SAW CHAIN MAINTENANCE

"Courtesy of Oregon Saw Chain Division, Omark Industries"

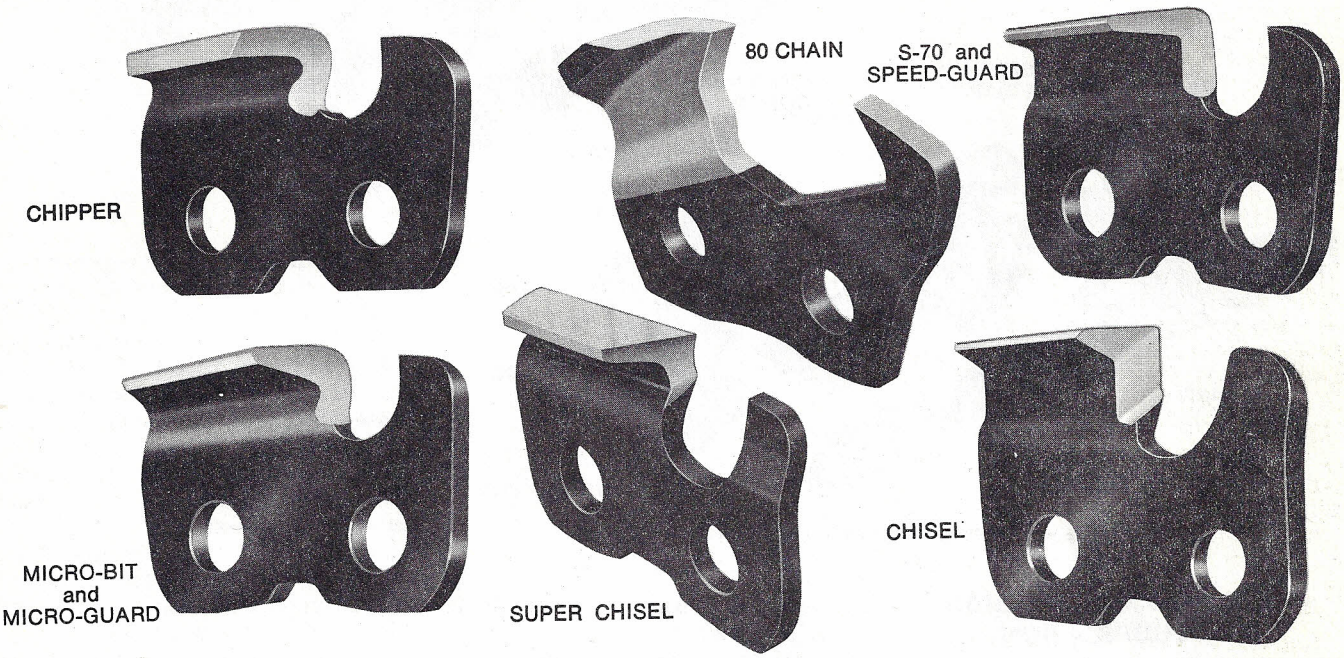


Fig. CM1–Cutting links from each of the six types of saw chains.

SAW CHAIN

This section on saw chain maintenance has been prepared to give information that will enable mechanics to service the cutting chain as well as the engine of the chain saw. Information for trouble shooting saw chain problems is also given in this section.

SAW CHAIN TYPES

Some chains now in popular use can be classified into six types as:

Chipper Tooth Chain: ¼", ⅜", .404", 7/16", ½", ⅝", ¾" pitches; .050", .058", .063", .122" gauges.

80 Chain: .325", .404" pitches; .050", .058", .063" gauges.

S-70 and Speed-Guard: ⅜" pitch: .050", .058", .063" gauges.

Micro-Bit & Micro-Guard: .404", 7/16", ½" pitches; .050", .058", .063" gauges.

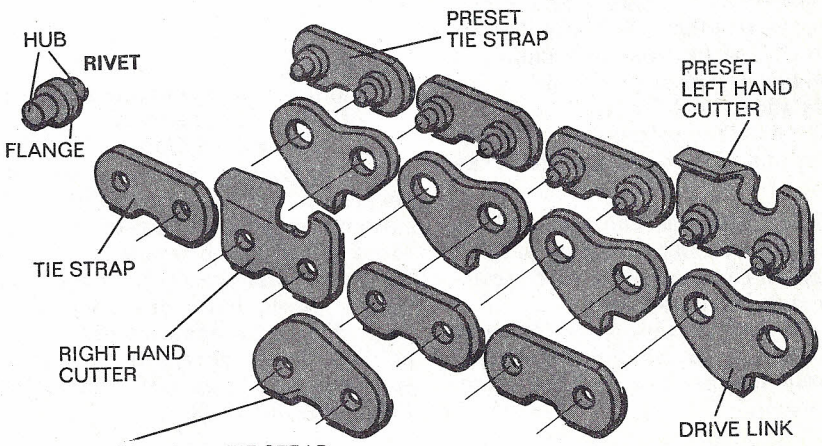
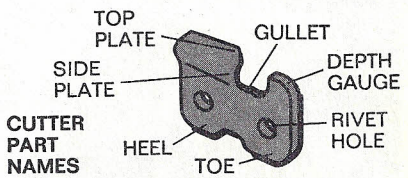


Fig. CM2–Nomenclature of chipper type saw chains. Micro-bit, Super Chisel, S-70 and Chisel are similar except for cutter design.

Super Chisel Chain: .404" pitch; .050", .058", .063" gauges.

Chisel Chain: ½", 9/16", ⅝" pitches: .058", .063" gauges.



SAW CHAIN NOMENCLATURE

To identify parts of a saw chain, refer to Fig. CM2 for chipper type chains and to Fig. CM3 for 80 series chains.

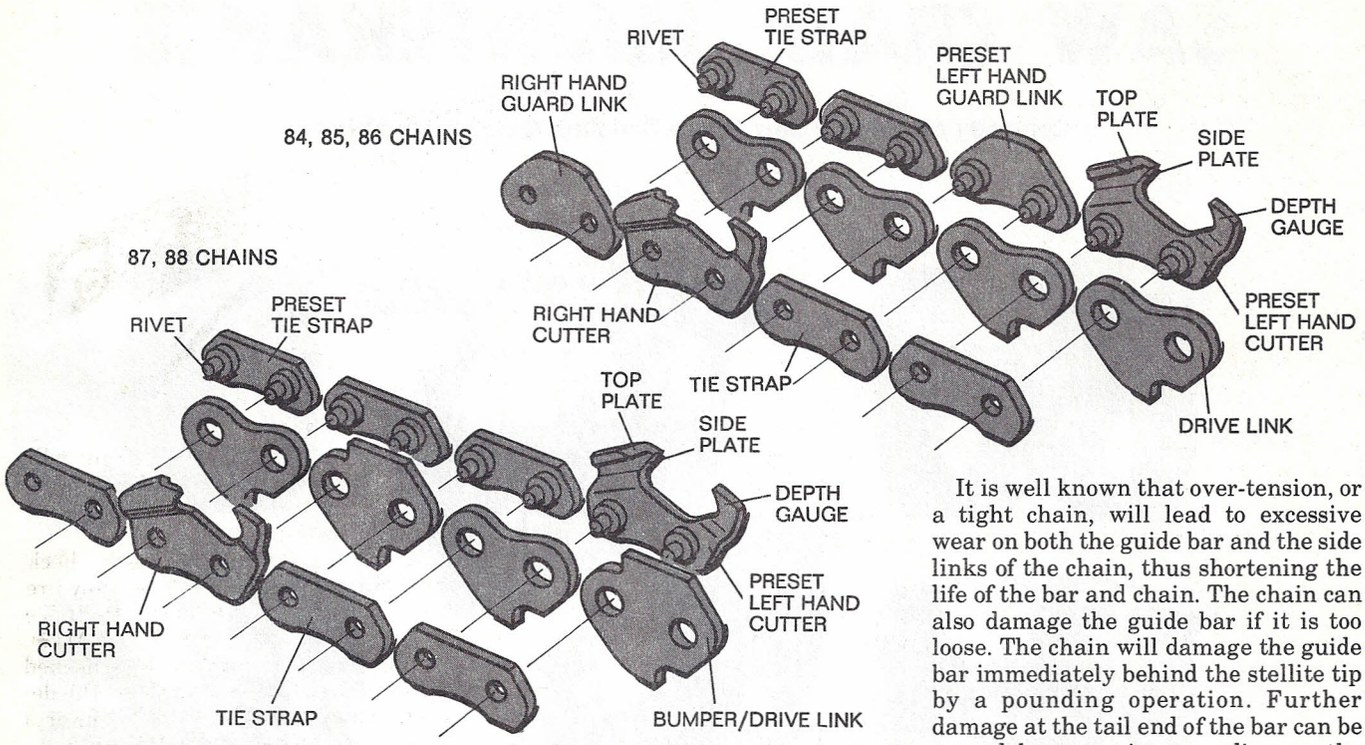


Fig. CM3–Nomenclature of 80 series chains.

