TM 9-3405-216-14&P

TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS LIST

FOR

SAW, BAND

MODEL L-9

(NSN 3405-00-473-6430)

W.F. Wells & Sons, Inc.

HEADQUARTERS, DEPARTMENT OF THE ARMY

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Technical Manual
No. 9-3405-216-14&P

HEADQUARTERS
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Washington, DC, 4 August 1982

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REPORTING OF ERRORS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2, located in the back of this manual direct to: Commander, US Army Armament Materiel Readiness Command, ATTN: DRSAR-MAS, Rock Island, IL 61299. A Reply will be furnished directly to you.

NOTE

This manual is published for the purpose of identifying an authorized commercial manual for the use of the personnel to whom this equipment is issued.

Manufactured by: W.F. Wells & Sons, Inc.
16645 Heimbach Road
Three Rivers, Michigan 49093

Procured under Contract No. DAAA09-79-C-4819

This technical manual is an authentication of the manufacturers' commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. This technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment.

INSTRUCTIONS FOR REQUISITIONING PARTS

NOT IDENTIFIED BP NSN

When requisitioning parts not identified by National Stock Number, it is mandatory that the following information be furnished the supply officer.

1 - Manufacturer's Federal Supply Code Number. 82331

2 - Manufacturer's Part Number exactly as listed herein.

3 - Nomenclature exactly as listed herein, including dimensions, if necessary.

4 - Manufacturer's Model Number. L-9

5 - Manufacturer's Serial Number (End Item).

6 - Any other information such as Type, Frame Number, and Electrical Characteristics, if applicable.

7 - If DD Form 1348 is used, fill in all blocks except 4, 5, 6, and Remarks field in accordance with AR 725-50.

Complete Form as Follows:

(a) In blocks 4, 5, 6, list manufacturer's Federal Supply Code Number - 82331 followed by a colon and manufacturer's Part Number for the repair part.

(b) Complete Remarks field as follows:
Noun: (nomenclature or repair part)
For: NSN: 3405-00-473-6430
Manufacturer: W. F. Wells & Sons Inc.
16645 Heimbach Road
Model: L-9 Three Rivers, Michigan 49093
Serial: (of end item)

Any other pertinent information such as Frame Number, Type, Dimensions, etc.

SAFETY MANUAL

For Use and Care of Band Sawing Machinery

CONTENTS

A. OSHA and the metal cutting band saw machine 2
B. Safety during installation 2
C. Safety during manual operation 2
D. Safety during operation with barfeed 3
E. Safety during maintenance 3

A. OSHA AND THE METAL CUTTING BAND SAW MACHINE

A1. As of this writing OSHA regulations do not carry a single set of standards for metal band sawing machinery such as those applying to presses. Instead, metal band sawing machinery falls under the general safety regulations. This means that each inspector makes his own decisions as to whether or not a machine is safe and properly guarded.

A2. In this manual we will present the safety points we have found to be of importance to many inspectors.

A3. The general regulations provide many rules for your guidance. Listed below are the most common safety problems in the field. However, let us stress that this is our interpretation, and that your area inspector is the proper person to contact for answers to your questions. He may require safety devices other than those suggested here, based on more recent rulings or regulations.

A4. Many states also have codes similar to OSHA, but with different interpretations. Therefore, we will limit this discussion to the national requirements. You should check with your own area inspector for further regulations.

A5.

A. The machine should be installed in accordance with the national electrical code and any area codes that are more restrictive.

B. Be sure to ground the machine with the grounding wire. This wire should be green.

C. Sawing machines should have all guards in place and maintained in good condition.

D. A guard should be used to cover the saw blade from the cutting head to the blade guides.

E. Most metal sawing is below the 90 decibel noise level. However, when using high blade speeds, check for excessive noise and consult your regional OSHA Office for proper employee protection when over 90 decibels.

F. Be sure to train employees who operate and maintain the machine in accordance with this manual and the other manuals supplied with the machine.

G. We recommend you discuss the possibility of color coding the various parts of your machine with your area inspector.

B. SAFETY DURING INSTALLATION

B1. Many metal cutting band sawing machines are top heavy and should always be handled as such. Use tag chains when moving a machine with fork lift trucks or cranes.

B2. Do not lift the machine by the cutting head when moving with fork lift trucks or cranes. Lift the machine only by connecting to the base or bed.

B3. When moving the machine, be careful to place slings and chains where they will not damage hydraulic hose, tubing, fittings or electrical equipment.

B4. After installation, make sure the machine has been grounded with the grounding wire, and that the energized conductors are properly attached to the switch terminals (and not accidentally crossed with the grounding wire). Check the voltage before using the machine to be sure of the proper connection.

B5. Install the machine to comply with any area code as well as the national electrical code.

C. SAFETY DURING OPERATION

C1. The operator should always keep his hands and feet clear when operating a metal band sawing machine to prevent injury from moving parts or while loading or removing metal pieces.

C2. Reports show that many accidents while working around metal sawing machines are caused by dropping work pieces on the toes, and in some cases over half of the reported accidents were from this cause.

C3. Never place round barstock or cut pieces on a stock support table without some type of retaining device to keep them from rolling off the table.

C4. Use some type of supporting or catching device for the cut off work pieces, whether long or short. They can drop off unexpectedly and injure feet and legs.

C5. Never use pedestal type single roller stock support devices (stock stands) with heavy loads. They are very unstable with large bars and tip over easily. These devices are designed for light loads that can be lifted manually and placed on the roller by one operator.

C6. When cutting thin pieces from large blocks (such as die blocks) always remember these thin work pieces are likely to tip over when cut off. Take steps to support them or they can cause injury.

C7. Be sure to keep clear of the clamping area when operating machines equipped with hydraulic vises. When these vises clamp, a very high force is applied that can cause severe injury.

C8. When loading large material requiring more than one person, be sure the operator and his helpers are all clear before starting any machine movement.

C9. Never reach or position any part of your body under a saw blade. Someone could start the machine, or some type of malfunction could cause the cutting head to drop.

C10. Never reach through or under a pinch point that could create a hazard if a machine part should move.

C11. Never wipe or clean off parts which are being sawed. The wipe rag could catch on the saw blade, and pull the operator's hand into the moving blade.

C12. It is good sawing practice to support the saw blade as close as possible to the work piece for maximum cutting accuracy as well as safety. Always keep the saw guides as close as possible to the work piece. Attaching blade guards to the guides will also keep the guards closed as far as possible.

C13. Always stop the machine when it becomes necessary to adjust it.

C14. If the operator leaves his control station to observe or inspect the operation of the machine, he should always have another qualified operator at the control station in case he is inadvertently caught in the machine. Failure to do this could be very serious.

C15. Do not get into the habit of climbing or leaning on the machine while it is in operation. Greasy, coolant-covered surfaces can be very slippery.

C16. It is very important that your mind be entirely on your job at all times when working on a machine. Outside activities and problems which occupy your mind during working hours greatly endanger your personal safety.

C17. Always keep the floor and working area around the machine free from debris, oil and coolant slicks. These can be extremely hazardous.

C18. Avoid unnecessary contact with machine coolants or other cutting compounds.

C19. Always wear safety glasses when operating a band sawing machine.

C20. If it is necessary for two or more operators to work with a machine, be sure only one lead operator "calls the signals", and make sure the other workers are clear before starting any machine movement.

C21. Read, study and know this manual and the other machine manuals before any attempt is made to operate the band sawing machine.

D. SAFETY DURING OPERATION WITH BARFEED

D1. Always remember that movements occur without warning when automatic machinery is operating. In manual operation, a push button is depressed to start a movement so one can anticipate what will happen. When in the automatic mode, the movement occurs without operator action. If someone has reached into the machine, a serious accident can happen.

D2. This suggests two good rules to remember: (1.) Whenever someone is around a machine running in automatic operation, the operator should always be at his station to stop the machine in case the person gets caught by it. This may be a person walking by who stops for a moment, but carelessly places his foot on the machine, or lays his hand near a moving part.

(2.) If the operator decides to leave his control station to perform a quick adjustment, first shut down the machine. If the operator does not shut it down, and should accidentally slip and become caught, the machine will keep running. With no one at the stop button to shut it down, he could sustain serious injuries before help arrived.

D3. Many automatic sawing machines have barfeeds with a moving carriage. Never allow anyone, or yourself, to get between the carriage and the saw base.

E. SAFETY DURING MAINTENANCE

E1. Always lock off the electrical supply disconnect when working on moving parts of the machine, its electrical or hydraulic systems.

E2. Never remove hydraulic lines or parts from the machine unless the cutting head is resting on the saw bed or other solid support. In normal operation the cutting head is supported by hydraulic cylinders. Removal of hoses or machine parts will permit a discharge of pressurized oil, allowing the cutting head to fall to its lower position. This could cause injury to personnel as well as damage to the machine.

E3. Never adjust the hydraulic system pressures beyond those given on the hydraulic diagrams. To do so can cause hydraulic lines or other parts to rupture and create a hazard.

E4. Always replace guards before putting the machine back into operation.

E5. A saw blade which has been removed from service and coiled should always be tied with wire or other suitable device to keep it from uncoiling. A coiled blade suddenly springing open can cause serious cuts to persons nearby.

E6. Never change a broken blade on a machine manufactured for high blade speeds until you are sure the blade wheels have stopped coasting. Opening the covers too soon may allow the blade to catch on a wheel and be thrown out, striking someone.

E7. When changing saw blades, always close the blade wheel guards before applying the final blade tension.

E8. If a machine should for any reason stop or refuse to start, lock out the electrical disconnect switch before starting any service procedures.

BAND SAW BLADE SELECTION AND APPLICATION

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1. GENERAL

Bandsawing machines are unique compared to other machine tools in that they use a flexible cutting tool. Tensioning the tool (saw blade) and supporting it near the cutting zone (with saw guides) results in its becoming sufficiently rigid to perform useful work.

Most machine tools feed the cutting tool on the basis of inches per revolution. Band saws generally feed the cutting tool based on pounds of cutting force. This allows the tool to cut at its own rate in relation to inches per revolution.

When the proper cutting feed force is applied to the blade, it will cut at maximum efficiency and still maintain good accuracy. This type of feed is necessary because most cutoff sawing involves ever-changing cross section areas. With this method the blade will not be over-fed as it enters a larger cross section area. The cutting force will be maintained but the forward progress of the blade into the cut will slow, until it enters a smaller section. At this point it will progress faster through the cut. This explains why THE BLADE CUTS AT ITS OWN RATE.

2. BLADE TYPES

Band saw blades are generally referred to by the type of material from which they are made. “CARBON” blades are manufactured from high carbon steel and “HIGH SPEED” blades are manufactured from high speed steel. The “WELDED EDGE” blade has a high speed steel strip welded to an alloy blade back. “CARBIDE” blades have carbide steel fused to the tooth tips.

2.1 CARBON STEEL BLADES

Carbon steel blades can be called the work horse of the industry, as they are very widely used. They perform well on steel sections, aluminum, plastics, carbon and similar materials. The limiting factor is the cutting rate. As the cutting rate is increased the heat generated in the blade increases. Carbon blades will easily reach a temperature that removes the heat treatment of the steel, allowing the teeth to dull. They do, however, work very well on applications where high cutting rates are not required. On steel they are seldom run over 120 lineal feet per minute with coolant, and will cut materials up to 250 Brinell hardness with good results.

The two basic types of carbon steel blades are as follows:

2.2 CARBON STEEL BLADES WITH A HARD EDGE AND A SOFT OR FLEXIBLE BACK

This blade is available with several types of backs, from soft to spring tempered, with a hard edge only the depth of the teeth. It is the most common of the carbon steel blades.

The softer back on this type of blade has the lowest tensile strength of all blades. This makes for the lowest “beam strength”, limiting the amount of cutting force which can be applied. (Beam strength is the deflection of the blade body between the saw guides as it contacts the work piece and a cutting force develops.) Blade tensioning is also the lowest of all blades as a result of the low tensile strength of the blade back.

2.3 HARD BACK BLADES

Hard back blades are the second type of carbon steel blade. This blade is completely heat treated, edge and back, with the back as hard as possible while still allowing it to flex around the drive wheels. The hard back improves the two limiting factors discussed in section 2.2, beam strength and tensile strength.

Because this blade is an improvement over the “soft back”, it can be more highly tensioned with a resulting improved beam strength. It can be fed into the work piece with. more cutting force. This provides an increased cutting rate. However, the blade cannot travel any faster in lineal feet per minute without losing the heat treatment.

2.4 ALLOY STEEL BLADES

Alloy steel blades offer an improvement over carbon steel blades. They can be operated at higher lineal feet per minute speeds, and have greater beam strength and tensioning strength. This results in increased cutting rates as we can operate the blade at higher speeds and with greater cutting force.

Some alloys that work-harden with cutting can be cut with alloy steel blades that cannot be cut with carbon steel blades. A very heavy cutting force must be used, and the alloy steel teeth have sufficient strength to cut without stripping.

Alloy steel blades are also referred to as “intermediate” or “semi-high speed”. Their performance levels fall somewhere between carbon steel and high speed steel blades. There is no standardization between manufacturers of these blades, and they vary widely. Some approach the performance of high speed steel blades while others are only slightly improved over carbon steel blades.

When using alloy steel blades we suggest working closely with the blade manufacturer.

2.5 HIGH SPEED STEEL BLADES

High speed steel blades are available in two types, solid high speed and welded edge. The latter is a high speed steel edge welded to an alloy back.

Solid high speed blades are the most popular "premium" blades in use today. However, the welded edge blades are predicted to surpass the solid high speed blades within a few years.

Both blade types have high beam and tensile strength. This, combined with the high temperature capabilities of high speed steel, provides a blade with the fastest cutting rates available. Tip hardness is greater than other blades, thus harder alloys (up to 400 Brinell) can be cut successfully. Blade speeds up to 350 lineal feet per minute with coolant can be used on mild steel without generating excessive heat.

Solid high speed blades require a special welding unit, while the welded edge blade can be welded on equipment used for other blades.

Some welded edge blades are prone to losing teeth if they are subjected to a sudden impact such as starting a cut too hard or cutting tubing with excessive vibration. We would recommend trying both types on your applications and using the one that works best for you.

2.6 SUPER HIGH SPEED BLADES

Super high speed blades are high speed steel blades with alloys added to provide higher tip wear and heat resistance. These blades can be best evaluated by using them on a production cutting application where you have past performance records of other blades.

2.7 CARBIDE TIPPED BLADES

Carbide tipped blades have an alloy back and teeth with carbide tooth tips welded on by various means. These blades provide the hardest tooth available. They will cut much harder materials than any other type of blade, even to the point of cutting case hardened materials.

The blade speed can be increased to greater lineal feet per minute when using these blades. However, the feed rate and cutting force should not be higher than other blades, as most blade damage results from chipping the carbide teeth. The most successful sawing applications are those without severe vibration.

Generally the successful use of carbide tipped blades is based on experience with the blade. We would recommend trying it on a particularly difficult job.

2.8 CARBIDE EDGE-COATED BLADES

Carbide edge-coated blades are alloy blades with no teeth, but with carbide granules bonded to one edge, forming the cutting surface. These blades are usually operated at higher lineal feet per minute speeds and with less cutting force, as the chip storage area is small and may load if forced too hard. However, this blade will cut hard materials that cannot be cut by any other method.

3. WHAT BLADE SHOULD I USE?

These general guidelines will help you choose the proper blade type:

3.1 If cutting mild steel is the primary operation, either carbon steel or high speed steel blades will do a good job. Use carbon steel blades if machine time is not a factor and cost per cut does not include overhead rates. If overhead cost is included, high speed blades may be the least expensive overall. See cutting cost section.

3.2 When many operators use a machine each day for cutting a variety of materials, consider using carbon steel blades. A high speed steel blade can be ruined just as easily and will cost much more to replace. High speed steel blades work best when one operator only has control of a machine on each shift.

3.3 When cutting alloy steels that work-harden, use a high speed steel or alloy steel blade so that greater cutting forces can be used.

3.4 Brass and bronze should always be cut with a NEW BLADE. The sharpest teeth possible are required. Then use the blade on steel to finish out the life.

3.5 Aluminum can usually be cut very successfully with carbon steel blades run at high lineal feet per minute speeds, if the machine has a sufficiently large drive motor. Speeds from 300 to 1200 lineal feet per minute are not uncommon.

3.6 Tough alloy steels, such as many die steels, require slow blade speeds and medium to low cutting forces. On large blocks use a new blade for each cut. Save the used blades to cut smaller pieces.

3.7 Use high speed steel blades for cutting stainless steel.

4. BLADE PITCH

Three teeth minimum should be in contact with the work at all times if possible. Gullet capacity (space between each tooth) must be large enough to store all chips cut during travel of the tooth across the work.

