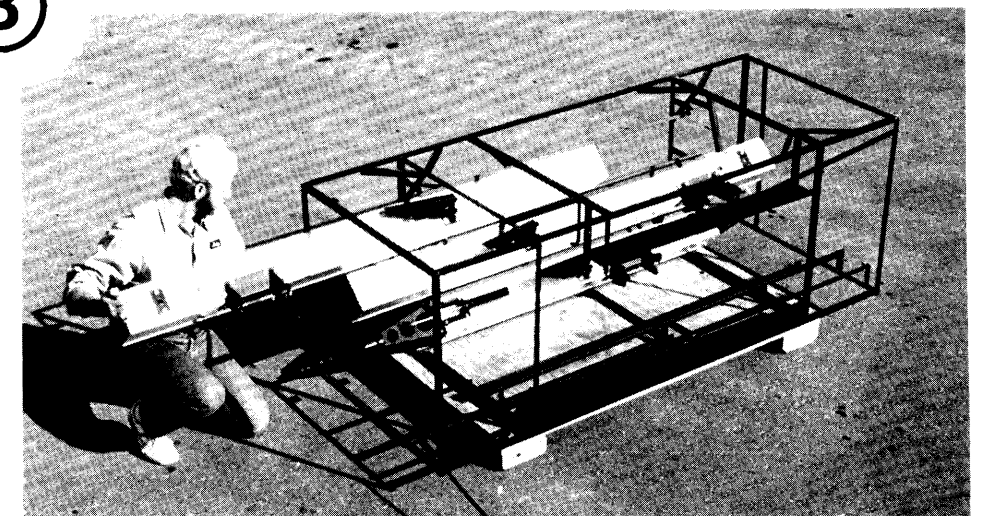
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2. Slide front track assembly (clamp fixture first) into middle guide above the track just loaded. Again, push all the way to the back of the crate.

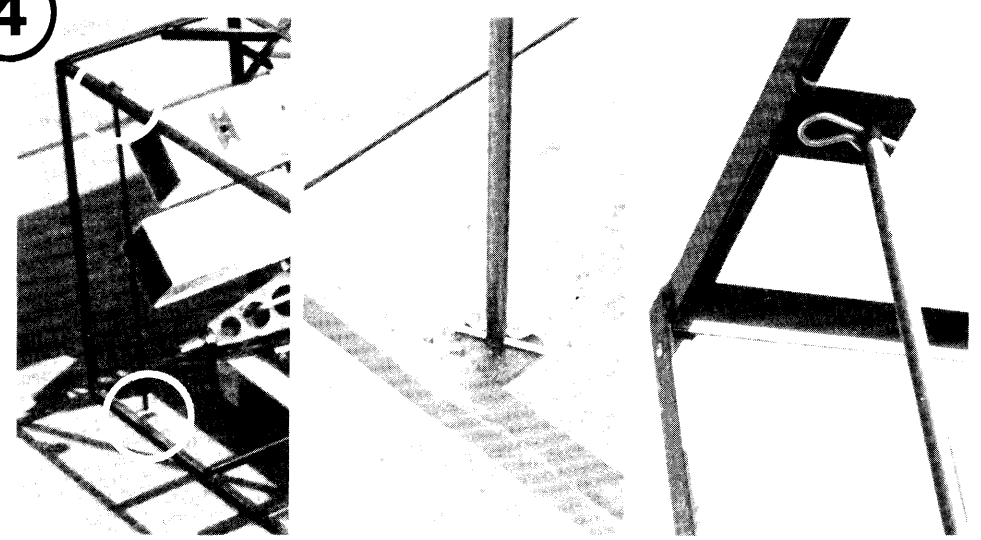
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3. Slide rear track assembly (clamp fixture last) in top guide all the way to rear of crate.



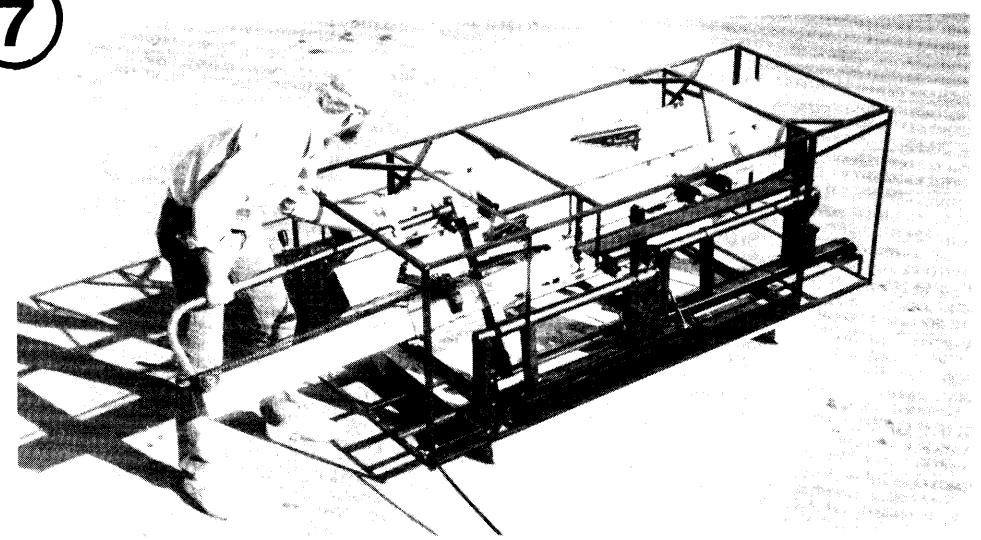
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4. Replace stop bar with lock pins above bottom bracket and below top bracket as shown.