CHAIN BREAK IN, TENSION AND LUBRICATION

BREAKING IN A NEW CHAIN. As with any machine or accessory containing moving parts, the first hour or so of operation can make a great difference to the length of life. Careful attention to the instructions for breaking in and making tension adjustments can greatly add to the life of the chain.

The following instructions are important and will add to the life of saw chain:

1. If possible, soak chain in oil bath before use and between uses.
2. Install chain properly with recommended chain tension.
3. Run chain at slow speed for about 5 minutes, giving it plenty of oil.
4. Stop engine and readjust chain tension.
5. Recheck tension until chain is fully broken in.
6. Keep chain well lubricated when in use.
7. Keep chain sharp. Always use a new file on a new chain.
8. Correct chain tension, especially on bar lengths of 32 inches and over, is important to prevent the chain jumping the bar and causing damage to the equipment and loss of time to the operator.

CHAIN TENSION ADJUSTMENTS. Correct tension is very important. It will increase the life of the saw and chain. Loose tension is a major cause of saw chain problems; it ruins chain, bar and sprocket. Check chain tension often, but make adjustments only when the attachments have cooled off. To insure correct tension follow steps shown in Figs. CM4, CM5, CM6, CM7, CM8 and CM9.

It is well known that over-tension, or a tight chain, will lead to excessive wear on both the guide bar and the side links of the chain, thus shortening the life of the bar and chain. The chain can also damage the guide bar if it is too loose. The chain will damage the guide bar immediately behind the stellite tip by a pounding operation. Further damage at the tail end of the bar can be caused by excessive pounding as the chain arcs off the sprocket. These pounding forces will cause stress in the chain components, which may eventually break, or the pounding may cause the chain to have stiff links. A loose chain may jump off of the bar, damaging the drive links, or wear the rails of the guide bar itself.

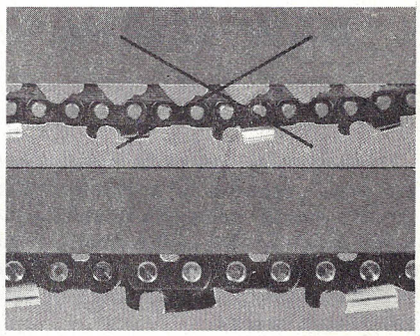


Fig. CM6–Correct Tension: Tighten until chain just touches bottom bar rails. Chain on roller nose bars must be tighter.

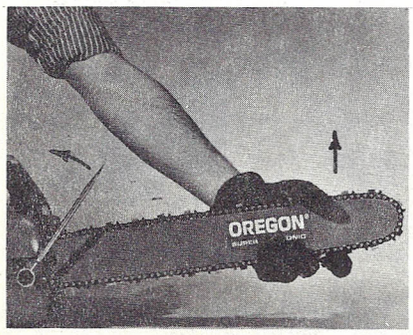


Fig. CM4–Loosen bar nuts.

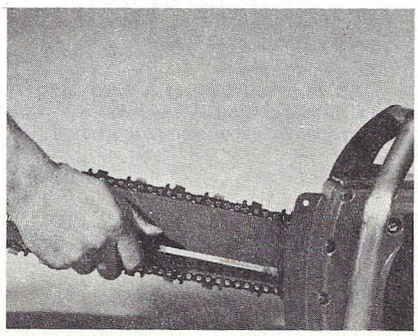


Fig. CM5–Tighten tension adjusting screw.

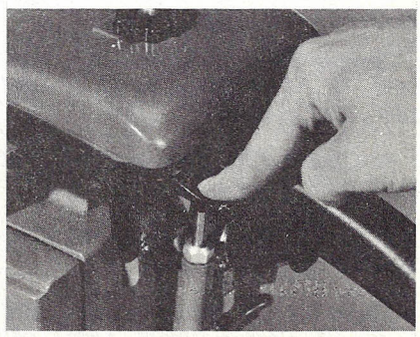


Fig. CM7–Lubricate chain liberally.

LUBRICATION. The importance of proper lubrication of the chain and guide bar cannot be over-stressed. Each rivet in the chain should be considered as a bearing and must be lubricated. This is particularly important in direct drive or high speed chains. The same applies to bearing surface between the chain and the guide bar.

Clean chain in solvent before and after filing, then give chain an oil bath for proper lubrication. DO NOT leave it all to the oil pump. Be sure to use the correct weight of clean oil (not reclaimed crankcase oil) to allow maximum chain lubrication under all cutting conditions and varying temperatures.

CHAIN SHARPENING

CHIPPER CHAIN. A full round file (not a rat tail) is used to sharpen the chipper-type chains. For good results, the procedures shown in Figs. CM11, CM12, CM13, and CM14 should be adopted.

For average sawing, maintain the filing angles shown in Fig. CM15 by holding the file in the position shown in Figs. CM11 through CM14. Do not allow the file to drag on the backstroke, and rotate the file occasionally to increase file life. Approximately 1/10th of the file diameter should be above the cutting edge of the cutter. If the distance is less than this, the cutting edge will be too blunt; if distance is greater, a rapidly wearing feather edge will result. For convenience, file alternate (either all right hand or left hand) cutters; then reverse the chain in the vise or turn the saw around and file the remaining cutters. All cutters must be filed alike and the same amount to keep the cutting edges at the same height. Check this by laying a file or straightedge across the tops of the cutters. Continue filing high cutters in normal manner until all cutters are same height.

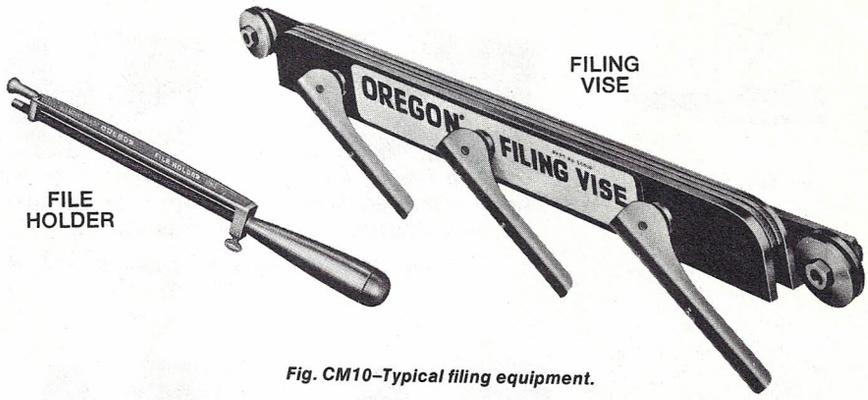


Fig. CM10–Typical filing equipment.