Any blade meeting the above conditions can be used for the job. In general it follows that: a coarse tooth blade will cut faster-a fine tooth blade will give the smoothest finish and usually the least burr.

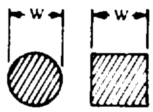
Fig. 4-1 chart gives the usual choice of pitch. Special conditions may cause use of pitches listed here to be wrong; however, it is a good starting place until one has the experience of cutting a particular material.

FIG. 4.1

TABLE OF BLADE TOOTH SIZE AND STYLE

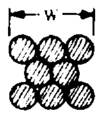
SELECT YOUR BLADE TOOTH STYLE AND SIZE HERE

SOLID STOCK



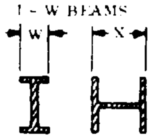
W WIDTH	TOOTH STYLE	TOOTH SIZE
0"-.5"	REGULAR	18 – 10
.5"-1"	REGULAR	10 – 8
1"-5"	REGULAR	8 – 4
5"-18"	REG. OR HOOK	4 – 3
18" UP	REG. OR HOOK	3

SOLID STOCK IN BUNDLES



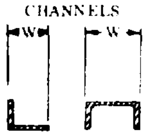
W WIDTH	TOOTH STYLE	TOOTH SIZE
1"-5"	REGULAR	14–10
5"-10"	REGULAR	10 – 8
10"-18"	REG. OR HOOK	6 – 3
18" UP	REG. OR HOOK	4 – 3

STRUCTURAL I - W BEAMS



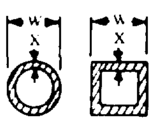
W WIDTH	X WIDTH	POUNDS PER FOOT	TOOTH STYLE	TOOTH SIZE
1.5"-2.5"	3"-4"	4.4 – 7.7	REGULAR	10 – 8
2.5"-3.5"	4"-6"	7.7 – 12.2	REGULAR	8 – 6
3.5"-4.5"	6"-10"	12 – 35	REGULAR	8 – 6
4.5"-6"	10"-18"	35 – 70	REGULAR	6 – 4
6" UP	18" UP	70 UP	REG. OR HOOK	4 – 3

ANGLES AND CHANNELS



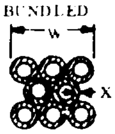
W WIDTH	POUNDS PER FOOT	TOOTH STYLE	TOOTH SIZE
.5"-1.5"	.38 – 1.25	REGULAR	14 – 10
1.5"-2.5"	1.25 – 3.00	REGULAR	10 – 8
2.5"-5"	3.00 – 9.00	REGULAR	8 – 6
5"-10"	9.00 – 20.00	REGULAR	6 – 4
10"-UP	20 UP	REG. OR HOOK	4 – 3

TUBING



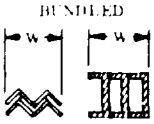
W WIDTH	X WALL THICKNESS	TOOTH STYLE	TOOTH SIZE
.5"-6"	18 GAUGE AND THINNER	REGULAR	18 – 14
.5"-3"	16 GAUGE TO 3/8"	REGULAR	14 – 10
3"-6"	16 GAUGE TO 3/8"	REGULAR	14 – 10
6" UP	3/16" TO 1"	REGULAR	10 – 4
6" UP	1" AND THICKER	REG. OR HOOK	6 – 3

TUBING BUNDLED



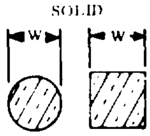
W WIDTH	X WALL THICKNESS	TOOTH STYLE	TOOTH SIZE
3"-6"	18 GAUGE AND THINNER	REGULAR	14 – 10
.5"-6"	16 GAUGE TO 3/8"	REGULAR	14 – 10
6" UP	16 GAUGE TO 3/8"	REGULAR	10 – 6
.5"-6"	3/16" TO 1"	REG. OR HOOK	6 – 3
6" UP	1" AND THICKER	REG. OR HOOK	4 – 3

ANGLES AND CHANNELS BUNDLED



W WIDTH	POUNDS PER FOOT EACH PIECE	TOOTH STYLE	TOOTH SIZE
1"-5"	.38 – 1.25	REGULAR	10 – 8
1"-5"	1.25 – 3.00	REGULAR	8 – 6
5"-10"	3.00 – 9.00	REGULAR	6 – 4
10"-18"	9.00 – 20.00	REGULAR	4 – 3
18" UP	20 UP	REG. OR HOOK	4 – 3

NON-FERROUS SOLID



W WIDTH	TOOTH STYLE	TOOTH SIZE
0"-.5"	REGULAR	10 – 8
.5"-1"	REG. OR HOOK	8 – 6
1"-5"	REG. OR HOOK	8 – 4
5"-18"	REG. OR HOOK	4 – 2
18" UP	REG. OR HOOK	3 – 2

1. NON FERROUS BUNDLED CUTTING USE STANDARD BUNDLED CHARTS ABOVE.
2. REGULAR AND RAKER TOOTH FORMS ARE THE SAME

5. BLADE SET

Blade set is normally one of two types:

5.1 Raker (or regular type). One tooth left, one tooth right, one tooth straight and then the pattern is repeated. This is the most common set and is almost universal in use and application. We recommend using this type of set.

5.2 Wavy set. All teeth slowly oscillate from center to left across to right then back to center, repeating this oscillating pattern. This set is common on blade pitches that are too fine for regular setting, usually 18 and finer. We recommend using this set only when fine teeth are used, and regular set is not available.

5.3 A raker tooth form is best for all normal applications.

6. TOOTH FORM OR STYLE

6.1 Regular or normal tooth style works well on most applications, as the cutting angle does not encourage the blade to dig into the work piece but still generates a good chip. The tooth will normally have enough chip storage.

6.2 Skip tooth blades are used for cutting wide surfaces where maximum tooth gullet storage is required, and for non-ferrous materials making larger chips.

6.3 High positive cutting angles or hook tooth forms are fast cutting in non-ferrous materials and are made with large gullet capacity. They are equally good in cutting larger steel bars.

7. COOLANT

7.1 Coolant and cutting oil perform nearly the same task. They lubricate the blade against wear and absorb most of the cutting heat.

7.2 At slow cutting speeds one can use a plain light oil with very good results; however, most oils are combustible and use of them increases insurance costs.

7.3 Soluble oil and water work together and do a good job with most of the advantages of other fluids. The oil is in an emulsion, but still gives good lubricating properties. Water carries away cutting heat better than pure oil. It can be used for all cutting speeds below 200 surface feet per minute. Over 200 surface feet per minute the heat will break down the oil. At these higher blade speeds other fluids will carry the heat away faster than a soluble oil and water solution.

7.4 Synthetic cutting fluids are recommended for blade speeds above 200 surface feet per minute because of the more intense heat generated. Synthetic cutting fluids are equally good below 200 surface feet per minute and make a good all-purpose coolant. We recommend using this type of coolant for all general work.

7.5 In general, all metals can be cut faster with coolant; however, some alloys and cast iron are best cut dry. Refer to the cutting speed chart for information.

8. CUTTING FORCE

8.1 Cutting force is the force required for a saw blade tooth's cutting edge to penetrate the work piece and form or shear a chip from the material.

8.2 When the cutting force is too light, small dusty chips will be formed. The blade will slide over the work, doing little cutting, and abrasive wear will quickly dull the blade.

8.3 When the cutting force is correct, most chips will be curled or rolled up with a few small chips mixed in. At this point the blade is cutting full contact length of the work, giving the longest blade life and most accurate cutting.

8.4 Increasing the cutting force beyond this point will produce coarse curled chips. This will put the cutting edge at its maximum point of stress. Although the blade will be cutting at the maximum possible speed, the high force will be undesirable. High shearing force, high heat generation, and the high chip storage load at these forces will cause the blade to fail or cut inaccurately.

8.5 The ideal cutting force is outlined in section 8.3. Any additional cutting force will shorten blade life, but increase production per hour, also blade cost per cut.

8.6 Any less cutting force than outlined in section 8.3 will increase blade cost per cut and decrease cuts per hour. See Fig. 8.1.

8.7 The proper cutting force can easily be reached by operator's experience. Various blades will differ slightly and the amount of blade wear causes variations. Different materials will vary also. There is no substitute for an observant, experienced operator.

8.8 Cutting force recommendations are given in Chart 8.2. They are very general due to the varying conditions in the field; however, they will serve as a starting place and will usually provide good blade life. After gaining some experience, most operators will watch the chip and adjust the force accordingly.

8.9 Some materials will not produce curled chips (cast iron is one). In this case judge the cutting force by the volume of chips being removed from the work. If it looks similar to the volume from cuttings of mild steels, cutting force should be in the proper range.

8.10 When cutting large solid work, decrease the cutting force. This gives the blade its best opportunity to cut straight. Also, the length of tooth contact is great and a fine chip may roll up and become very large during the travel time across the work. It is in an area of maximum heat generation; therefore, running the blade 15% slower than on average work will add to the blade life. This is reflected in the cutting charts in this section.

FIG. 8-1

APPROXIMATE BLADE LIFE CURVE

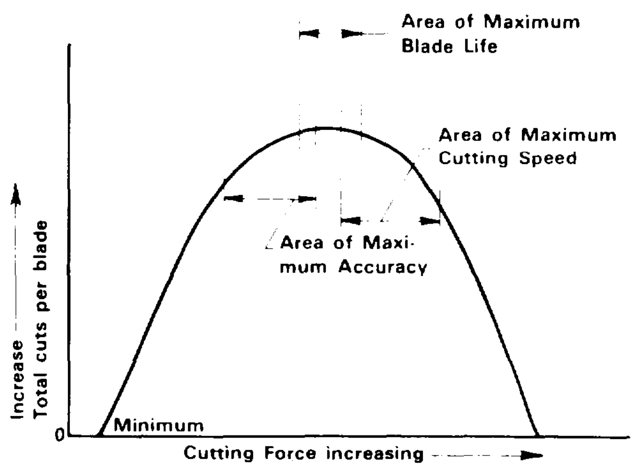


CHART 8.2 AVERAGE CUTTING FORCE CHART

MATERIAL	AVERAGE LENGTH OF BLADE CONTACT								
	0 --- 1"		1" ---5		5" --- 20		20" --- 60"		
BLADE WIDTH	1/2" to 1-1/4		1/2 to 1-1/4		1 to 1-1/4 *		1-1/4 †		
C -- Carbon Steel Blades H -- High Speed Steel Blades	C	H	C	H	C	H	C	H	
MILD STEEL	20	30	30	50	50	120	40	80	
SOLID BARS	20	30	30	50	50	120	40	80	
STRUCTURALS	20	30	30	50	40	80	40	80	
TUBING	20	30	30	40	40	80	40	80	
HIGH CARBON	20	30	40	80	50	150	40	80	
DIE STEELS	20	30	40	80	50	120	40	80	
STAINLESS	20	30	40	80	50	120	40	80	
HI-CHROME	20	30	40	100	50	120	40	80	
CAST IRON	20	30	30	60	40	60	40	60	
ALUMINUM	20	30	30	60	40	60	40	60	
BRASS	20	30	30	60	40	60	40	60	
BRONZE	20	30	40	60	50	100	40	80	

*Increasing the cutting force any higher on blades of less than 1" width may cause crooked cuts,

†Reduce the cutting force on blades of less than 1-1/4" or crooked cuts may result.

NOTE: Start all new blades at 20% lower cutting force for the first 150 square inches of cutting. This allows high points of any long teeth or extra-sharp teeth to wear down until all teeth are cutting uniformly. Failure to do this could cause tooth tips to fracture and ruin a new blade.

9. BLADE SPEED

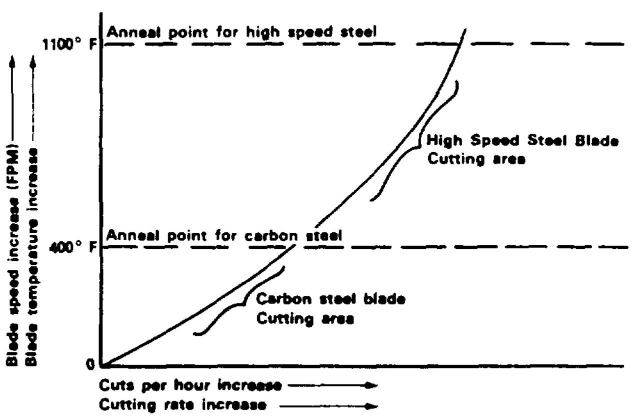
9.1 Blade speed is measured in feet per minute of blade travel. Slower than normal speeds will not harm the blade. Faster than normal speeds will generate excess heat and will quickly destroy the cutting edge of the blade. Blade speed selection is a compromise between good blade life, number of cuts per hour, and keeping the heat generated to an acceptable level. Fig. 9-1 shows this graphically.

9.2 Small work can be cut at higher speeds due to the short time during which the cutting edge is in contact with the work. As the work size becomes larger, the blade speed becomes slower to compensate for the longer contact time and more heat generated per tooth contact. When cutting large solid blocks 20 inches and over, the cutting speed should be reduced 15% to 30% from the average speeds shown on the cutting charts. This will compensate for the extra long blade contact.

9.3 If a good blade life is obtained at the given speeds, it may be possible to increase the cutting speed for better production. On production cutting, increase the blade speed 5% to 10% each time a new blade is installed. When the new blade fails to equal the number of cuts made by the last blade, reduce the speed to that of the last blade. This can soon reveal the best speed for your particular job.

FIG. 9-1

TEMPERATURE DUE TO BLADE SPEED



9.4 See recommended blade speeds later in this booklet (Section 13, table of blade speeds and cutting rates).

10. ACCURACY OF CUT

10.1 Accuracy of cut is shown in Fig. 8-1. The blade should be run on the conservative side in order to keep maximum tooth sharpness. Proceed as follows for maximum cutting accuracy:

A. Use less cutting force
B. Use less blade speed
C. Use maximum blade tension for highest beam strength

This technique is suggested for tool room cutting where time is not important, but where the highest percentage of straight cuts is necessary. However, straight cuts can also be made in production cutting. The possibility of slight run-off is higher, and the chance of a blade breakdown during a critical job is much more likely.

11. PRODUCTION CUTTING

Maximum production speed should be based on allowable blade life.

11.1 If more production per hour is necessary, use the highest reasonable speeds and feeds. This will result in less blade life but more production. Total cost per cut with all overhead expenses included may be the least overall cost.

This is a figure each must compute for himself as much depends upon work load. Many shops want minimum blade cost per cut and use carbon steel blades with slower production rates. Others use automatic equipment with high speed steel blades with maximum cutting conditions. This will often give the lowest cost per cut when total overhead is used to compute cost.

12. HOW TO DETERMINE THE LOWEST COST PER CUT

To determine this you must have the following information

1. Overhead cost per hour.
2. Blade cost.
3. Hours of run time
4. Number of pieces cut, or square inches cut

The following is a typical example with a simplified overhead figure:

1. Overhead cost per hour.

Cost of machine $5000.00	
Cost per year for 10 year life	$ 500.00
Cost per year for operator	7000.00
Total	$7500.00
Total hours worked 1 shift per yr.	2000.00
Simplified overhead cost per hr. $	3.75

2. Blade cost (approximate for this example)
   High speed steel blade $40.00 Example 'A'
   Carbon steel blade $8.00 Example 'B'

Cost of cutting 200 pieces of 4" 4140

Example 'A'
High speed steel blade
Cutting rate 4 in.2 minute*
Running time 10.5 hours
Blade cost 3 blades
$40.00 each $120.00 total

Example 'B'
Carbon steel blade
Cutting rate .84 in.2 minute*
Running time 50 hours
Blade cost 6 blades
$8.00 each $48.00 total

Referring to the nomograph 1 select cost per hour overhead on column 1 (3.75). Select hours per run on column 3. Find total run overhead on column 2.

Example 'A' (continued)

Total overhead	$ 39.37
Add blade cost	120.00
Total cost	$159.37

Example 'B' (continued)

Total overhead	$ 187.50
Add blade cost	48.00
Total cost	$235.50

NOW select total cost on column 4 and number of pieces cut on column 6. Now read cost per cut from column 5

Example 'A' (continued)
Cost per cut $0.79

Example 'B' (continued)
Cost per cut $1.18

*Square inches per minute

If cost per square inch is desired, figure total run 200 x 12.56 area equals 2,512 square inches cut.

Example 'A' (continued)
Find 2,512 on column 7 and move horizontally left to column 6.
Select 159.37 on column 4, read 6.5 on column 5, move decimal two places to the left for cost of $0.065 per square inch.

Example 'B' (continued)
Select column 7 as above use total cost 235.50 for column 4.
Read 9.3 on column 5. move deceimal two places to left for cost per square inch of $0.093.