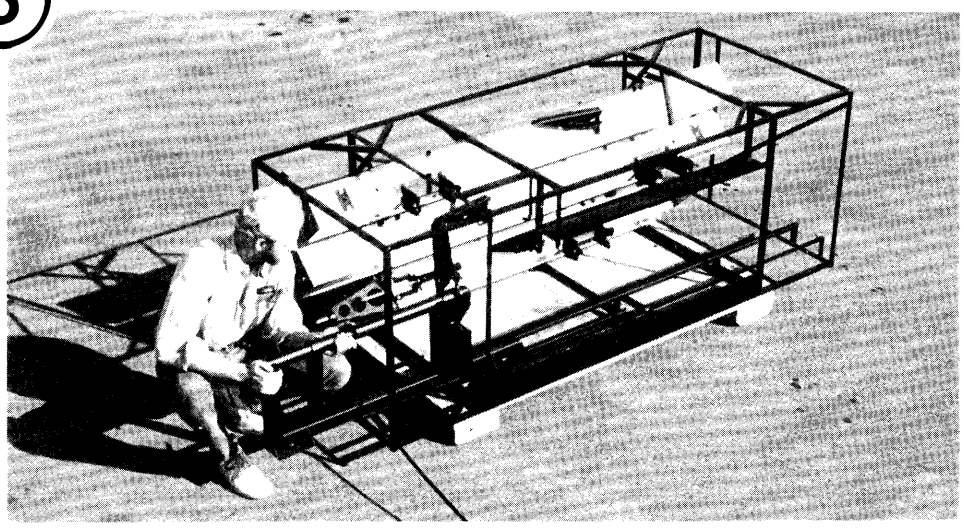
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7. Load mast by placing pin located on idle upper track pulley housing in guide found just left of the log deck guides. Slide mast in crate until pin at end of guide locates inside the pulley housing.



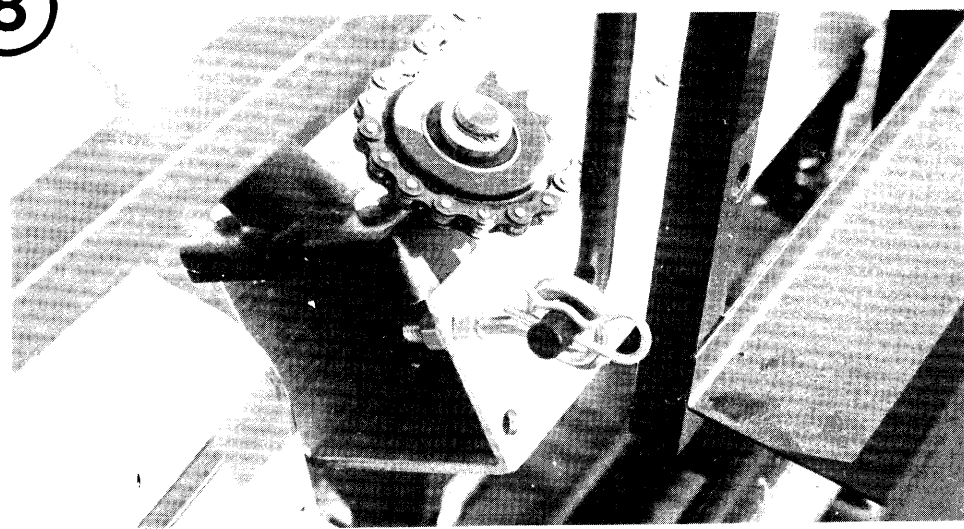
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5. Load one of the log decks in the top guide on the far right hand side of the crate (side support end first). Slide all the way to rear of crate. You will have to tilt deck to allow side supports to miss support angles of the crate.



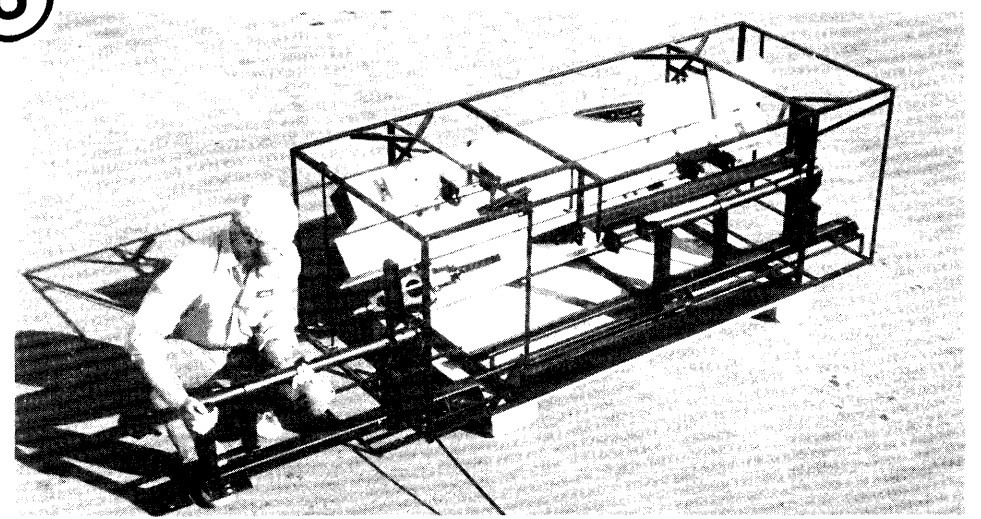
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8. Hang eye-bolt at top of mast on crate hook and lock with pin.



6

6. Place the other log deck in the lower guide at the far right side of the crate (side support end first) and slide till it butts against the first log deck.



9

9. Attach guide handle to carriage head and load into crate (idle side first) on guide just left of mast pin guide. Slide carriage in crate until hook brackets rest over cross support with tapped hole.