Suggested file sizes for standard (chipper-type) chain:

Chain Pitch	Round File Size
¼″	⅛″
.354″	5mm
⅜″	3/16″
⅜″ (S-70)	7/32″
.404″	7/32″
7/16″, ½″	¼″
9/16″, ⅝″	9/32″
¾″	5/16″

Different size and design chain will require different file sizes. If manufacturer's recommendations are not available, refer to the above chart.

After filing the cutting edges, check the depth gauges, or riders as they are sometimes called, for correct distance below the cutting edges (Fig. CM17). Depth gauges are generally checked with a jointer that is pre-set for the desired distance, as the one shown, or a jointer with an adjustable setting.

Average depth gauge setting for standard (chipper-type) chain:

Chain Pitch	Depth Gauge Setting
¼″	.020″
.354″	.025″
⅜″	.020″
⅜″ (S-70)	.025″
.404″	.030″
7/16″	.030″
½″	.030″-.040″
9/16″, ⅝″	.040″
¾″	.050″-.060″

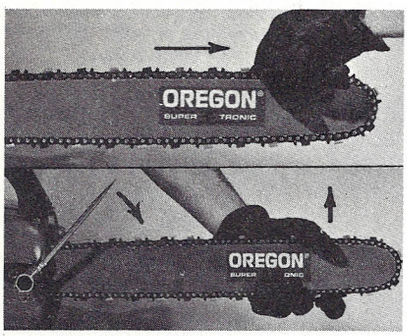


Fig. CM8–Pull chain around bar to be sure it fits sprocket and bar. Hold bar tip up, tighten nuts.

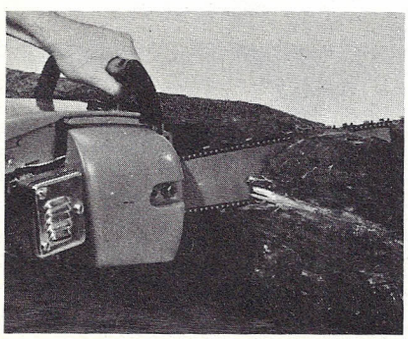


Fig. CM9–Use extra oil first half-hour of cutting with new chain.

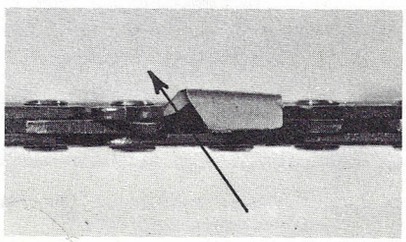


Fig. CM11–File from inside to outside of cutter.

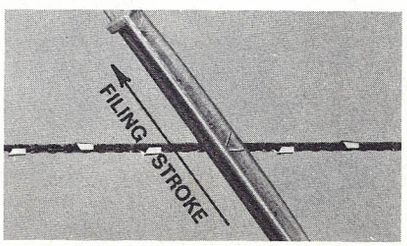


Fig. CM12–Place File Holder on cutter–keep mark on holder parallel with chain.

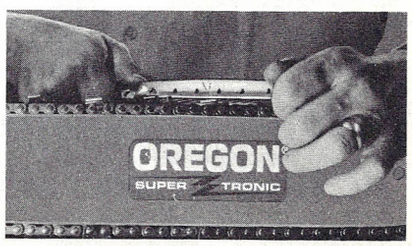


Fig. CM13–Hold file level. Press against cutter and make 2 or 3 light strokes forward.

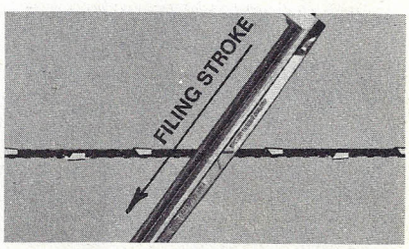
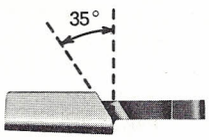
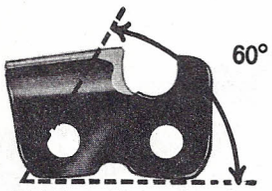


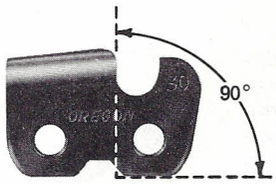
Fig. CM14–Sharpen all cutters on one side. Move to other side and file all cutters opposite.



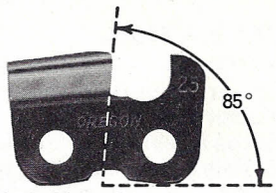
35° Top Plate Angle.



60° Top Plate Cutting Angle—Chipper, Micro-Bit, Micro-Guard.

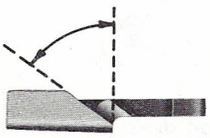


90° Side Plate Angle—Chipper, Micro-Bit, Micro-Guard.



85° Side Plate Angle for S-70 chain only.

Fig. CM15–Filing angles for chipper type chain in average use.



Top plate angle not 35°—caused by holding file at wrong angle.



Hook in side plate—caused by pressing file down too hard, or holding file handle too high.



Backslope in side plate—caused by holding file handle low. Chain won't feed properly; cutters wear fast at heel.

Fig. CM16–Filing errors. If your cutters look like these, refile them.

The normal top plate filing angle of 35° and the depth gauge distances for different pitch chain have been determined to be the most satisfactory for general sawing. However, the woodsman may, through trial and error, find the most suitable depth gauge distance for a particular condition. No specific figures can be given due to the variety of sawing conditions, but the following information can be used as a guide.

A. On larger horsepower saws and saws with slow chain speeds, the depth gauge distance may be increased, which will allow the cutter to take a larger chip. The depth gauge distance should be decreased on small saws and direct drive saws.

B. When cutting continually in soft woods, the depth gauge distance can be increased somewhat.

C. When cutting hard woods, frozen or resin timber, the depth gauge distance should be decreased.

When sharpening the cutting edges on the saw chain, the drive link tangs should also be sharpened to keep the guide groove clean, and any burrs on the sides of the drive link tangs should be removed. See Fig. CM44.

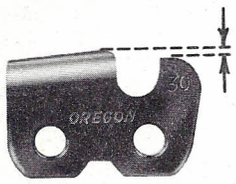


Fig. CM17–Check depth gauges every 3rd or 4th sharpening on Chipper chain.

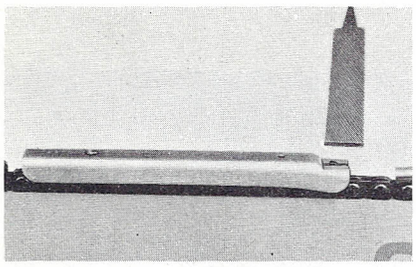


Fig. CM18–Place Gaugit on chain.

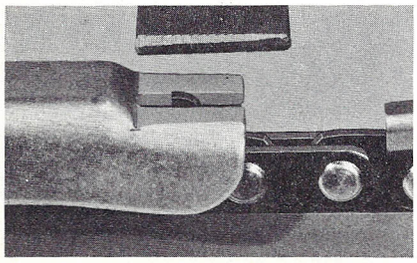


Fig. CM19–If depth gauge projects, file it level.

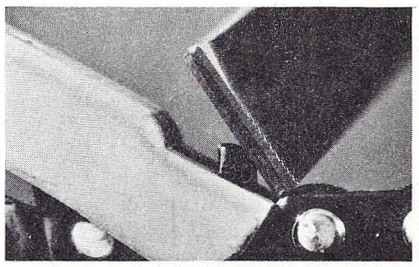


Fig. CM20–Round off front corner. Use tilted gaugit to protect top of cutter.

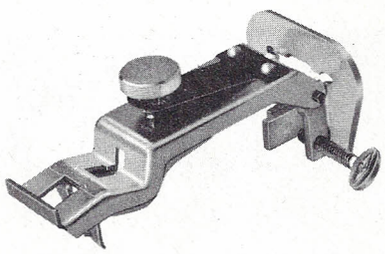


Fig. CM21–80 chain top file guide. For hand sharpening 80 chain accurately and uniformly.