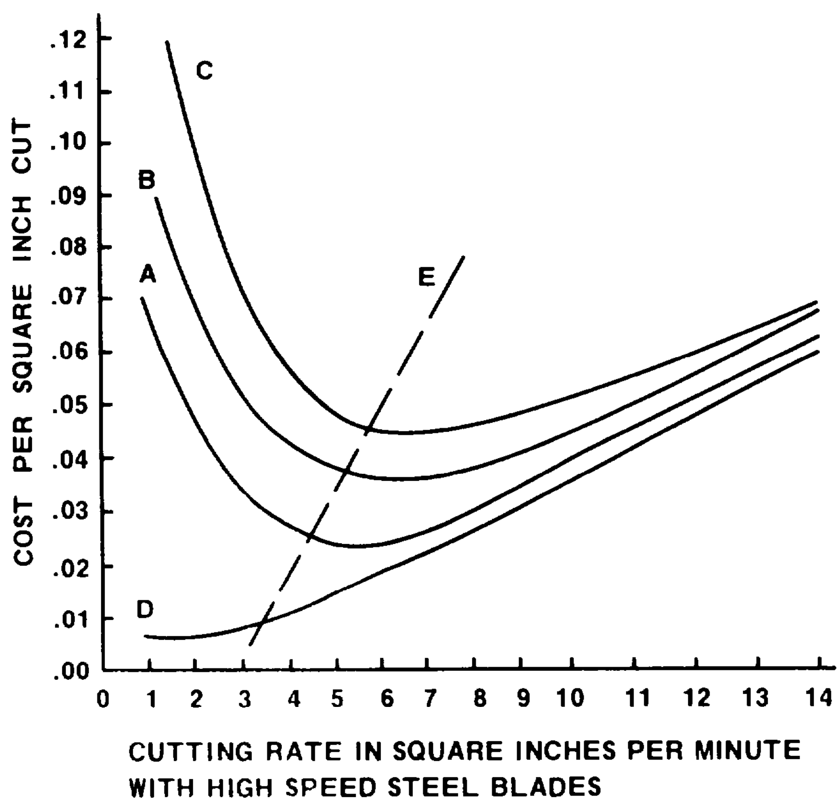
Graph 1
Graph 1 has been constructed by computing more examples as above with the high speed steel blade, except the overhead rate has been changed to:
Curve A $3.75 per hour
B $6.00 per hour
C $10.00 per hour
D $Blade cost only

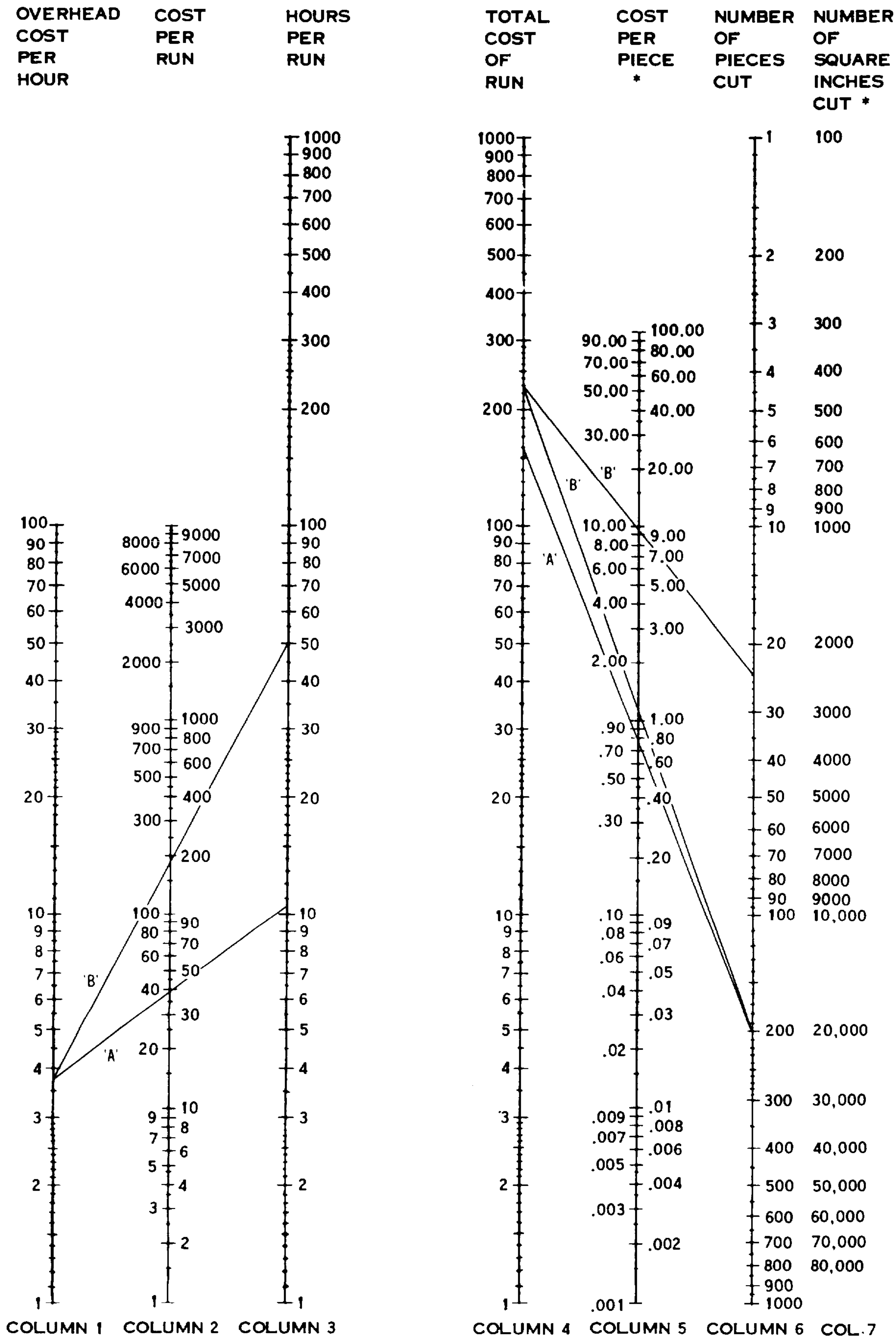
Also the number of blades used to cut the same number of pieces increased as the cutting rate Increased, as the blades were fed harder and therefore broke down sooner and this also changed the total cost used.

By connecting the minimum cost points on each curve (Line E) a general cost trend appears. That is, as overhead rates increase, more economical sawing is acheived by Increasing the cutting rate even though blade life IS shortened.

The only way to find the minimum costs for your applications is to compute a chart as shown, or use this one as an average until your own shop history accumulates.

GRAPH 1





* WHEN USING SQUARE INCHES CUT READ THE COST PER PIECE AND MOVE THE DECIMAL POINT 2 PLACES TO THE LEFT FOR COST PER SQUARE INCH.

NOMOGRAPH 1

13. TABLE OF BLADE SPEEDS AND CUTTING RATES FOR USE WITH COOLANT

	BLADE SPEED HIGH SPEED STEEL BLADE			SQUARE INCHES PER MINUTE CUTTING RATE	BLADE SPEED CARBON STEEL BLADE			SQUARE INCHES PER MINUTE CUTTING RATE
	WORKPIECE WIDTH				WORKPIECE WIDTH			
	0"-3"	3"-6"	6"-UP		0"-3"	3"-6"	6"-UP	
CARBON STEEL								
1010-1035	300	250	200	10-16	130	120	90	1-2
1038-1095	175	140	100	6-9	100	80	60	1-2
1100 SERIES	350	300	250	8-20	140	130	120	1-3
1200 SERIES	325	250	200	8-20	120	100	80	1-3
1300 SERIES	250	200	150	6-10	100	80	60	.5-1
2000 SERIES	175	130	100	3-7	85	75	50	.5-1
3000 SERIES	200	150	125	3-7	110	80	50	.5-1
4000 SERIES	225	175	150	3-8	85	70	50	.5-1
5000 SERIES	225	175	150	4-8	65	50	50	.5-1
52100	150	100	75	3-7	70	50	50	.5-1
6000 SERIES	200	150	125	3-7	65	50	50	.5-1
8000 SERIES	200	150	125	4-7	65	50	50	.5-1
9000 SERIES	150	125	75	2-5	100	60	50	.5-1
STAINLESS STEEL								
300 SERIES	125	80	60	1-3	50	50	50	.2-.7
400 SERIES	125	80	50	2-4	50	50	50	.2-.7
HIGH SPEED TOOL STEEL								
S,H SERIES	120	100	50	3-5	50	50	50	.5-1
T,M SERIES	100	75	50	1-2	50	50	50	.2-.7
DIE STEEL								
A,H SERIES	175	125	100	3-4	50	50	50	.5-1
D* SERIES	100	75	50	1-2	50	50	50	.2-.7
L,O SERIES	175	100	75	4-6	50	50	50	.5-1
NICKEL BASE ALLOY STEEL								
MONEL	75	50	50	.5-2	50	50	50	–
INCONEL X	75	50	50	.5-2	50	50	50	–
TITANIUM	50	50	50		50	50	50	
ALUMINUM								
BAR STOCK	500	500	500	10-40	500	500	500	10-30
CAST	200	200	200	10-20	200	200	200	10-15
CAST IRON*	100	75	50	2-4	100	75	50	.5-1
KIRKSITE	500	400	300	5-20	200	120	80	5-10
BRONZE								
MANGANESE	300	200	150	4-10	200	100	80	.5-1
ALUMINUM	100	75	50	3-10	50	50	50	.5-1
PHOSPHOR	275	225	200	3-8	125	100	80	.5-1
SILICON	175	150	100	3-12	75	50	50	.5-1

*Do not use coolant.

Above blade speeds are for cutting with coolant. When dry cutting reduce high speed steel blade speeds 50% and carbon steel blade speeds 25%.

14. HOW TO DETERMINE CUTTING RATE OR TIME

After selecting the desired cutting rate from the foregoing charts, locate the same point on Column 3 of Nomograph 2. Now compute the cross sectional area of the work piece and locate it on Column 1 of Nomograph 2. Now place a straight line from the Column 1 point to the Column 3 point and read the cutting time required per cut from the intersecting point on Column 2.

When sawing conditions are set for the listed blade speed, blade tooth pitch, and cutting force, the time per cut should be similar to the time per cut. on Nomograph 2. If not the cutting force can be adjusted to increase or decrease the cutting time.

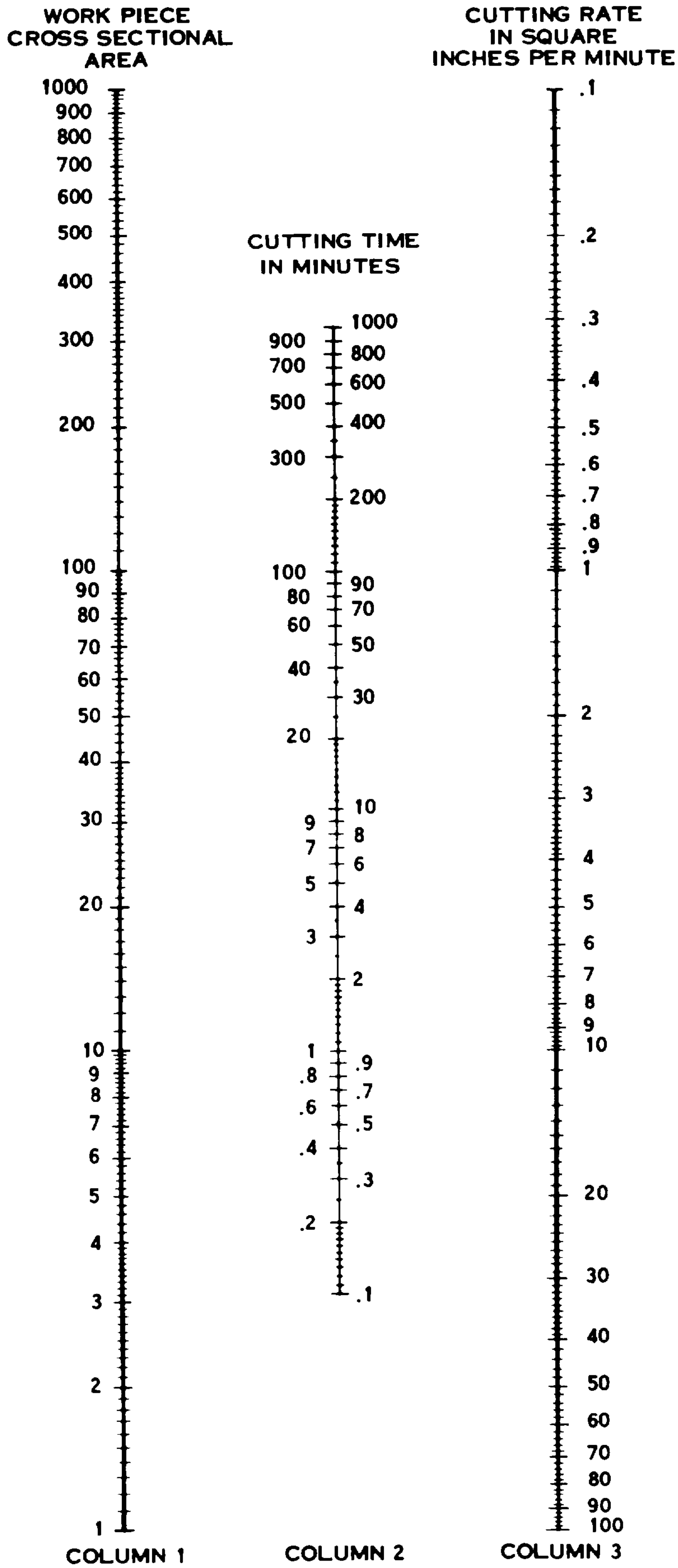
When the cutting time is known it can be set on Column 2 and a line from Column 1 through Column 2 will intersect Column 3 to give the present cutting rate.

TABLE OF STEEL SECTION WEIGHT AND CORRESPONDING AREA IN SQ. INCHES

Steel Section Weight Per Foot - Pounds	Area of Section in Square inches
500	147.05
450	132.35
400	117.64
350	102.94
300	88.23
250	73.52
200	58.82
150	44.11
100	29.41
90	26.47
80	23.52
70	20.58
60	17.64
50	14.70
40	11.76
30	8.82
20	5.88
10	2.94
9	2.68
8	2.35
7	2.05
6	1.76
5	1.47
4	1.17
3	0.88
2	0.58
1	0.29

TABLE OF DIAMETERS IN INCHES AND CORRESPONDING AREAS IN SQUARE INCHES

Diameter Inches	Area	Diameter	Area
		6	28.27
		6 1-8	29.47
3-8	.11	6 1-4	30.70
1-2	.20	6 3-8	31.92
9-16	.25	6 1-2	33.18
5-8	.31	6 5-8	34.47
3-4	.44	6 3-4	35.80
7-8	.60	6 7-8	37.12
1	.79	7	38.48
1 1-8	.99	7 1-8	39.87
1 1-4	1.22	7 1-4	41.30
13-8	1.49	7 3-8	42.72
1 1-2	1.76	7 1-2	44.17
1 5-8	2.07	7 5-8	45.66
1 3-4	2.40	7 3-4	47.20
1 7-8	2.76	7 7-8	48.71
2	3.14	8	50.26
2 1-8	3.55	8 1-8	51.85
2 1-4	3.97	8 1-4	53.50
2 3-8	4.43	8 3-8	55.09
2 1-2	4.90	8 1-2	56.74
2 5-8	5.41	8 5-8	58.43
2 3-4	5.93	8 3-4	60.00
2 7-8	6.49	8 7-8	61.86
3	7.06	9	63.61
3 1-8	7.67	9 1-8	65.40
3 1-4	8.25	9 1-4	67.20
3 3-8	8.95	9 3-8	69.03
3 1-2	9.62	9 1-2	71.00
3 5-8	10.32	9 5-8	72.76
3 3-4	11.04	9 3-4	74.50
3 7-8	11.79	9 7-8	76.59
4	12.56	10	78.53
4 1-8	13.36	10 1-8	80.52
4 1-4	14.18	10 1-4	82.50
4 3-8	15.03	10 3-8	84.54
4 1-2	15.90	10 1-2	86.60
4 5-8	16.80	10 5-8	88.66
4 3-4	17.72	10 3-4	91.00
4 7-8	18.67	10 7-8	92.89
5	19.63	11	95.00
5 1-8	20.63	11 1-8	97.21
5 1-4	21.64	11 1-4	99.50
5 3-8	22.69	113-8	101.62
5 1-2	23.75	11 1-2	104.00
5 5-8	24.85	11 5-8	106.14
5 3-4	25.96	11 3-4	108.40
5 7-8	27.11	11 7-8	110.75


WORK PIECE CROSS SECTIONAL AREA
CUTTING TIME IN MINUTES
CUTTING RATE IN SQUARE INCHES PER MINUTE
COLUMN 1
COLUMN 2
COLUMN 3

NOMOGRAPH 2

15. SAWING PROBLEMS

SLOW CUTTING

Use coarser pitch tooth if possible.
Use faster blade speed when possible.
Increase cutting force if possible.

POOR BLADE LIFE

Blade is running too fast.
Cutting force is too heavy.
Blade pitch is too fine.
Use ample coolant.

TOOTH STRIPPING

Cutting force is too heavy.
Blade pitch is wrong. Use a coarser pitch blade on wide sections, a finer pitch on thin sections, plus ample coolant.
Check blade brush to make sure it is cleaning the blade.

BLADE STARTS CUT INTO WORK PIECE, THEN STOPS CUTTING

This condition is typical of work hardening material. Apply ample cutting force so teeth are continually cutting, not sliding through the work piece.
Blade running too fast, causing the teeth to dull from overheating.
Use coarser pitch blade.

CROOKED CUTS

Replace old blade.
Place blade guides as close to work as practical.
Check alignment of blade guides.
Check for leakage in hydraulic system allowing the cutting head to leak down.
Check alignment of the cutting head guide post.

BLADE BREAKAGE

Blade tensioned too tight. See manual for your machine.
Roller guides adjusted too tight, causing high flexing of band.
Check blade wheels for wear and alignment (see maintenance instructions).
If saw blade is breaking at welds, use a longer annealing period with gradual decreasing of heat. If blades were purchased, return for rewelding.
Cutting force may be too high.

CONCAVE CUTS

Increase the blade tension.
Use a coarser pitch blade if possible.
Use less feed force.
Place guides as close as possible to the work piece.
Replace old blade.
Check for leakage in hydraulic system allowing cutting head to leak down.

JUMPING OF CUTTING HEAD

Check blade weld carefully for improper alignment or grinding.
Check blade for stripped teeth.

CUTTING HEAD BINDING ON HINGE OR COLUMNS

Machine is not properly leveled causing the hinge or columns to misalign.
Clean columns of rust, dirt, etc. and apply light film of oil.

BLADE VIBRATION

Change blade speed to break the resonant pattern of the blade.
Increase blade tension.
Use different pitch blade.
Change the cutting force.
Check work clamping.
Move blade guides closer to work.
Blade speed is too fast.

LOADING OF TOOTH GULLETS

Use a coarser pitch blade.
Apply coolant liberally or try a different type of coolant.
Use less feed force with increased blade speed.

BLADE STALLS IN WORK

Decrease cutting force.
Decrease cutting head approach speed.
Check blade tension.
Check drive motor belts.
Blade not tracking properly on wheels.

CHIPS WELDED TO TEETH

Use coolant.
Check blade brush.
Decrease cutting force rate.

LOSS OF TOOTH SET

Blade is running with teeth between guide rollers or on blade wheels.

BLADE SIDES ARE HEAVILY SCORED

Check carbide blocks in guide.
Check coolant supply

BLADE NOT TRACKING PROPERLY

Consult manual and align blade wheels.

(Continued Next Page)

15. Continued

SCALE ON WORKPIECE
All hot rolled materials will have a degree of mill scale. On low carbon mild steels this scale is negligible as far as cutting rates are concerned, but it shortens the blade life. When structurals, angles, etc. are being cut, the ratio of exterior area to the cross section area is very high, resulting in extreme abrasion to the blade and consequent shorter blade life.

On alloy steels this mill scale can be very detrimental to the band saw blade and we definitely recommend it be removed prior to the cut. Some scales are so hard and abrasive that they must be removed in order to successfully cut the materials.

HARD SURFACES
Hard surfaces can be created on a work piece by a wide variety of operations. The following are a few of the more common problems encountered:

CUTTING WITH A TORCH can create a "case hardened" area if an excess of acetylene is used to make the cut. While this shell is only a few thousandths of an inch thick, cutting through it with a band saw blade will dull the teeth, creating extreme problems.

GROUND SURFACES -- on some high carbon and die steels, improper grinding practices can result in the hardening of the surface.

HARD SPOTS IN THE WORK PIECE
Some welded seam tubing will have a hard zone by the welded area if it is not properly annealed. This hard section can at times be too hard to cut.

Some die steels may have inclusions of slag or scale within the block. These inclusions are as hard as the teeth on the blade, and will dull the teeth as the blade cuts through them. This in turn will cause the blade to start cutting crooked.

16. BLADE TENSION

As a general guide line, the higher the blade tension, the sooner the blade will fail and break due to running stress and tension. However, as the blade tension is increased, the accuracy of cut also increases. This means that a tension must be used that is high enough for accurate cutting, but not high enough to shorten blade life.

Machines that are equipped with manual hand knobs for blade tensioning have knobs sized so one can generally tighten them with one hand as tight as comfortably possible. This will put the blade in the proper operating range.

Machines with hydraulic blade tension control can in most cases be adjusted to over-tension a blade. As a starting point, we recommend checking the hydraulic diagram for the recommended pressure adjustment. On average sized work pieces this will be adequate tension for good cutting and good blade life.

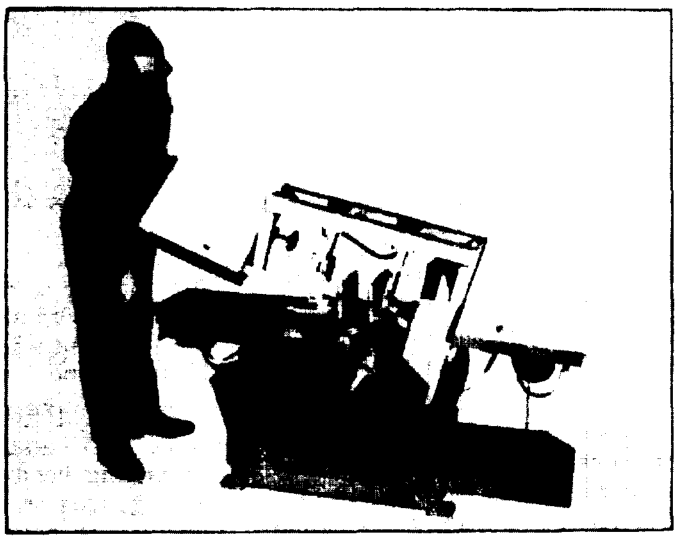
When cutting large material with wide blade spans, the blade tension may have to be increased to obtain maximum blade stability. Because the maximum allowable tension varies from blade types and manufacturers, the best procedure is to check with the blade manufacturer for the maximum allowable tension of the blade being used. This tension can then be applied and used as a good starting point.

Another method may also be used in the absence of any available information. Keep a record of the running time on the saw blade until it breaks. Then increase the blade tension 10% each time a new blade is installed until the blade breaks before it wears out. This will then be the maximum tension point. Reduce the tension 15% below this point and operate the blades long enough to see if the average blade life is used before the blade breaks.

When this point is reached, the blade will be operating at its maximum practical beam strength. Let us again call to your attention that this is normally only necessary when large machines are sawing near capacity work.

For most applications and blades, the tension range given on the hydraulic diagram or manual will result in adequate tension and good cutting. Some machines show the proper hydraulic pressure setting on the blade tension gauge by setting the gauge needle to a green dot on the dial.

MODEL L-9



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1. INTRODUCTION

The purpose of this manual is to provide instructions for the installation, operation and maintenance of your Model L-9 metal cutting band saw machine, a comparatively simple but rugged machine tool.

Any power driven machine tool constitutes a potential hazard to the operator's safety. The Model L-9 saw has been designed with safety in mind, but it is still necessary to observe all the safety rules employed in the operation of any machine. We recommend you read the safety manual included with this manual before you start up the machine. CAUTION: Some guards have been removed to show the underlying parts in the following photos. In actual use, make sure all guards are in place before operating the machine.

2. INSTALLATION

A. LOCATION. When installing the L-9 saw, it is important that proper consideration be given to the surroundings and location. It should be in an area large enough for operator safety. The machine and the work area should be properly lighted, without severe reflections or other visibility hazards.

The L-9 saw does not normally require any special foundations or footings. However, the floor under it should be adequate to support the machine with its maximum intended load. The machine should be level and shimmed so that each foot is resting firmly on the floor, carrying its proportion of the load without twisting or straining the machine bed.

B. ELECTRICAL HOOKUP. All electrical wiring to the machine must meet all local and national electrical codes, and should be installed so that it will not be subject to damage from normal operation of the machine or related material handling equipment.

C. CHECK-OUT. Before the initial start-up, visually inspect the machine to see that all drive belts are in proper position and that the machine appears free from damage. The cutting head should lift freely, and when the cutting head descent valve (Fig. 8) is opened, the cutting head should lower freely. If it does not, consult Section 4A concerning lubrication. If this does not adequately free up the cutting head, the machine should be thoroughly inspected for concealed damage such as bent frame members or broken cutting head hinge bolts.

Using the switch next to the cutting head descent valve (Fig. 8), turn on the blade motor. The machine should start and run quietly and freely. If it does not, check for damaged pulleys or belts, bent shafts, etc.

D. STOCK STOP INSTALLATION. Insert the bar slot end first into the hole in the machine bed. Align the slot in the bar end with the pin on the opposite side of the machine base. As the bar engages the pin, place the push arm into the notch on the cutting head pivot arm (Fig. 1). Attach the spring to the bracket as shown.

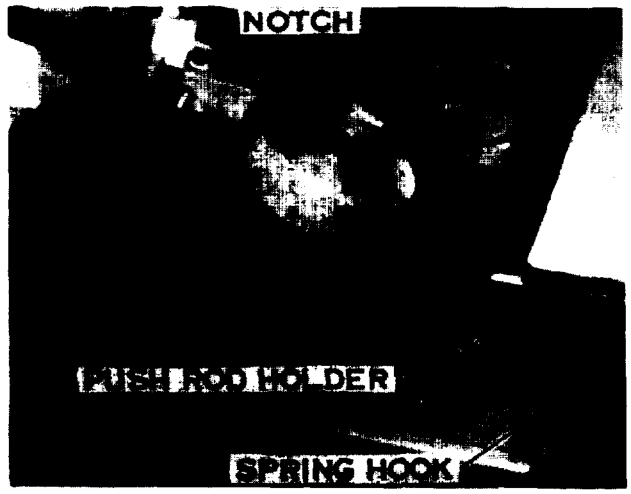


Figure 1

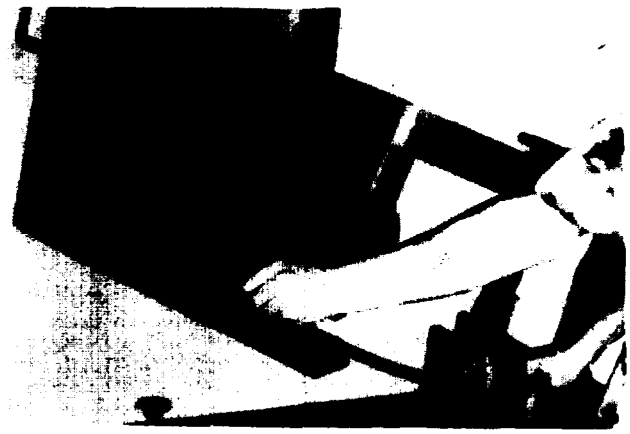


Figure 2

The purpose of the arm and pin is to swing the length stop up and away from the work piece, so that when cut off it will not twist and jam between the blade and length stop.

E. BLADE INSTALLATION. Raise the cutting head 6" or 7" and hold it in this position by closing the cutting head descent valve. Open both blade wheel guards on the cutting head. Swing up the blade guard cover (mounted on the saw guide). Hold the looped blade in front of you with the smooth back edge toward you. Lower the blade into the cutting head and place it around the wheels (Fig. 2). The teeth on the lower strand of the blade should be in position to cut as the blade travels toward the driving wheel. If the teeth are not pointing in this direction, remove the blade, turn it inside out, and replace it. At each blade guide, twist the blade to a vertical position (teeth down) and insert it up between the guide rollers (Fig. 3). Turn the blade tensioning knob just enough to take the slack out of the blade, but leave the blade loose enough so that it can be slid up against the wheel flanges (Fig. 4). After lifting the blade against the flanges, close the wheel guards and tension the blade by turning the handknob as tight as is comfortably possible with one hand (Fig. 5). If the blade is too loose, it may slip on the driving wheel or it may not cut straight. If the blade is too tight, metal fatigue will cause premature failure. With the blade properly installed and tensioned, start the blade motor for a final check.

3. OPERATION

A. CUTTING FORCE. When a new blade is installed on the machine, the cutting force should always be reduced for the first five or six cuts. A new blade, being sharp, will penetrate the work much faster and may be damaged by tooth tips chipping off or teeth stripping if the cutting force is not reduced. After the "break-in" period the cutting force may be increased to normal and, as the blade dulls, the cutting force may be increased more to maintain cutting speed. Eventually a point will be reached where either the blade will cut too slowly, or the force required to make it cut will be so high that crooked cuts will result, dictating a new blade.

The cutting force is adjusted by the step cam (Fig. 6) that controls the tension on the counterbalance spring. Lift the cutting head completely up. Then pull the spring rod out and rotate the cam up to the highest point for minimum cutting force, or the lowest point for maximum cutting force. In normal use, position the spring rod in the second step down from the top. If you find the blades are producing fine dust when cutting, increase the cutting force by iowering the rod one step. If the blade is being overfed and is producing large heavy curled chips, raise the spring rod one step on the cam to reduce the cutting force. Ideally, the average cutting should produce a mixture of chips and curled chips.

Normally, a narrow work piece requires a light cutting force, and a wide work piece requires a medium to heavy cutting force. Tooth pitch must also be considered in determining cutting force. A coarse pitch blade on a narrow work piece will require much less cutting force that a fine pitch blade on the same work piece. To familiarize yourself with the saw blades, tooth pitch, cutting force and other related factors, read the accompanying Saw Blade Selection and Application Manual.

B. BLADE SPEED. One of the critical factors when cutting any type of material is the blade speed. If a blade is run too fast for the material being cut, it will burn out long before it would have worn out had it been run at the proper speed. When the surface speed of any cutting tool is increased, the cutting edge will run hotter. At some point the critical temperature of the cutting tool will be exceeded and the tool will "soften" and subsequently fail.

To change the blade speed on 4-speed machines, open the belt guard and loosen the cap screw in the motor mount bracket (Fig. 7) so the motor will

Figure 3

Figure

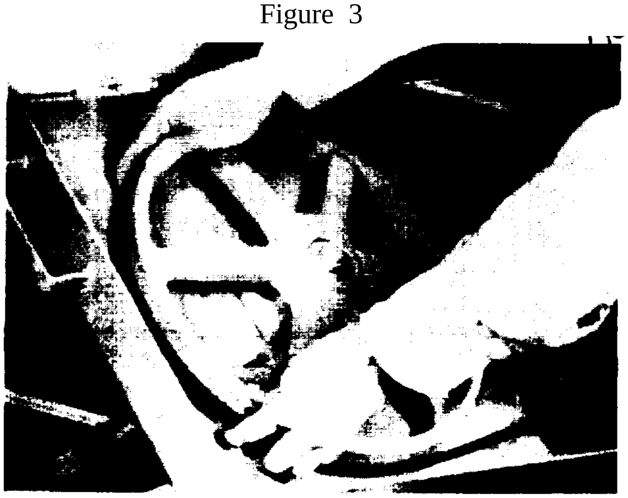


Figure 4

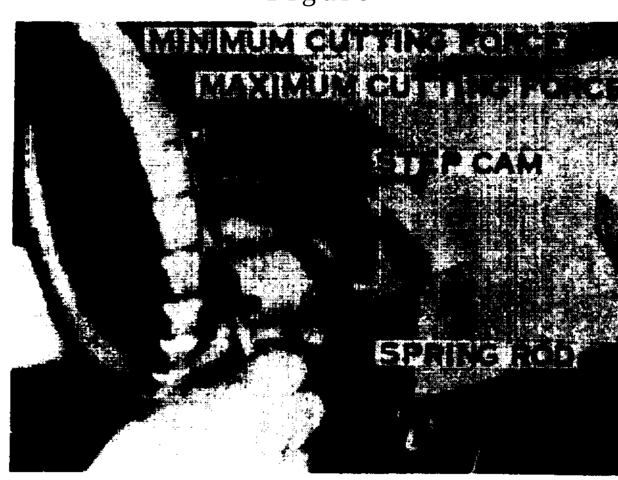


Figure 6

swing, and loosen the primary drive belt. Move the belt toward the large end of the motor pulley to increase the blade speed, or toward the small end to decrease the blade speed. Be sure to also move the belt on the counter-shaft pulley, in the same direction and the same number of steps, so that the belt will run straight from the motor pulley to the countershaft pulley. If the belt runs angled from pulley to pulley it will wear unduly and may jump off the pulley. When the belt is adjusted to the proper step for the desired blade speed, swing the motor to tension the belt and tighten the cap screw to securely clamp the motor mount bracket.