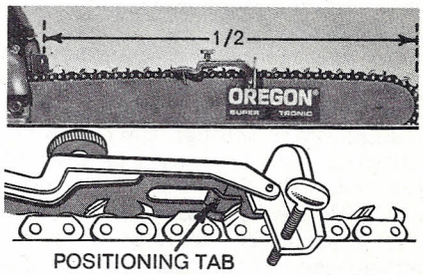


Fig. CM22–(A) Place Top File Guide midway on bar; C-Clamp vertical and facing bar nose. (B) Positioning Tab rests on cutter top plate; Support Legs fit over middle of cutter to be filed. Tighten C-Clamp snug.

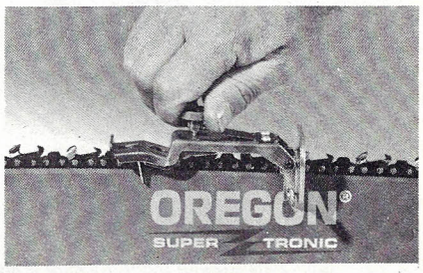


Fig. CM23–Hold down flat locking spring and turn Adjusting Knob until cutter projects slightly. Release spring.

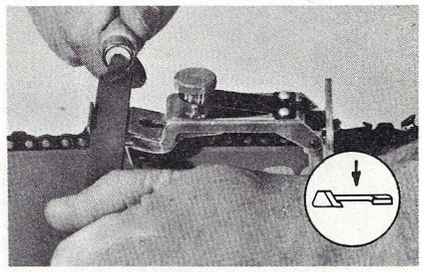


Fig. CM24–File cutter from inside toward outside of chain, until file slides freely. Hold file level at all times.

TYPE 80 CHAIN. This type of chain features a cutter design which is hand sharpened from the top by means of a "top file guide" (see Fig. CM21) and flat file. The "top file guide" provides accurate sharpening of cutter tops and lowering of depth gauges. Refer to Figs. CM22 through CM27 for filing top plates or to Figs. CM28 through CM32 for filing side plates.

CHISEL AND SUPER CHISEL. Refer to Fig. CM1 for view of Chisel and Super Chisel type of saw chain. To sharpen Super Chisel chains 50L, 51L and 52L, use Oregon File Holder Part No. 13252 and a round 7/32-inch file. Follow guide marks on file holder for filing stroke shown in Fig. CM33. Hold file holder with handle down 10 degrees as shown in Fig. CM34. Depth gauge setting should be 0.025. Refer to Fig. CM35 for filing specifications on Super Chisel chains 50L, 51L and 52L.

Sharpening file has a bevel edge for use on Super Chisel 50AL, 51AL and 52AL and Chisel chain. Hold file pointing downward and moving from front towards rear of cutter. Refer to Fig. CM36 for views of proper filing stroke. Fig. CM37 shows sharpening specifications for Super Chisel 50AL, 51AL and 52AL and Chisel chain. Refer to following table for correct depth gauge setting:

CHAIN	DEPTH GAUGE SETTING
50AL, 51AL, 52AL	0.025 in.
9AL, 10AL	0.030 in.
4AL, 5AL	0.040 in.
16AL, 17AL	0.045 in.

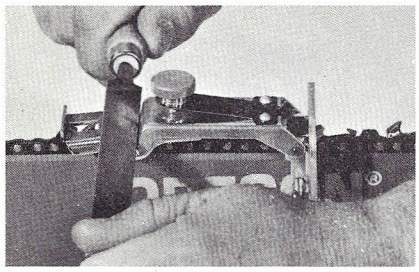


Fig. CM25–File depth gauge until file slides freely.

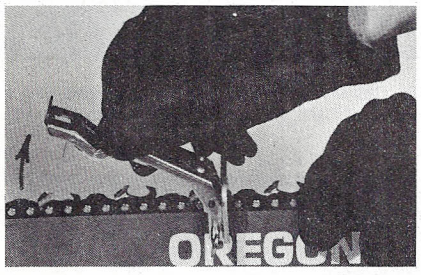


Fig. CM26–(A) Raise guide–not too high or it will hit C-Clamp and change setting; (B) Pull chain until next right hand cutter comes into position under Positioning Tab.

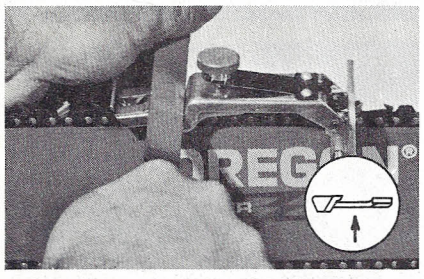


Fig. CM27–Press guide onto cutter and repeat in Figs. CM24 and CM25. File all cutters on one side of chain, then move to other side of bar and file all cutters on opposite side–do not change setting.

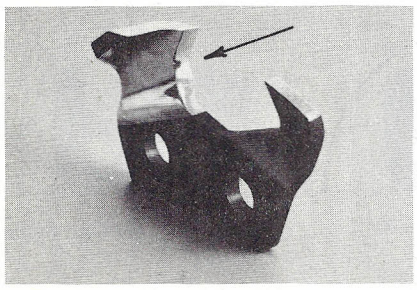


Fig. CM28–Side plate sharpening must be done by hand before every fifth time top plates are sharpened.

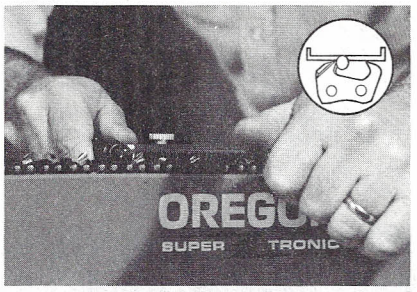


Fig. CM29–Place 5 mm. file holder (No. 12204) on cutter top plate and depth gauge. Hold it level. Care should be taken to avoid hitting top plates when filing plates.

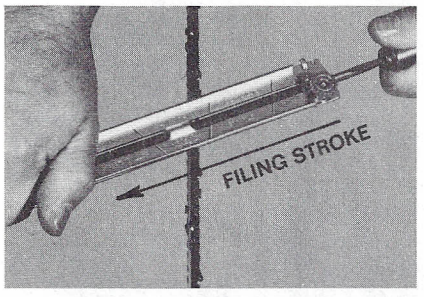


Fig. CM30–Hold file holder so that 24° guide mark is parallel to bar. File from inside toward outside of cutter. A few light strokes are enough.

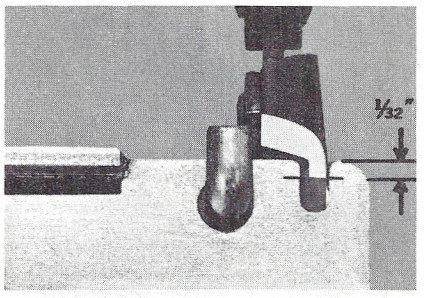


Fig. CM31–Measure side plate projection in notch of holder. It should be 1/32" long. File all cutters on one side of chain, move to other side of bar and file all cutters on opposite side.

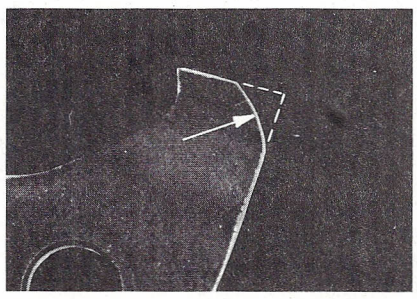


Fig. CM32–Maintain rounded front corner of depth gauge as shown here.