On variable speed machines, start the drive motor, then turn the crank arm (Fig. 7b) until the indicator shows the desired blade speed. The crank arm will be self locking as long as the small friction screw is kept snug.

C. VISE OPERATION. To adjust the saw vise to the work piece size, place the work piece on the saw bed against the stationary vise jaw. Then simply lift the half nut carrier handle (Fig. 8) connected to the movable vise jaw and slide it up against the work piece. Lowering the handle engages the half nut and vise screw so that final tightening can be done with the handwheel at the end of the vise screw.

D. STOCK STOP BAR. If a number of pieces are to be cut the same length, the stock stop bar may be used to preclude measuring each piece. Place the work in the machine vise and lower the cutting head until the blade is just above the work piece. Position the work piece under the blade for the desired length of cut, and tighten the vise securely. Loosen the clamp screw in the stop arm casting (Fig. 9) so that the casting will slide along the stock stop bar. Slide it up against the end of the work piece and tighten the clamp screw, positioning the stop on the upper edge of the work piece.

This will allow the arm to swing up and away from the work piece, eliminating jamming of the work piece between the blade and the stop arm at the completion of the cut. When setting the stop for short work pieces, be careful not to adjust the stop arm so that it will swing up into the saw guide.

E. GUIDE ARMS SETTING. Before starting a cut, adjust the two saw guide arms as close as possible to the work piece, but be sure to leave enough room so that the guides will not hit the vise jaws or stock stop bar as the cutting head swings through the cut. Keeping the guides as close to the work as possible will insure the best cutting results and will maintain the blade guard as close as possible to the work piece.

F. CUTTING HEAD DESCENT RATE. To start a cut, start the blade motor and "crack open" the

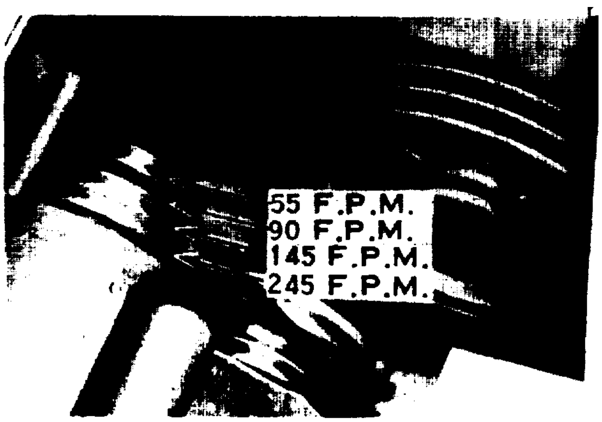


Figure 7

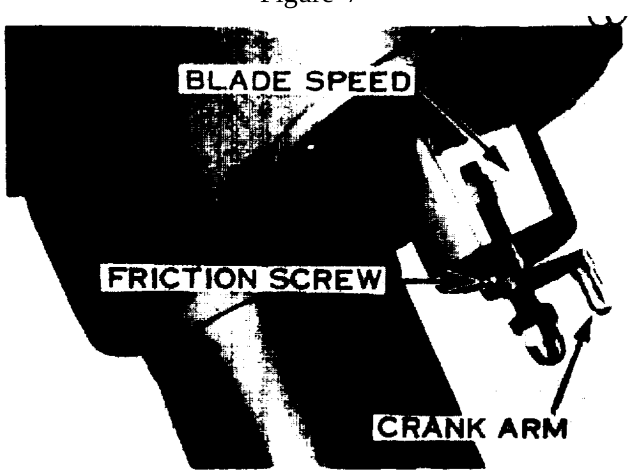


Figure 7-B

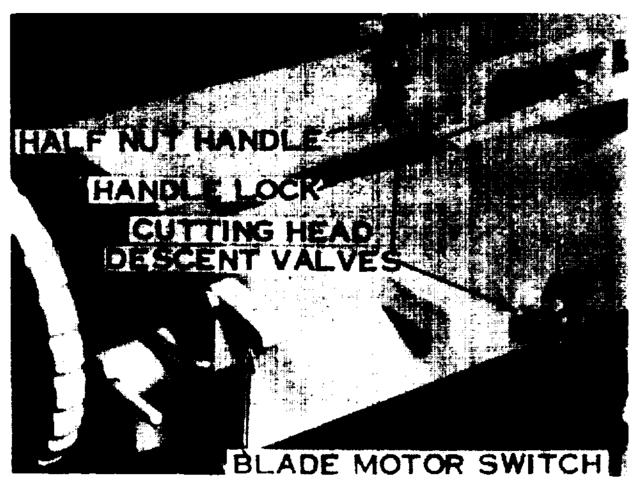


Figure 8


Figure 9

cutting head descent valve to lower the blade very slowly onto the work piece. This will protect the blade at the start of the cut when only a few teeth are engaged. As soon as the cut has progressed far enough that several teeth are engaged, the valve may be opened about l/4 turn. This will allow the cutting head to descend at its sawing rate, and opening the valve further will not speed the cutting action.

If the work piece to be cut is thin wall tubing or any other thin section (so that only a few teeth will be in contact with the work piece at any time), a light cutting force should be used, and the cutting head descent valve should be opened only enough to allow a slow, even feed through the cut. A thin section does not present enough area to the saw blade for normal cutting forces to be used. Therefore, the cutting head would fall through the work too rapidly, causing overfeeding and blade failure. This situation is prevented by slowing the maximum rate of descent.

G. COOLANT. If your machine is equipped with a coolant system, it is wired so that the coolant pump will run whenever the blade motor is turned on. CAUTION: Do not run the coolant pump any length of time unless it is submerged in coolant. If you wish to run the machine without coolant in the tank, unplug the coolant pump.

For most sawing applications, a weak soluble oil and water mixture is used for coolant. If the coolant becomes too thick or oily, it will result in too much lubrication and poor blade life. Most materials can be cut satisfactorily without coolant, but blade life will be somewhat less and the time per cut will be somewhat longer because the blade speed must be reduced to prevent overheating. It may be desirable to cut some items dry due to their size, shape or other physical characteristics, or to eliminate other possible problems which may arise when using coolant. The only materials on which we do not recommend using coolant are the "D" series of air and oil hardening tool steels, cast iron, and brass or bronze alloys.

H. ANGLE CUTTING. To make cuts of various angles from 90 to 45 degrees, loosen the two bolts holding the stationary vise jaw to the saw bed. Use a protractor to position the vise jaw on the bed to the desired angle. As the angle becomes more acute, it may be necessary to remove the bolt from the slot in the vise jaw (Fig. 10). This bolt may then be placed in either of the other holes in order to obtain the desired angle. Tighten the bolts securely when the angle is set. Next, loosen the two bolts on the movable vise jaw (Fig. 11), slide it snugly up against the adjusted stationary jaw, and retighten the bolts. Be sure to check the guide arms before making a cut to be sure they are as close as practical, but with the necessary clearance.

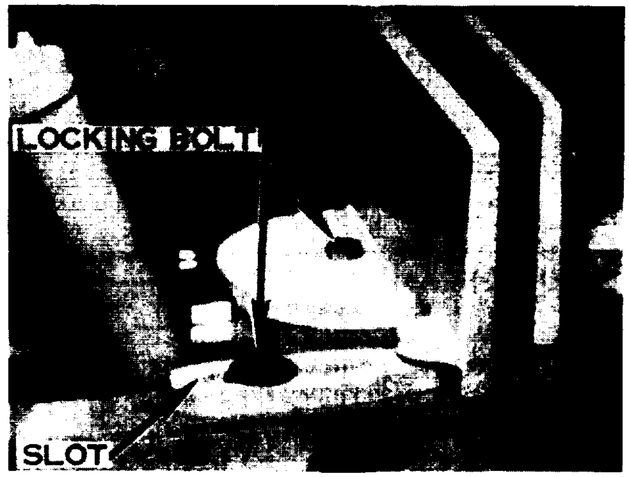


Figure 10

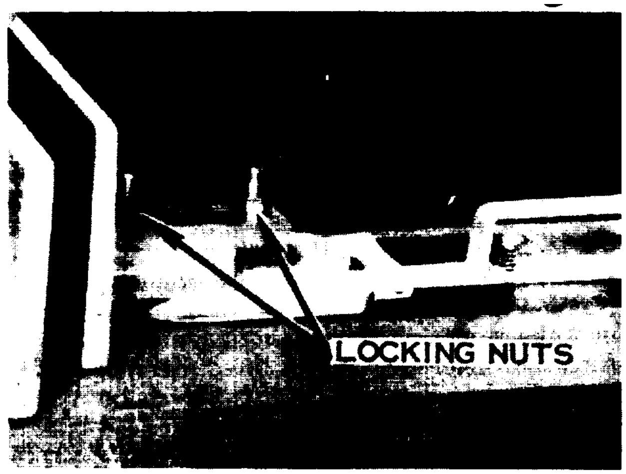
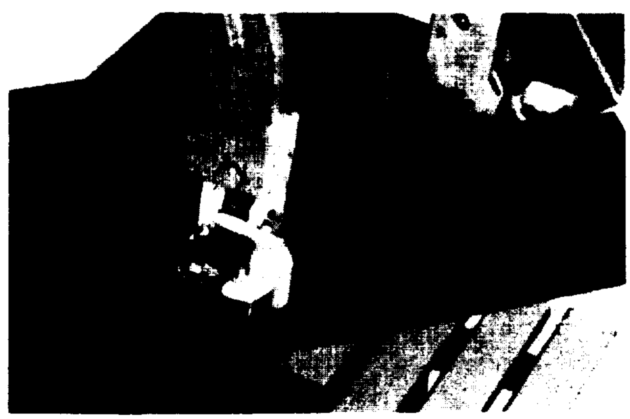


Figure 11


Machine set up for 45° cuts.

4. MAINTENANCE

Any machine tool will require periodic maintenance including lubrication, minor adjustments, and eventual replacement of some parts. A good maintenance program will insure a smooth running machine. For normal maintenance we recommend the following:

A. LUBRICATION.

SAW BLADE GUIDE ROLLERS VISE SLIDE WAYS VISE SCREW	Clean and lubricate with a light to medium weight oil, daily for heavy use and weekly for occasional use.
RING GEAR	We do not recommend any lubrication. If it is greased or oiled it will pick up dirt and shavings which would normally fall away.
GUIDE BEAM	This should be kept clean, with a light film of oil maintained on it.
CUTTING HEAD PIVOT POINTS CYLINDER PIVOT POINTS BLADE TENSION SCREW	A few drops of light to medium oil should be applied weekly.
VARIABLE SPEED DRIVE PULLEY	Grease monthly (Fig. 13).

The oil level of the hydraulic cylinder should be maintained within l/2" from the top, with the piston rod all the way down. This will require occasional filling with a medium grade of hydraulic oil. If the oil level falls below the top hose fittings in the cylinder, the cutting head action will become spongy and a considerable drop in the head will be noticed after the head is raised and released onto the hydraulic cylinder. If this happens, remove the cylinder cap and fill the cylinder. Replace the cap, leaving it loose, and work the head up and down 8 or 9 times, closing the cutting head descent valve each time before the head is lifted. Remove the cap and refill the cylinder. Repeat this cycle until all air has been worked out of the system and the oil level does not fall between cycling periods.

B. BLADE WHEEL ALIGNMENT. When the blade wheels are properly adjusted, the blade will run with the smooth edge making light contact with the wheel flanges. If this contact becomes too heavy, it will wear the wheel flange unduly and create a noisy scrubbing sound. It also causes an edgewise strain on the blade at the point of wheel contact which can cause blade fatigue and breakage.

Before making any blade wheel pitch adjustments, we strongly recommend that a new blade be installed on the machine. If a blade that is worn or stretched out of shape is used to make this adjustment, the end result may not be satisfactory. To make a wheel pitch adjustment, release the blade tension and loosen the cap screw in the outer edge of the wheel axle plate (Fig. 12). Turn the socket set screws next to them in or out to get the desired change of axle inclination. If the blade is running hard against the wheel flange, turn the set screws out (counterclockwise) and retighten the cap screws. This will lower the outer edge of the wheel, reducing the tendency of the blade to run against the flange. If the blade runs down away from the flange, turn the set screws in (clockwise) and tighten the cap screws. This will raise the outer edge of the wheel, causing the blade to run closer to the flange.

C. RING GEAR AND PINION ADJUSTMENT. The ring gear and pinion should be adjusted to .010" to .015" clearance between the two gears. To make this adjustment, loosen the cap screw in the lower edge of the pinion bearing flange (Fig. 13). Lightly tap the flange in the direction desired to get the proper clearance, then tighten the cap screw and check the clearance. Be sure to have a blade on the machine, under normal tension, when making this adjustment.

Figure 12

Figure 13

D. TIMING BELT ADJUSTMENT (Fig. 13). The timing belt should be adjusted tight or snug, but not tensioned as one may do with V-belts. If the belt "sings" it indicates too much tension. If the belt is run too loose it may jump cogs. Therefore, when performing this adjustment, the mid-span point of the belt, when moved with the fingers, should have a small but definite up and down movement. Loosen the timing belt adjustment bolt and rotate the cam sleeve until the desired position is reached. Then hold the cam in position while retightening the bolt.

E. MOTOR SWITCH ADJUSTMENT. Switch adjustment can be made by means of the set screw in the end of the pin which the switch rod passes through (Fig. 14). Loosen the set screw and adjust the switch rod longer or shorter as required so that the cutting head, when lowered, will turn the switch off just before it comes to rest on the stop. The switch should not be turned off so soon that the cutting head rests on the switch rather than on the stop.

Figure 14

F. DRIVE BELT ADJUSTMENT. 4-speed machines: There are two different V-belt drives on the 4-speed machine. The primary drive belt goes from the motor to a countershaft pulley, and the final drive belts go from the countershaft pulley to the ring gear pinion shaft pulley. To adjust the final drive belts, turn the screw shown in Fig. 15. These belts should be reasonably tight, so that there is only 1/4" of movement when the belt is pushed with the fingers midway between the pulleys.

To adjust the primary drive belt, loosen the cap screw in the motor mount bracket (Fig. 15) and swing the motor up until the belt is tensioned. This belt will not require much tension to drive the machine satisfactorily. With the belt tensioned properly, retighten the cap screw to clamp the motor mount bracket securely to the support bar.

G. BLADE GUIDE ADJUSTMENT. For satisfactory cutting results, it is necessary to maintain the blade guides in good repair and proper adjustment. This is probably the most important adjustment on the machine, and must be done carefully and thoroughly. It is very important that a new blade be installed on the machine before making any blade guide adjustments. Because this adjustment is so important, a separate manual has been prepared and is included with the original machine manuals.

H. BLADE BRUSH ADJUSTMENT. The blade brush should engage the blade lightly, usually just enough to turn it. The blade brush should not engage the blade beyond the depth of the teeth. To make this adjustment, slightly loosen the wingnut and turn the thumb screw to engage the brush against the blade (Fig. 16). Retighten the wingnut. Do not make this adjustment with the machine running for safety reasons.

I. BLADE TENSION INDICATOR ACCESSORY. When the blade has been installed in accordance with this manual, tighten the blade until the marks on the indicator line up (Fig. 17).

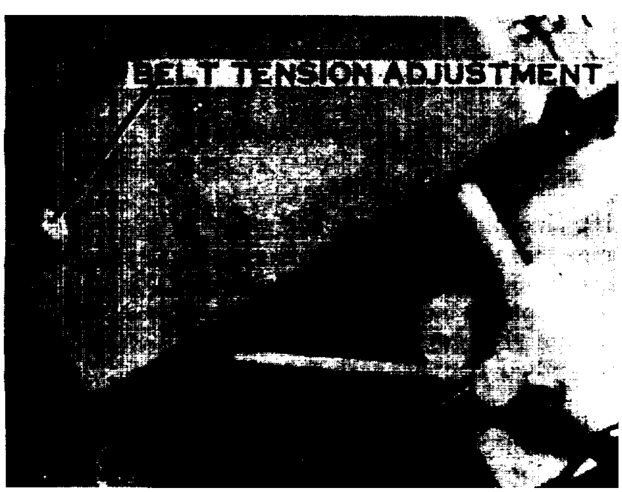


Figure 15

Figure 16

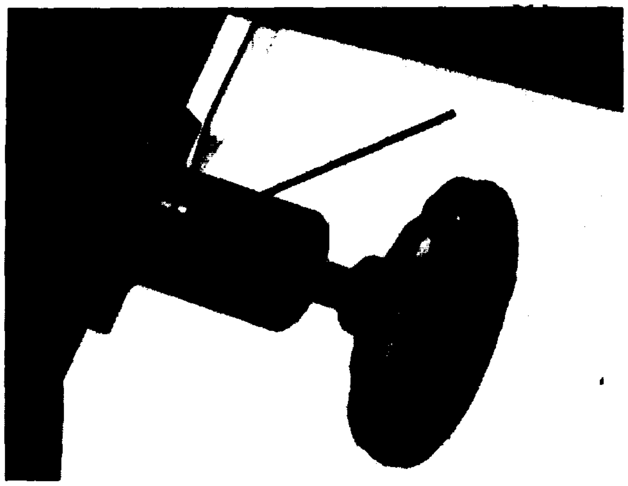


Figure 17

5. TROUBLE SHOOTING

Problems will eventually be encountered with any machine tool, and it is our intent here to help solve them. The Model L-9 saw is a basically simple machine, and it is usually not difficult to find the underlying cause of the problem.