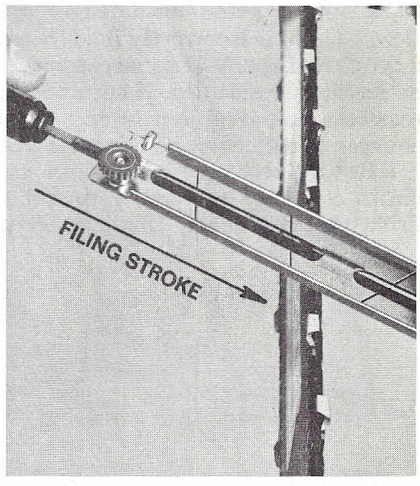


Fig. CM33–File holder is aligned with bar using aligning mark on holder.

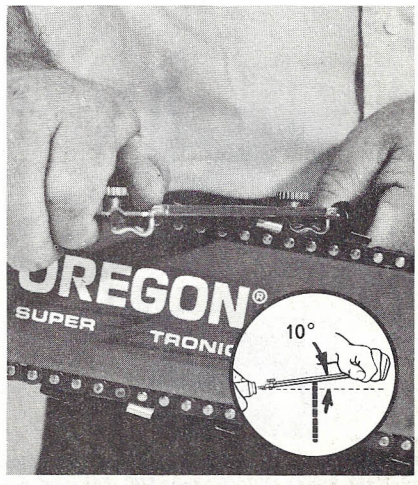


Fig. CM34–Hold file handle down 10° as shown.

GULLETS. The gullet is the open area between the depth gauge and the side plate. The gullet should be cleaned out with a round file before every fifth sharpening. This will keep the gullet open and allow better chip clearance and more efficient side plate cutting action. Hold file lever as shown in Fig. CM40 and at a 20 degree angle with cutter. Filing stroke is opposite to direction of sharpening stroke.

TROUBLESHOOTING

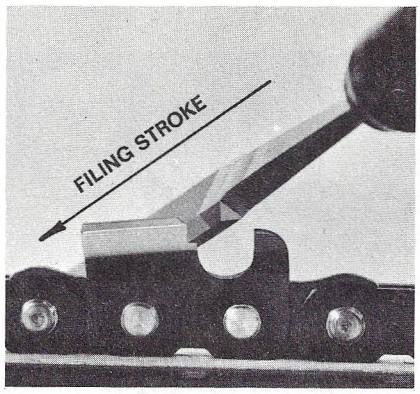
If chain does not cut satisfactorily, remove chain from bar and clean with solvent to remove pitch and resin. Inspect chain and refer to one of the following problem areas:

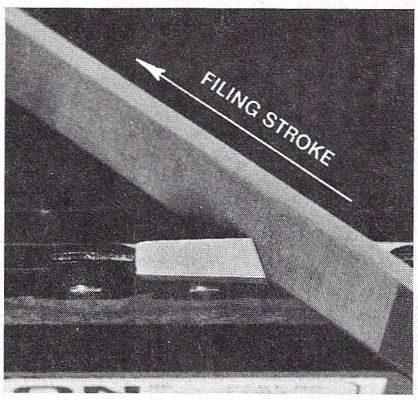
CUTTER. Inadequate saw chain performance may be due to damaged or incorrectly sharpened cutters. Inspect cutters and compare with cutters shown in Fig. CM41. Be sure poor cutting performance is due to saw chain and not to saw engine malady such as faulty carburetor adjustment.

If cutters are damaged by abrasion as shown in Views 1, 2 or 3 of Fig. CM41, file or grind out damaged portion. If chain is incorrectly filed (Views 4 thru 11—Fig. CM41), sharpen cutters as previously outlined. If cutter is excessively damaged, renew cutter and sharpen to match wear of worn cutters.

DRIVE LINK. Drive links in a saw chain contact the drive sprocket to drive the saw chain. Damaged drive links will result in erratic saw chain performance and eventual damage to drive sprocket and chain bar. Fig. CM42 shows a new drive link while Fig. CM44 shows various damaged drive links.

Drive link in View A has been damaged by climbing up on sprocket teeth due to incorrect chain tension. View B shows a drive link damaged by bottoming in sprocket. This may be due to a worn or wrong pitch sprocket. Drive link in View C was damaged by link





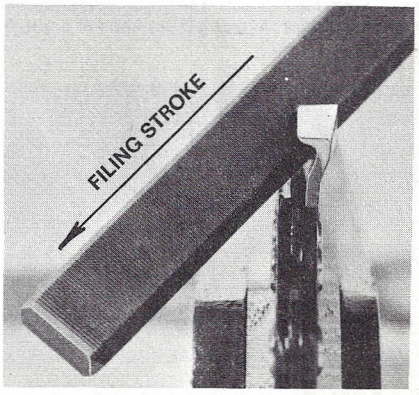


Fig. CM36–Views of correct filing stroke when using bevel edge file.

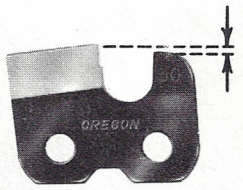


Fig. CM38–Check depth gauges every 3rd sharpening on Super Chisel 50AL, 51AL and 52AL and Chisel chain.

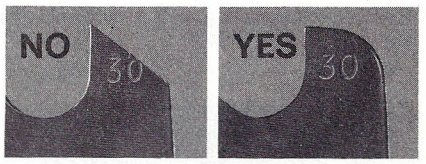
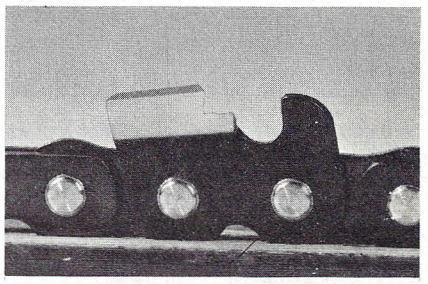


Fig. CM39–After lowering depth gauges of any cutter, ROUND off front corner to maintain original shape.



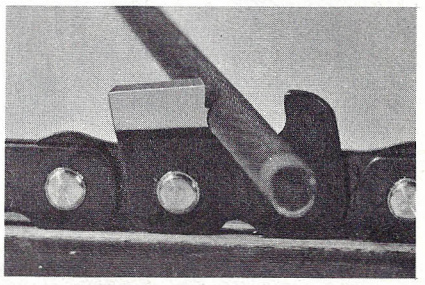
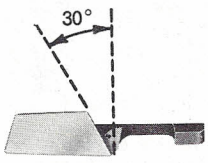
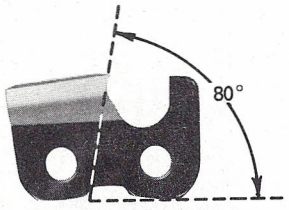


Fig. CM40–Before every fifth sharpening, clean out gullets with round file. Hold file level and at 20° angle to cutter. Filing stroke is made in opposite direction from the sharpening stroke.



Top Plate Angle 30°.



Side Plate Angle 80°.

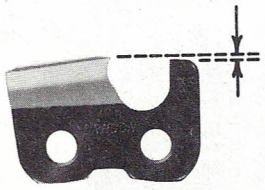
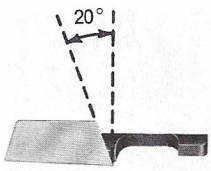
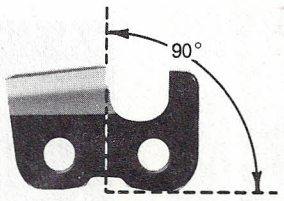


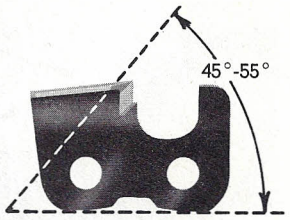
Fig. CM35–View of top and side plate specifications for Super Chisel chain 50L, 51L and 52L. Check depth gauges every 3rd sharpening.



Top Plate Filing Angle 20°. Gradually increase angle as cutter is filed back.

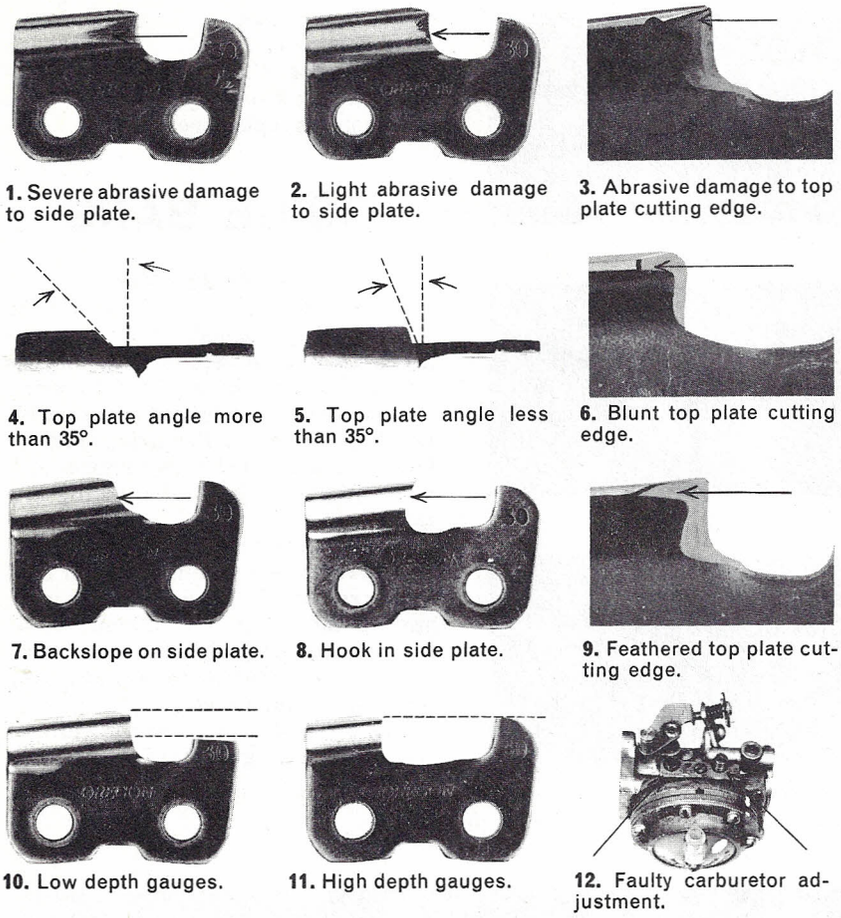


Side Plate Angle 90°.



Top Plate Cutting Angle 45°-55°.

Fig. CM37–View of top and side plate specifications for Super Chisel 50AL, 51AL and 52AL and Chisel chain.



1. Severe abrasive damage to side plate.
2. Light abrasive damage to side plate.
3. Abrasive damage to top plate cutting edge.
4. Top plate angle more than 35°.
5. Top plate angle less than 35°.
6. Blunt top plate cutting edge.
7. Backslope on side plate.
8. Hook in side plate.
9. Feathered top plate cutting edge.
10. Low depth gauges.
11. High depth gauges.
12. Faulty carburetor adjustment.

Fig. CM41–Cutter problems.

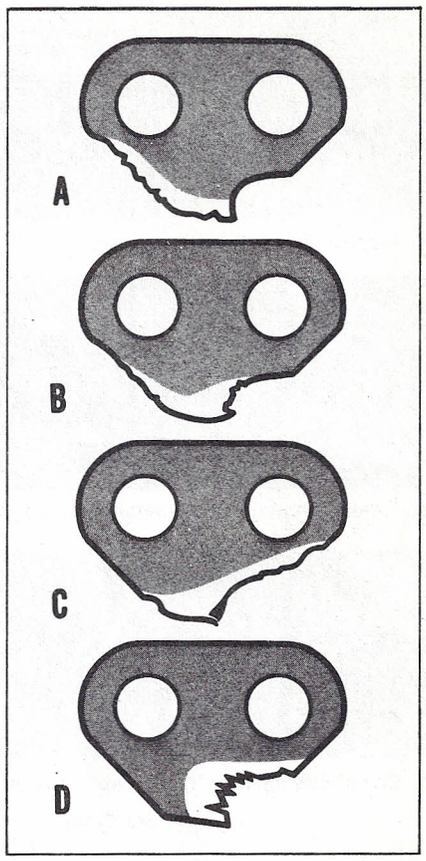


Fig. CM44–View of damaged drive links. Refer to text.

striking side of bar entry or misaligned sprocket. Refunnel bar entry or align sprocket with bar groove. View D shows a drive link damaged by jumping out of bar groove due to loose chain. Readjust chain tension.

TIGHT JOINTS. A chain with tight joints is ruined and must be renewed. Tight joints are due to tie straps being peened or burred thereby preventing flex at joints. Damage to tie straps may be due to a worn sprocket (Fig. CM43), loose chain tension (Fig. CM45) or worn bar rails (Fig. CM43A).

CROOKED CUTTING. When a chain cuts crooked or runs to one side it may be due to incorrect chain filing, chain damage or a worn bar. Refer to Fig. CM46 for examples of incorrect chain filing or chain damage which

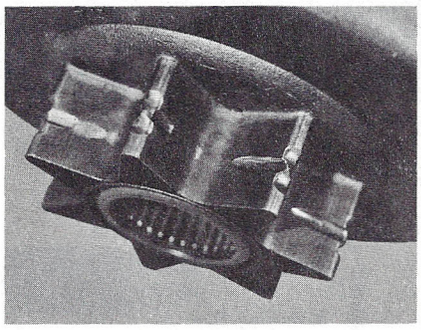


Fig. CM43–Worn sprocket.

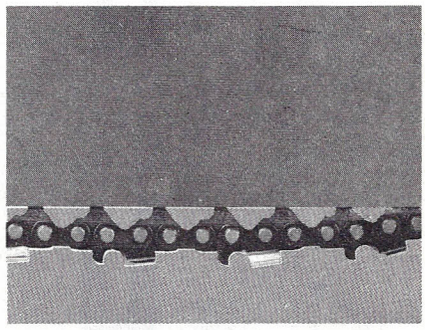


Fig. CM45–Loose chain tension.

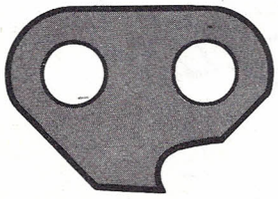


Fig. CM42–New drive link. Compare appearance of drive links on used chain to this one.

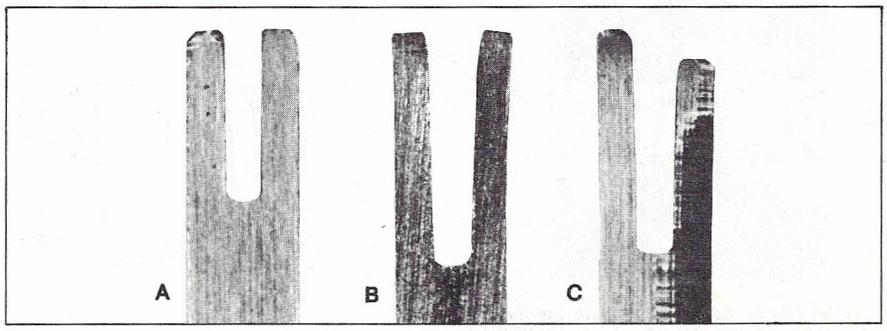
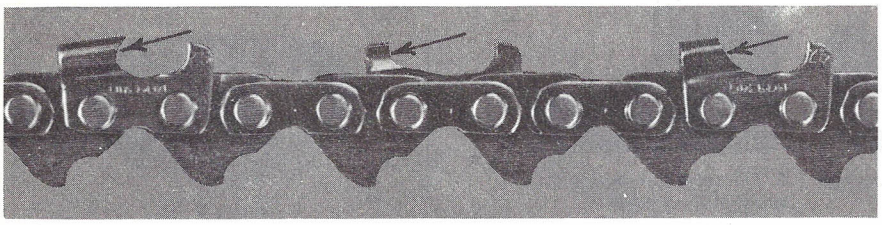
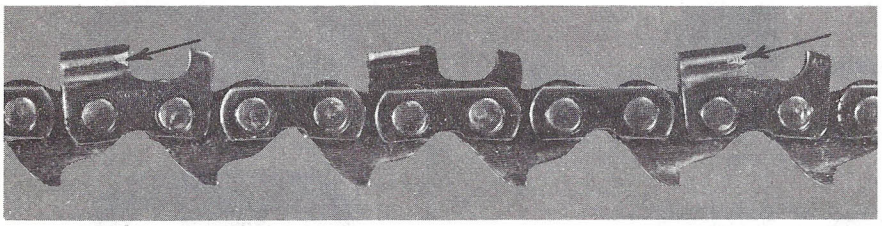