A. CROOKED CUTS. This problem can be caused by many faults which may occur singly or in any combination. A machine that is perfectly aligned and properly operated can make unsatisfactory cuts if the blade being used is defective. For this reason, if a machine suddenly begins to cut out of tolerance, we recommend that a new blade be installed as a first attempt to obtain satisfactory cuts. Always keep the blade guide arms adjusted as close to the work as practical, as a long blade span provides less rigidity.

If a new blade is installed and the machine continues to make crooked cuts, consult Section 3-A and the saw blade manual concerning the proper cutting force for the material being cut and the length of blade in contact with the cut.

Crooked cuts are sometimes caused by the blade being too loose. Consult Section 2-E concerning blade tension. If the preceding suggestions have been followed and the machine still does not cut straight, consult the separate manual on saw guide adjustment and carefully check the adjustment and alignment of the saw blade guides.

B. BLADE STALLS. If the blade stalls during a cut, first check to determine whether the blade is slipping on the drive wheel or if the V-belts are slipping on the pulleys. If the saw blade is slipping on the drive wheel, the blade is not properly tensioned. Consult Section 2-E and properly tension the saw blade. If the V-belts are slipping on the pulleys, consult Section 4-F and properly tension the belts. If nothing is slipping but the motor is stalled and will not start, allow it to cool, then push the stop or reset button to reset.

C. BROKEN BLADES. Consult the separate guide booklet and check to see if the blade guide rollers are too tight. Sometimes poor blade wheel alignment causes broken blades. Consult Section 4-B and check for this condition. Another cause of blade breakage is too much cutting force. Consult Section 3-A and the Saw Blade Selection and Application Manual to determine the correct cutting force for the material being cut.

D. STRIPPED TEETH. The most frequent cause of stripped blade teeth is incorrect tooth pitch for the job being performed. Consult the saw blade manual to determine the proper blade tooth pitch for the material and size being cut. Sometimes excessive cutting force will cause teeth to strip. Consult Section 3-A and the saw blade manual concerning proper cutting force. Another possibility is improper blade brush adjustment. Consult Section 4-H to correct this condition.

E. POOR BLADE LIFE. This problem is usually caused by a blade speed too fast for the type of material being cut. Consult Section 3-B and the saw blade manual to determine the proper blade speed. Cutting scaly material or cutting through or near torch-cut areas can also reduce blade life.

F. ERRATIC FEED. If the cutting head does not feed smoothly into the cut but surges and hesitates, we suggest you consult Section 4-A concerning lubrication. This problem may also be caused by improper blade tooth pitch for the job being performed. In this case, consult the Saw Blade Selection and Application Manual to determine the correct blade pitch. Another possibility is poor blade brush adjustment. Consult Section 4-H of this manual.

6. SPARE PARTS FOR MINIMUM DOWN-TIME

QUANTITY	PART NO.	DESCRIPTION AND COMMERCIAL PART NO.
4	901500	Guide Bearing Fafnir 5200 PP
2	901200	Guide Bearing Fafnir 200 PP
1	900083	Blade Brush
4-SPEED MACHINES ONLY:		
1	908503	Drive Motor Belt 4L280
2	908504	Final Drive Belt 4L390
VARIABLE SPEED MACHINES ONLY:		
1	909041	Variable Speed Belt 260K8
1	908550	Timing Belt 270L100

7. REPLACEMENT PARTS LIST

A. Required for any part order:
1. Saw model
2. Serial number

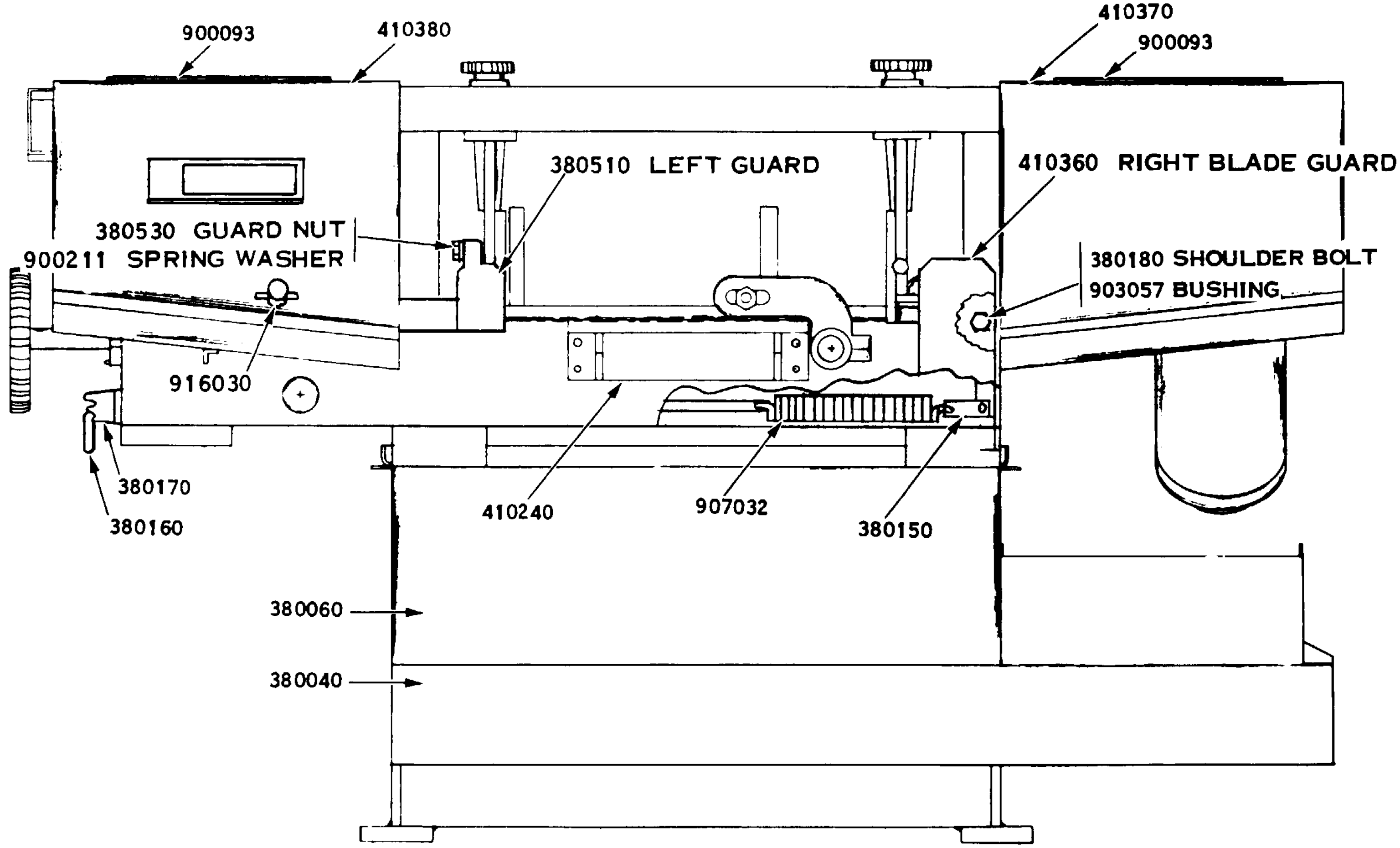
B. This parts list does not show all the parts that make up the machine. We have tried to show all the common parts that may require replacement. Also, some parts may not be shown due to machine design changes. When this occurs, order parts as described above.

C. Parts that can normally be obtained from local mill supply stores, etc. are not listed.

D. Parts not listed: Give a complete detailed description of what it is, where it is used, and what it does in operation. This will often give us enough information to supply the part.

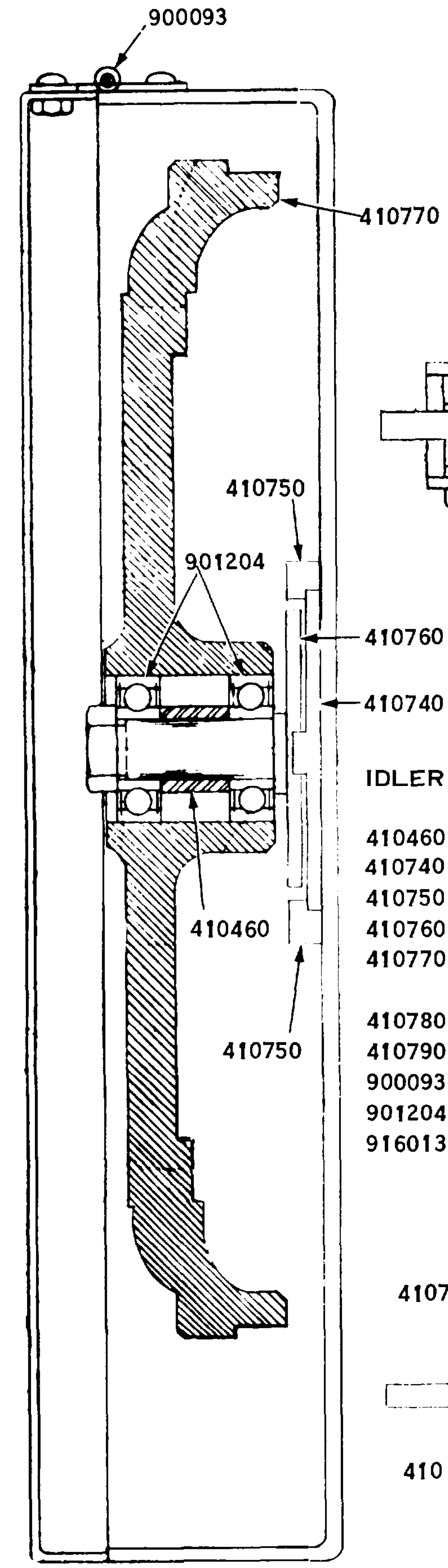
GENERAL PARTS LIST

380040	COOLANT TANK WITH SPLASH GUARD	410240	TIP—OFF BLOCK
380060	CHIP PAN	410360	RIGHT BLADE GUARD
380150	BALANCE SPRING LINK	410370	DRIVE WHEEL GUARD
380160	BALANCE SPRING ROD	410380	IDLER WHEEL GUARD
380170	STEP CAM	900093	GUARD HINGE
380180	SHOULDER BOLT	900211	SPRING WASHER
380510	LEFT GUARD	903057	HEAD PIVOT BUSHING
380530	GUARD NUT	907032	BALANCE SPRING
		916030	WHEEL GUARD LATCH



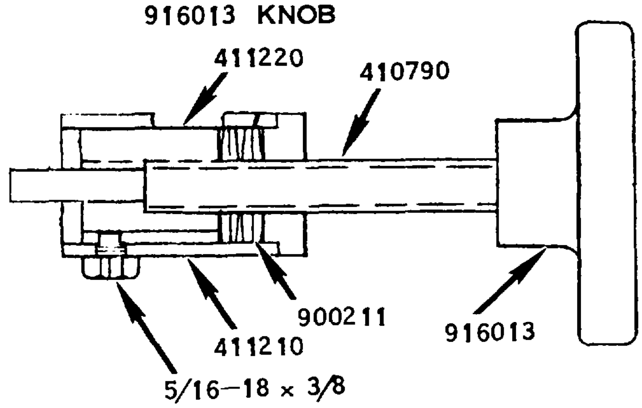
GENERAL PARTS LIST

15180 IDLER WHEEL AND BEARINGS ASSEMBLY



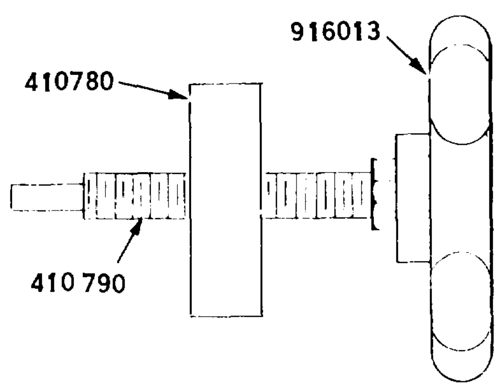
BAND TENSION INDICATOR ACCESSORY

410790 BLADE TENSION SCREW
411210 HOUSING
411220 KEYED NUT
900211 SPRING WASHER
916013 KNOB

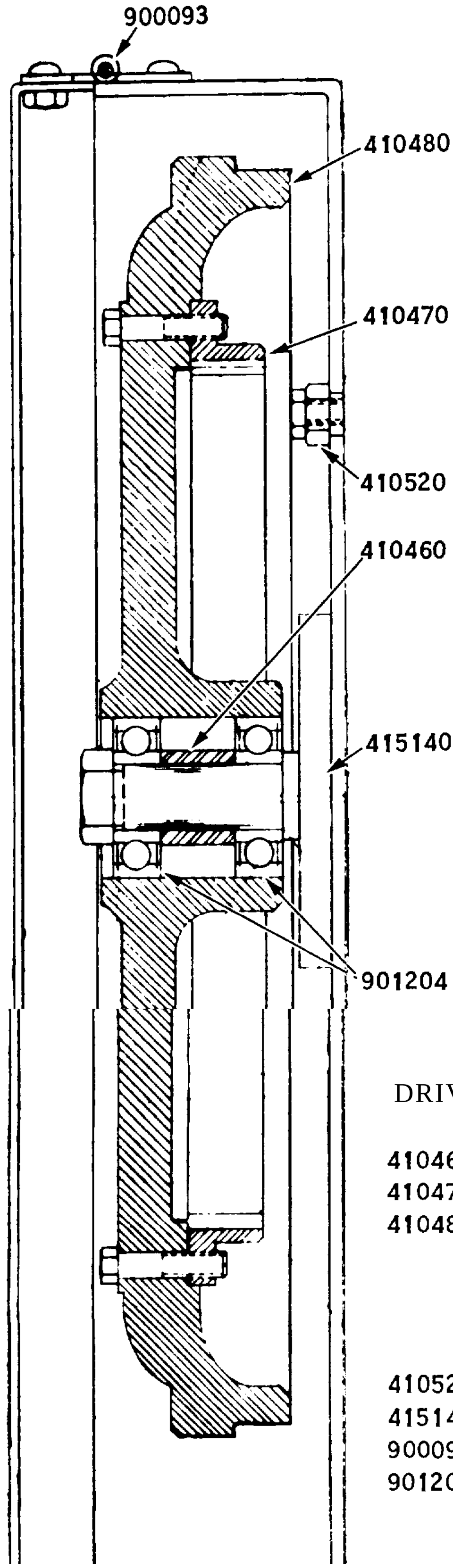


IDLER WHEEL ASSEMBLY

410460	BEARING SPACER
410740	WHEEL SLIDE PLATE
410750	SLIDE PLATE RETAINERS
410760	WHEEL AXLE PLATE
410770	IDLER WHEEL ONLY
	415180 WHEEL, BEARINGS, AND SPACER
410780	BLADE TENSION SCREW BLOCK
410790	BLADE TENSION SCREW
900093	GUARD HINGE
901204	WHEEL BEARINGS
916013	BLADE TENSION HAND KNOB



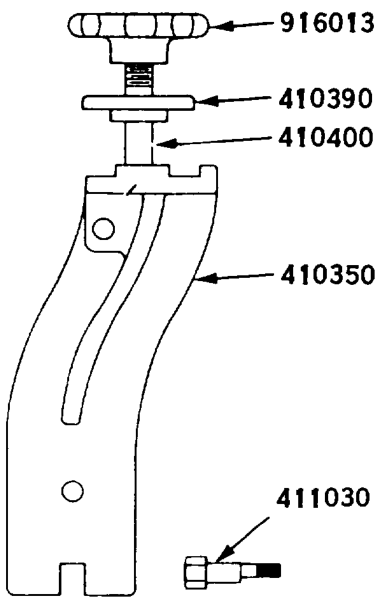
415190 DRIVE WHEEL. BEARINGS. AND GEAR ASSEMBLY
(415191 WITHOUT GEAR)