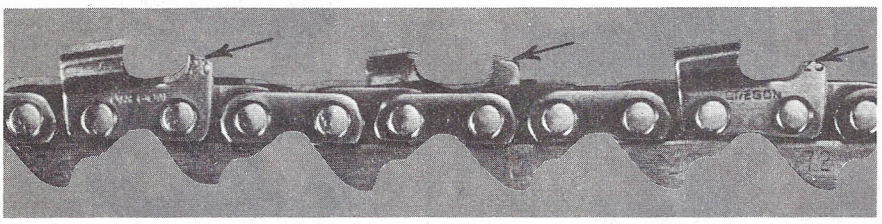
Fig. CM43A–Worn bar rails. A) Shallow groove. B) Spread rails. C) Uneven rails.



a. Incorrectly filed chain cuts crooked.

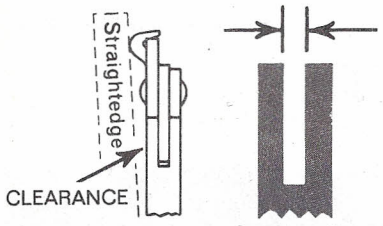


b. Chain damaged by abrasion cuts crooked.



c. Chain with incorrectly set depth gauges cuts crooked.

Fig. CM46–Cutter conditions causing crooked cutting.



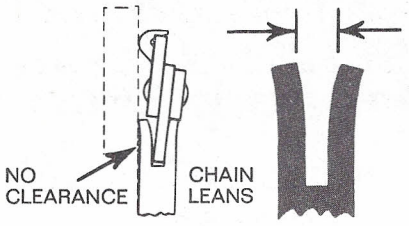


Fig. CM47–Checking for worn bar rails.

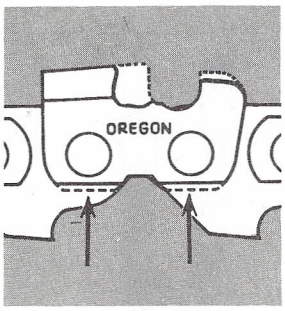


Fig. CM48–File off bottom of new part to match worn parts. File new cutter back to match worn cutters.

may cause crooked cutting. Chain cutters should be refiled, if possible, or renewed. Fig. CM47 shows method of determining if bar is excessively worn and requires replacement.

GUIDE BARS

Solid Nose Bars

Guide rails are sometimes split from the bar being pinched while the saw is hung up in a cut. Splits of two inches long or less can be repaired by using ordinary welding methods on bars with non-hardened rails. Repairing splits on bars with hardened rails requires special equipment for re-hardening the rails.

Small kinks or bends in guide bars can be removed by laying the bar on a large true anvil or other similar work surface and using light hammer blows to bring the bar back into shape. Technique is very similar to straightening other flat metal pieces.

Use a file to funnel the entrance to the guide rail groove of the bar as

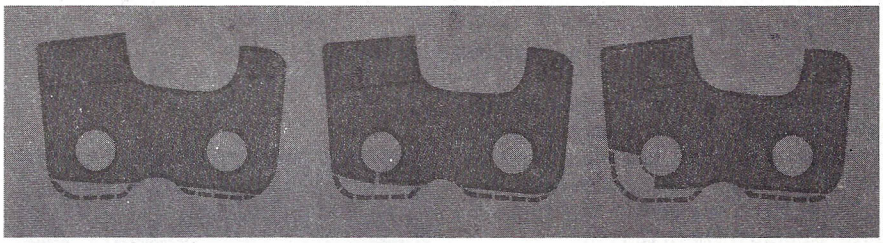


Fig. CM49–Cutting frozen wood causes cutters to wear, crack and break at the back rivet hole unless proper precautions are taken.

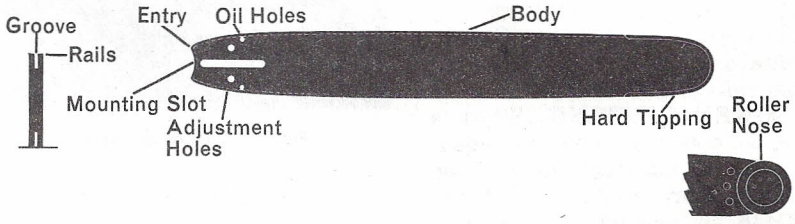


Fig. CM50–Bar nomenclature.

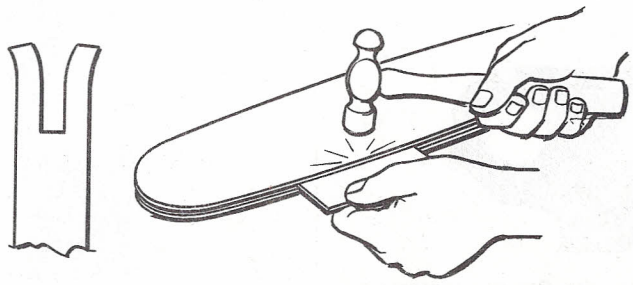


Fig. CM51–Closing spread bar rails. Use steel shim .004" thicker than drive link tangs.

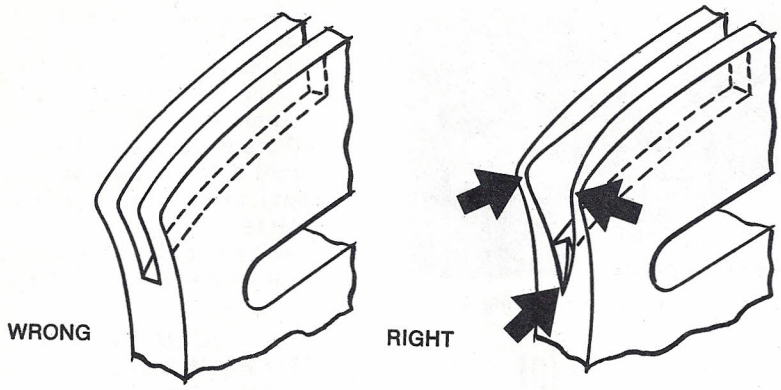


Fig. CM52–Cut funnel shaped opening to guide groove with file.

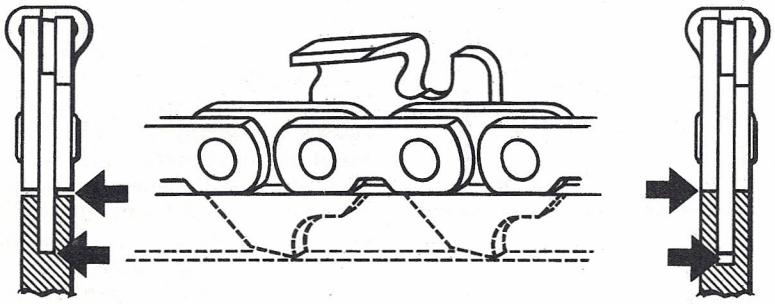


Fig. CM53–Guide groove too shallow in cross section view at left. Tang must clear bottom of groove as in cross section view at right.

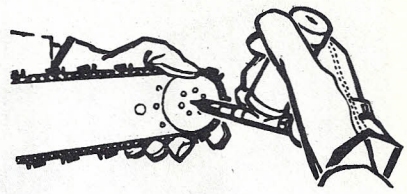


Fig. CM54–Lubricating roller nose bar.

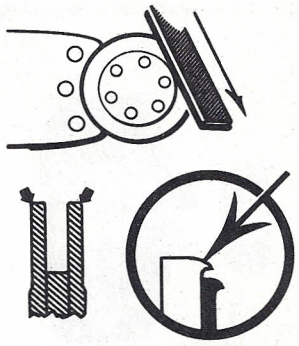


Fig. CM55–Removing burrs from roller side plates.

shown in the "right" view in Fig. CM52. If the guide rails are as in the "wrong" view in this illustration, damage to the chain can occur as the chain enters the groove.

Check the fit of the chain to the guide bar as shown in Fig. CM53. If the tangs of the drive links touch the bottom of the guide rail groove, poor cutting and damage to the chain will result. The side links of the chain should ride on the rails and the tangs should clear the bottom of the guide groove. When replacing a chain or a guide bar, the length of the tang and the guide bar groove depth should be checked.

If the guide rails are worn or rough, they can be ground smooth and the groove deepened on a special bar grinding machine.

ROLLER NOSE BARS

LUBRICATION. The precision bearings in the roller nose bar must be lubricated regularly for efficient operation and long life. Grease roller nose bearing every time saw is refueled. Always grease the bearing after a day's use. Grease bearing by cleaning oil hole and inserting grease with any good type hand grease gun with a needle nozzle. Insert nozzle into hole in center of roller and pump gun until grease flows from rim of roller. A lighter grease may be necessary for winter operation.

SIDE PLATE CARE. Refer to Fig. CM55. Remove burrs that form on side plate of roller with a flat file. Pump bearing full of grease before filing. File away from slot so filings will not get into bearing. Wipe filings from inside and outside of roller before mounting chain.

ROLLER RENEWAL. Roller may be removed by drilling or punching out roller retaining rivets in end of guide bar. Remove roller and install new roller with new retaining rivets. Care should be taken not to damage rivets or mounting holes when peening or driving out rivets.

CHAIN REPAIR

Minor repairs can be accomplished in the field. If a chain breaker is not available, file off the head or heads of rivets where renewal is necessary, then remove rivets with a sharp punch. A small chisel or screwdriver may be used to spread side links if rivet is not completely cleared.

A chain breaker is essential for ease and quickness in breaking chain for removal or replacement of a component. Special tools are also available to form rivet head when a new rivet is installed. A hammer may be used to form rivet head if necessary. Do not strike rivet excessively as rivet may be fractured.

Note: New components must be filed down to match worn components as shown in Fig. CM48.

COLD WEATHER CUTTING PROBLEMS

To extend chain life when cutting in cold weather, consider the following:

1. Oil—Mix chain oil half and half with kerosene. **Use twice as much oil** while cutting with this mixture. Be sure oiler is working.
2. Tension—Keep chain tensioned—check often. See Fig. CM4 thru CM6.
3. Cutters—Keep cutters properly sharpened. Touch up at least every hour. Never force a dull chain to cut.
4. Bar—Clean out bar groove and keep oil hole open. Turn bar over to equalize wear on rails.
5. Sprocket—Always install new sprocket with new chain.

Refer to Fig. CM49 for illustration of chain damage due to cold weather.

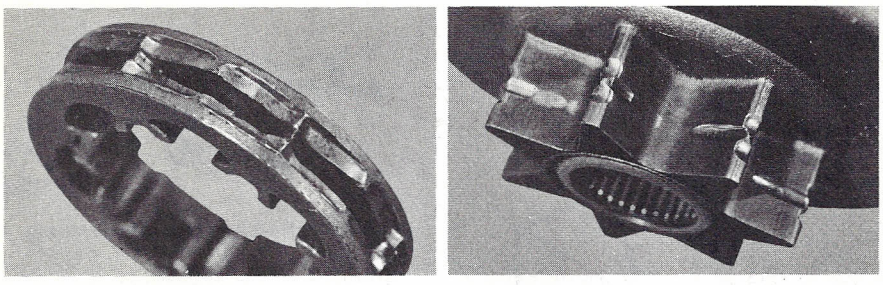


Fig. CM56–View of worn self-aligning sprocket (left) and worn integral star sprocket (right).

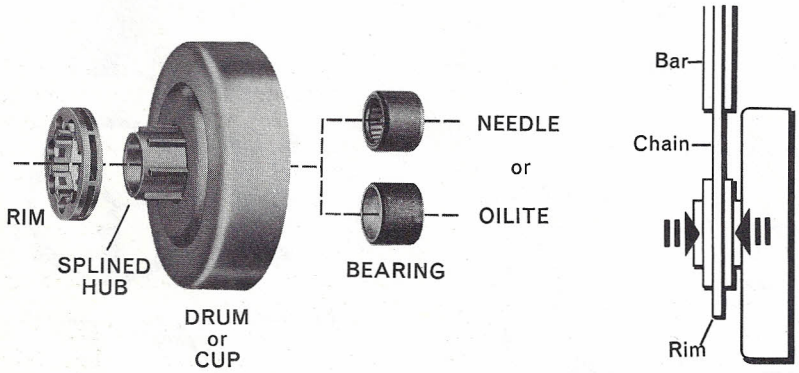


Fig. CM57–View of typical self-aligning sprocket and clutch assembly. Note that sprocket can float on splined hub to align with bar groove.

SPROCKETS AND CLUTCHES

SPROCKETS

Two types of chain drive sprockets are used: The integral star and the self-aligning rim sprocket shown in Fig. CM56. The integral star sprocket is permanently attached to the clutch drum. The self-aligning rim sprocket assembly shown in Fig. CM57 consists of a splined hub fastened to the clutch drum and the rim sprocket is located over the splined hub. The sprocket is permitted to float on the splined hub and automatically align with groove in the guide bar. Sprockets for gear drive saws fit on the output shaft instead of a hub on the clutch drum.

FAILURES AND CAUSES. Drive sprockets are, like any moving part subject to extreme friction, subject to wear. A worn sprocket can quickly damage the bar and the chain. The illustrations in Fig. CM56 are typical examples of worn sprockets which should be renewed to keep from damaging the bar and chain. Wear on the sprocket teeth can be caused by any of the following:

1. Wrong pitch chain.
2. Insufficient chain lubrication.
3. Excessive chain tension.
4. Improper chain filing and jointing.
5. A badly worn and possibly stretched chain has a slight variation in pitch which will contribute to rapid wear of sprocket teeth.
6. A badly worn bar will contribute to rapid wear of the chain which will cause the sprocket to wear. Rapid deterioration and wear on chain drive lugs, side links and cutters will result from installing a new chain. Never install a new chain on a worn sprocket or bar.

CLUTCH

CLUTCH BEARING. The clutch drum and sprocket can rotate freely (or stop) when the clutch is disengaged. A caged needle roller bearing is located between the clutch drum hub and the shaft. The bearing on most models uses the shaft as the inner race and the clutch drum hub as the outer race and can be removed by hand without any special tools.

Clutch needle bearing failure is often caused by storing the saw after operating under extremely wet conditions. The water will penetrate the needle bearing, form rust and cause the needles to become locked. It is recommended that the clutch drum be removed periodically (depending on local conditions) and the bearing repacked with a good grade of water-resistant grease (not water pump grease).

CLUTCH DRUM AND SHOES. Rapid clutch drum wear, shoe glazing or grooving may be caused by any of the following:

1. Improper filing. Hooked cutters and excessive joint will especially cause the clutch to slip.
2. Chain pinched in cut causing clutch to slip. Throttle should be released immediately when chain becomes pinched.
3. Oil soaked or worn clutch shoes. Clutch shoes should be inspected periodically. Glazing can be removed by wire brushing or other similar method.