DRIVE WHEEL ASSEMBLY

410460	BEARING SPACER
410470	RING GEAR
410480	DRIVE WHEEL ONLY
	415191 WHEEL, BEARINGS, AND SPACER
	415190 WHEEL, BEARINGS, SPACER, AND GEAR
410520	ECCENTRIC BUSHING
415140	WHEEL AXLE PLATE
900093	GUARD HINGE
901204	WHEEL BEARINGS

GUIDE ARM ASSEMBLY

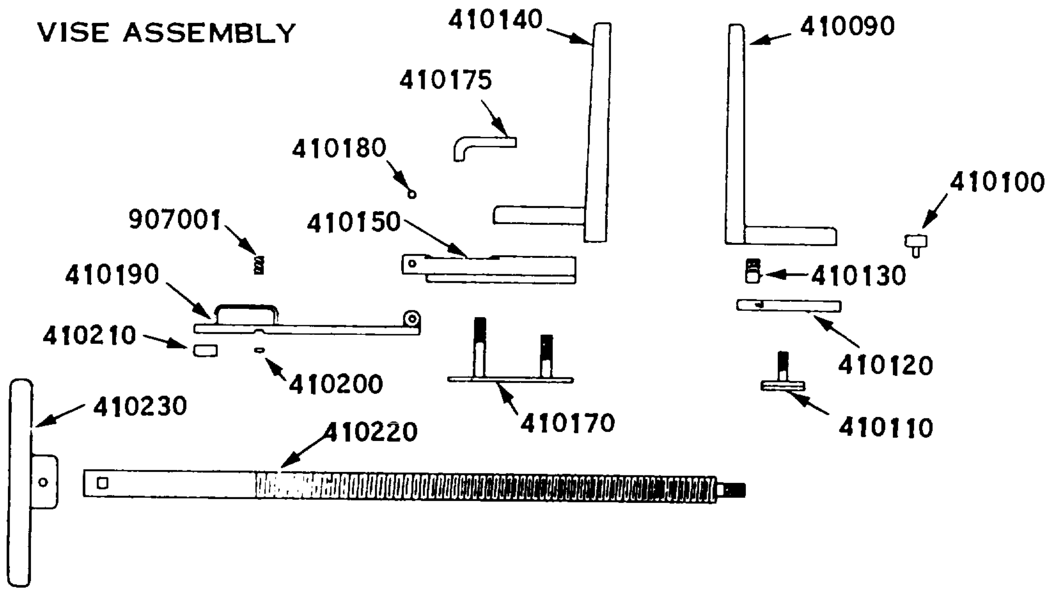


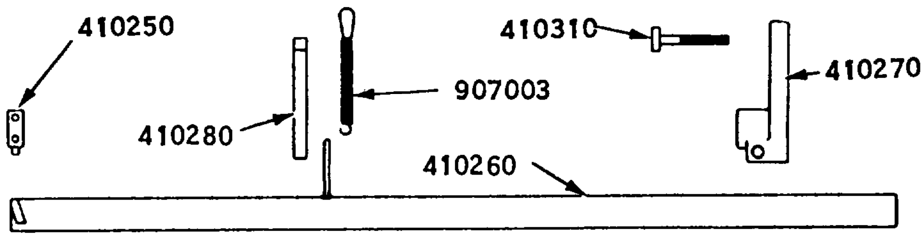
GUIDE ARM ASSEMBLY

410350	GUIDE ARM ONLY (WILL FIT LEFT OR RIGHT)
410390	CLAMP WASHER
410400	ARM STUD
411030	ECCENTRIC BOLT
916013	ARM KNOB

VISE ASSEMBLY

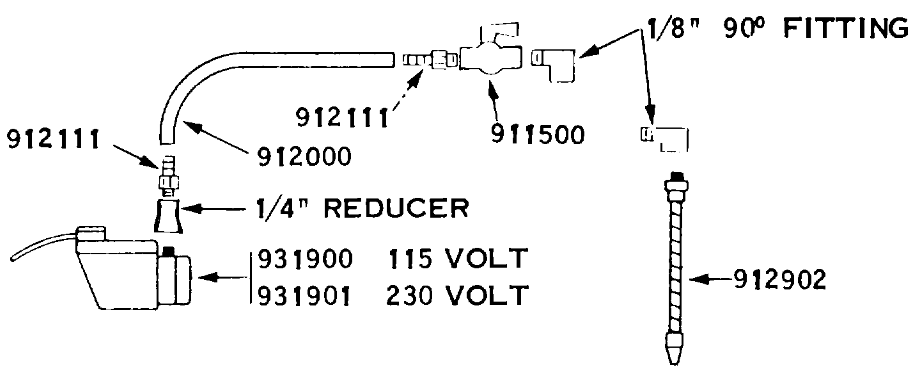
410090	STATIONARY VISE JAW
410100	VISE JAW BACK-UP BAR
410110	STATIONARY JAW STUD
410120	VISE ANGLE BAR
410130	ANGLE BAR STUD
410140	MOVABLE VISE JAW
410150	SLIDE BLOCK
410170	SLIDE BLOCK STUD BAR
410175	MOVABLE JAW CLAMP BAR
410180	SLIDE BLOCK HINGE PIN
410190	SLIDE BLOCK HANDLE
410200	HANDLE LOCK
410210	BRASS HALF NUT
410220	VISE SCREW
410230	VISE HANGLE
907001	LOCK SPRING





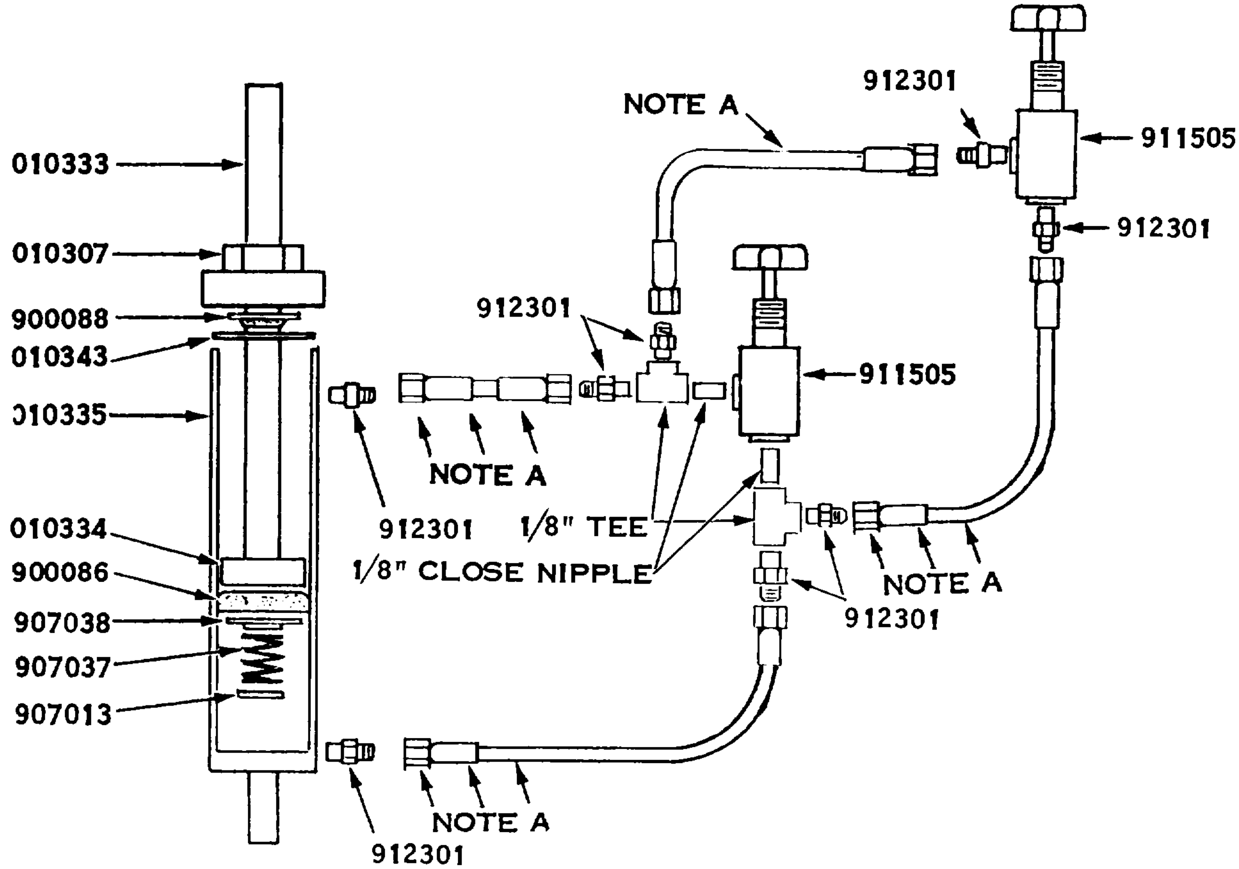
STOCK STOP ASSEMBLY

410250	STOCK STOP PIN
410270	STOCK STOP ARM
410280	STOCKSTOP PUSHROD
410310	STOCK STOP BOLT
410260	STOCKSTOP BAR
907003	STOCK STOP SPRING



COOLANT PARTS

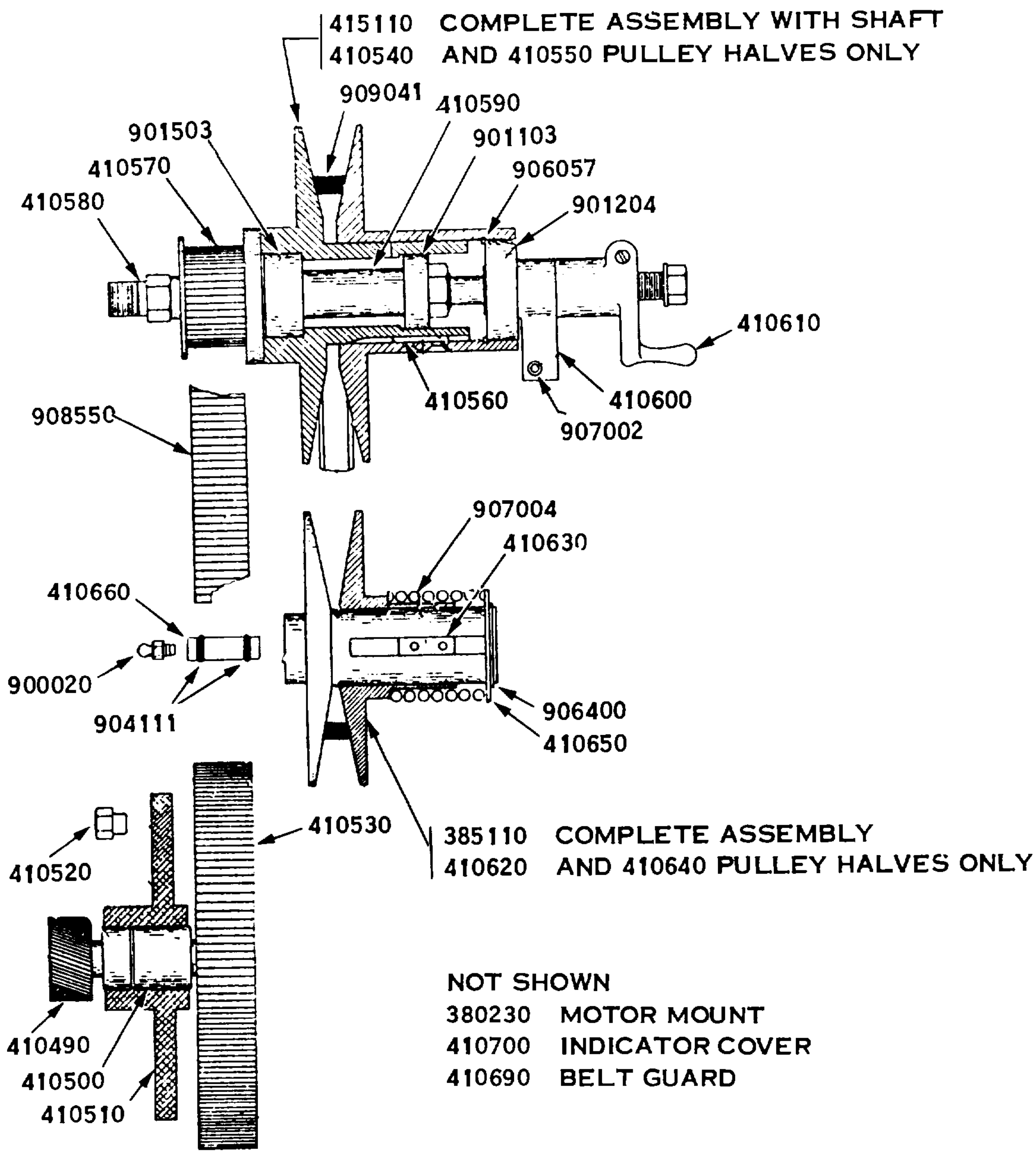
911500	COOLANTVALVE
912000	COOLANT HOSE (SPECIFY LENGTH)
912111	HOSE FITTING
912902	COOLANT NOZZLE
931900	115 VOLT COOLANT PUMP
931901	230 VOLT COOLANT PUMP



HYDRAULIC CYLINDER AND VALVE ASSEMBLY

010307	CYLINDER CAP
010333	PISTON ROD
010334	PISTON
010335	CYLINDER TUBE
010343	ROD SEAL RETAINER
900086	PISTON LEATHER
900088	ROD SEAL
907013	RETAINING CLIP
907037	SPRING
907038	PISTON LEATHER RETAINER
911505	VALVE
912301	PIPE THREAD TO HOSE FITTING
NOTE A	TO ORDER HOSE ASSEMBLIES, SPECIFY LENGTH OF 912000 HOSE WITH 912154 FITTINGS AND 912155 COLLARS INSTALLED.

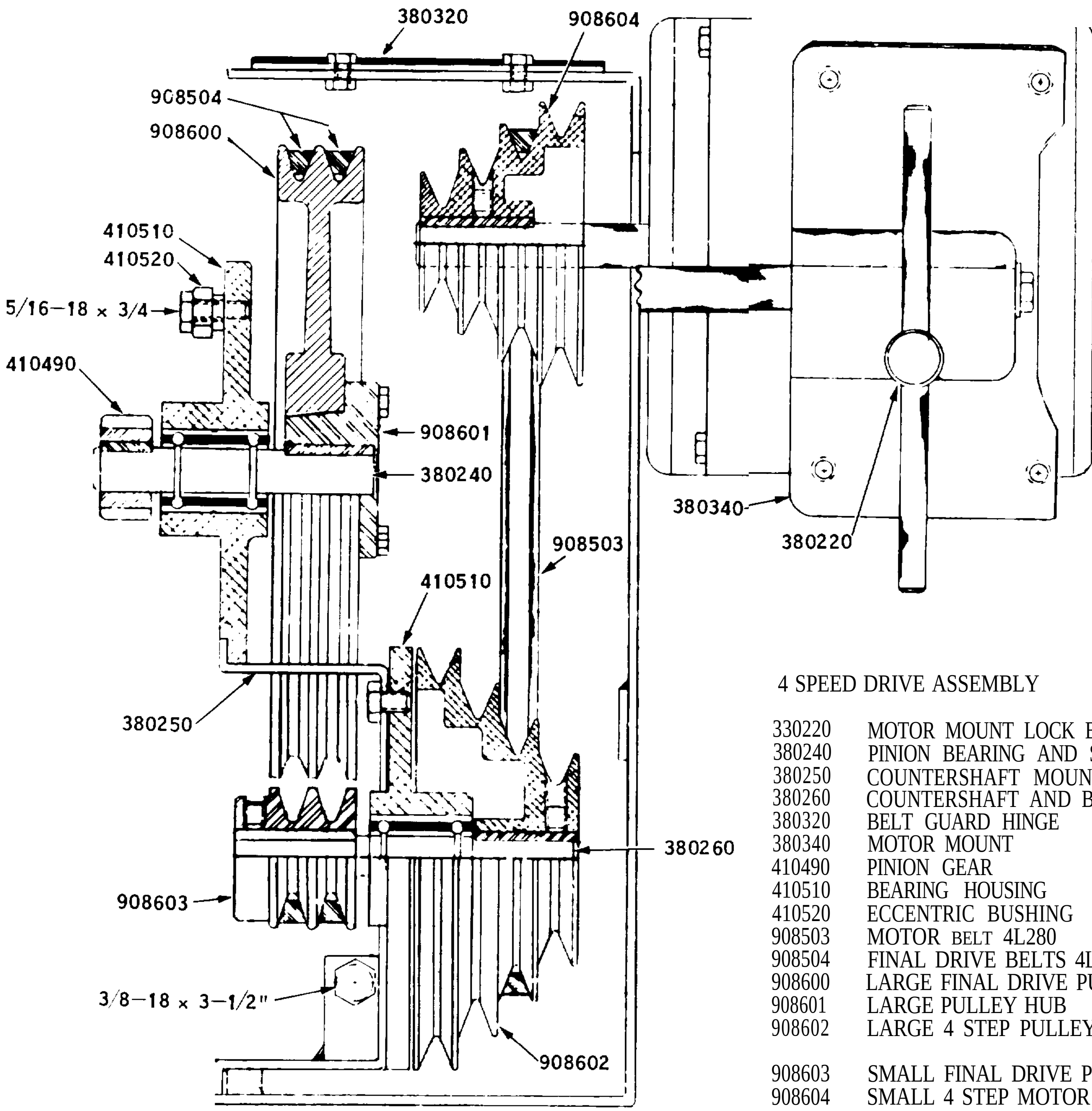
VARIABLE SPEED DRIVE ASSEMBLY



VARIABLE SPEED DRIVE ASSEMBLY

380230	MOTOR MOUNT
385110	COMPLETE MOTOR PULLEY ASSEMBLY
410490	RING GEAR PINION
410500	PINION GEAR BEARING AND SHAFT
410510	BEARING HOUSING
410520	ECCENTRIC BUSHING
410530	LARGE TIMING BELT PULLEY
410540	PULLEY HALF (COMES WITH 410550)
410550	PULLEY HALF (COMES WITH 410540)
410560	PULLEY KEY
410570	SMALL TIMING BELT PULLEY
410580	COUNTERSHAFT
410590	BEARING SPACER
410600	SPEED INDICATOR
410610	SPEED CHANGE CRANK
410620	MOTOR PULLEY HALF (COMES WITH 410640)
410630	PULLEY KEY
410640	MOTOR PULLEY HALF (COMES WITH 410620)
410650	SPRING RETAINER
410660	GREASE SLEEVE
410690	BELT GUARD
410700	INDICATOR COVER
415110	COMPLETE COUNTERSHAFT AND PULLEY ASSEMBLY
900020	GREASE FITTING
901103	BEARING TYPE 103
901204	BEARING TYPE 204
901503	BEARING TYPE 5203
904111	O-RING TYPE 2-111
906057	INTERNAL RETAINING RING
906400	EXTERNAL RETAINING RING
907002	INDICATOR SPRING
907004	MOTOR PULLEY SPRING
908550	TIMING BELT 270L100
909041	VARIABLE SPEED BELT 24V10

4 SPEED DRIVE ASSEMBLY



4 SPEED DRIVE ASSEMBLY

330220	MOTOR MOUNT LOCK BOLT
380240	PINION BEARING AND SHAFT
380250	COUNTERSHAFT MOUNT
380260	COUNTERSHAFT AND BEARING
380320	BELT GUARD HINGE
380340	MOTOR MOUNT
410490	PINION GEAR
410510	BEARING HOUSING
410520	ECCENTRIC BUSHING
908503	MOTOR BELT 4L280
908504	FINAL DRIVE BELTS 4L390
908600	LARGE FINAL DRIVE PULLEY
908601	LARGE PULLEY HUB
908602	LARGE 4 STEP PULLEY
908603	SMALL FINAL DRIVE PULLEY
908604	SMALL 4 STEP MOTOR PULLEY

SAW BLADE GUIDE AND METERING VALVE MANUAL

Adjustment, Maintenance, and Replacement Parts

INDEX

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C.	Preventive Maintenance	38
D.	Problems and Suggestions	39
E.	Spare Parts for Minimum Downtime	39
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A. BLADE GUIDE ADJUSTMENT- TYPE 415200, L-9 AND W-9 MACHINES

Adjustment of the saw blade guides is one of the most critical on your machine as it plays an important part in the overall machine performance. It is VERY IMPORTANT that a NEW BLADE be INSTALLED and PROPERLY TENSIONED before adjusting the blade guides.

TO ADJUST THE BLADE GUIDE ROLLER CLEARANCE, refer to Fig. 1. One guide roller is mounted on shoulder bolt 411140 and threaded directly into the housing 411080. This roller is rigidly mounted and non-adjustable. The opposing roller (Fig. 2) is mounted on a cam shoulder bolt 411100 and an adjustment of the roller centers can be made by loosening the hex nut on the top (Fig. 3) and rotating the bolt. These rollers should be adjusted just tight enough so that grasping the blade in the area between the guide and its adjacent band wheel and oscillating it across the vertical center will not permit movement of the blade in the cutting area between the two guides. Any movement of the blade transmitted through the rollers into the cutting area should be removed by adjusting the cam bolt. It is also very important that after this adjustment has been completed you can manually push the blade down partially out of the guide and when released it will partially return of its own accord. CAUTION: If these two guide rollers are adjusted too tightly it will cause the blade to “snake” through the rollers, resulting in metal fatigue and blade breakage. Guide rollers adjusted too tightly will also cause the metering valves controlling the cutting head feed to become inoperative or very erratic, resulting in extreme feed problems.

PARALLEL AND VERTICAL ALIGNMENT OF THE BLADE GUIDES. In order to make an accurate adjustment of the blade guides it is first necessary to check the stationary vise jaw for squareness on the saw bed (Fig. 4). Place a combination square on the machine bed using the front edge of the wide bed top plate in the vise slideway, and adjust the rear stationary vise jaw to obtain a true 90° setting. The guide settings will be trued to the vise face, so it is very important that the vise face be at right angles to the saw bed.

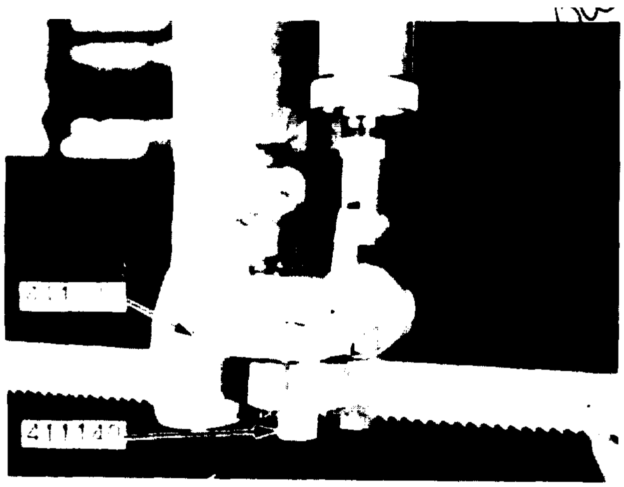


Fig. **1**

Fig. **3**

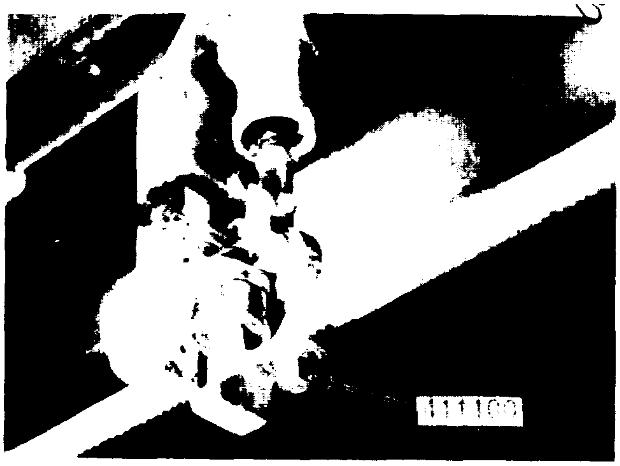


Fig. **2**

Fig. **4**

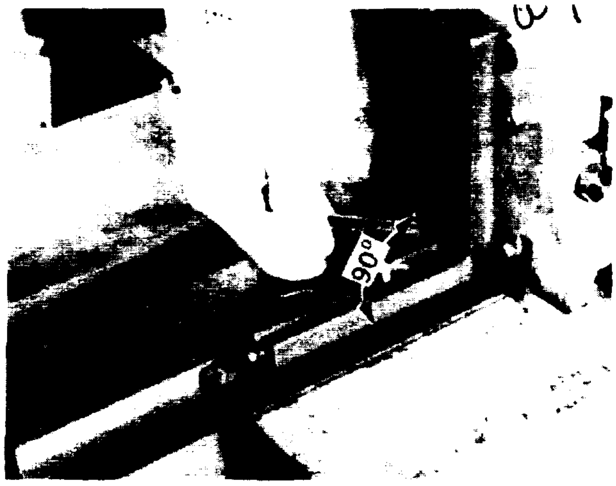


Fig. 5

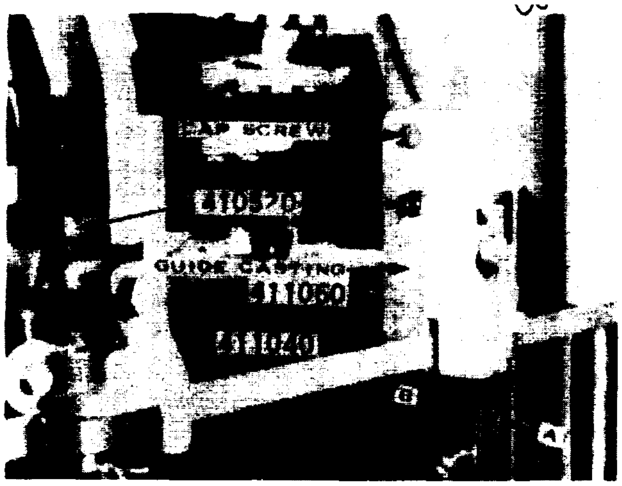


Fig. 6

Fig. 7

With a properly tensioned new blade on the machine, place the combination square against the front face of the blade very lightly so the blade will not be deflected and slide the square against the rear vise jaw (Fig. 5). If the blade and vise jaw are not at right angles, refer to Fig. 6. The cam bolt 410520 on the lower end of each guide arm can be adjusted to bring the blade into parallel alignment with the saw bed and at right angles to the work vise. Loosen the hex head cap screw (Fig. 6) and the hex nut on the 410520 cam bolt. By turning the cam bolt the lower end of the blade guide casting 411040 or 411060 can be moved in or out to bring the blade into parallel alignment with the saw bed. The question at this point is which guide should be moved in which direction to keep the blade in as straight a line as possible between the lower edge of the two blade carrier wheels. To find out, individually loosen the hand knob clamps which hold the guide *arms* to the guide beam, so that guide arm movement caused by the tensioned blade may be observed (Fig. 6, Ref. A & B). Then adjust the guide castings to minimize this deflection with the saw bed and at right angles to the work vise. After retightening the hex nut on the cam bolt and the hex head cap screw, recheck the blade against the stationary vise jaw to assure proper alignment is still intact.

At this point, place the blade gauge furnished with the machine on the saw blade (Fig. 7) adjacent to the stationary vise jaw and lower the cutting head until the cutting edge of the blade is near the work bed top. Place the combination square blade across the bed top and move the base of the square against the face of the blade gauge. If the gauge is not in vertical alignment with the square an adjustment can be made with blade screw 411070 (Fig. 7).

Turn the adjusting screw clockwise to cause the top end of the blade gauge to move away from the vise jaw or turn the screw counterclockwise to cause the top end of the blade gauge to move towards the vise jaw. After this has bean done on the guide arm adjacent to the stationary vise jaw, repeat the operation on the guide arm adjacent to the moveable vise jaw. If a large correction must be made on the second guide arm, recheck the setting of the first guide arm. If large corrections are made alternately, check and adjust each guide arm as necessary until the blade at either guide arm is in a true vertical position.

B. METERING VALVE ADJUSTMENT, TYPE 010660, MODEL W-9 MACHINES ONLY.

This is an extremely simple adjustment to make, yet is the one that creates the most problems.

Lower the cutting head slowly (with a low cutting force of 20 to 40 pounds) and as the head lowers, pry up the bearing arm as shown in Fig. 8 with a screw driver or similar tool. Note the clearance between the bearing arm and guide casting (Fig. 8) just at the point where the valve has been closed by lifting up the bearing arm and the cutting head stops its descent. This clearance should be ,060" to .090". If it is more than .090", lengthen the linkage by loosening the locknut (Fig. 9) and turning the threaded stud counterclockwise. Retighten the locknut and check the clearance by repeating the procedure. Repeat if necessary. If the clearance is less than .060", loosen the locknut (Fig. 9) and turn the threaded stud clockwise to shorten the linkage. Retighten the locknut and recheck the clearance. Repeat if necessary.

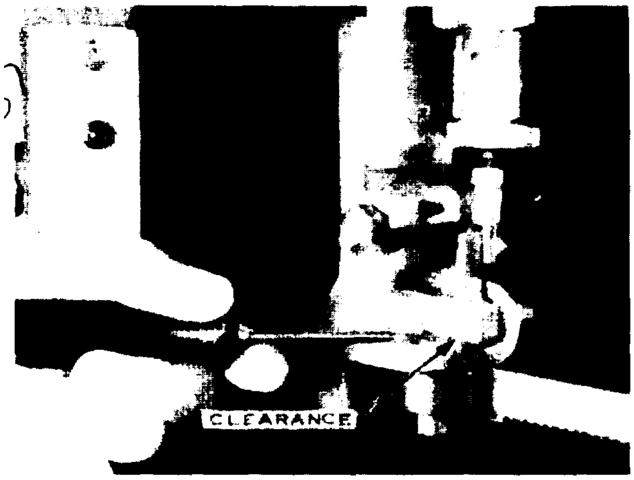


Fig. 8

After adjustment has been completed, check to be sure the back edge of the saw blade closes the metering valve before it contacts the guide casting. If the upper edge of the blade contacts the guide body before it closes the metering valve, all cutting force control is lost and the machine will overfeed, stripping the teeth from the blade.

The metering valve may require adjustment of the minimum cutting force. With reference to Fig. 10, turn the cutting force thimble "D" completely up into the valve body as shown. Next, adjust the self locking nut "A" up or down on the threaded stem "B" until the spring "C" is just touching at each end. Then turn nut "A" l/2 turn to tighten the spring. This adjustment establishes the minimum cutting force. If nut "A" is misadjusted to overtighten the spring, the minimum cutting force is increased and can become high enough to strip teeth from the blade.

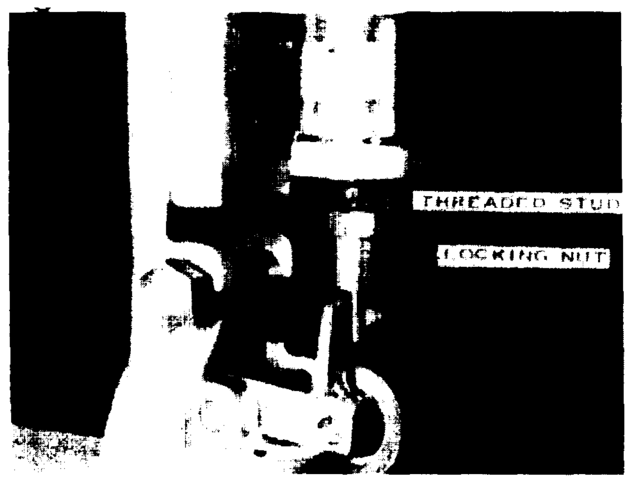


Fig. 9

C. PREVENTIVE MAINTENANCE

A MONTHLY CHECK should be performed on the metering valve and guide rollers as follows:

(1.) Open the cutting head control valve so the head can descend slowly. Now pry up the blade back-up roller as illustrated in Fig. 8. The arm should raise .060" to .090" to close the metering valve and stop the cutting head descent. If this test stops and holds the cutting head from descending, the metering valve is functioning properly.

(2,) A monthly check on the guide rollers can easily be performed by twisting the blade near the saw guides. The guide rollers, when adjusted properly, will not allow any movement of the blade in the cutting area when twisted, but still must be loose enough to allow the blade to slide through as outlined in Section A.

(3.) Check the blade to be sure it is vertical as shown in Fig. 7.

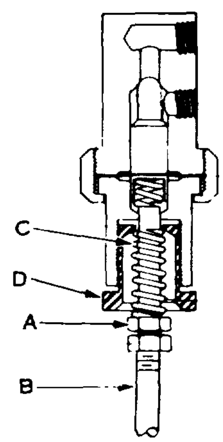


Fig. 10

(4.) These checks cover the most common maintenance adjustments on a band saw machine. If they are not performed regularly, good blade life and straight cuts cannot be achieved. They take only a few minutes and will assure that your machine will perform well.

D. PROBLEMS AND SUGGESTIONS

(1.) SAW NOT CUTTING STRAIGHT FROM TOP TO BOTTOM

A. The most common cause is loose blade guide rollers (Fig. 2) which allow the blade to "lean" from a vertical position, causing crooked cuts. See Section A for adjustments.

B. The saw blade guide casting is rotated so the blade is not held in a vertical position. See Section A for adjustment.

C. Long work piece is not being supported horizontally and level through the machine.

D. Check metering valve as outlined in Section C.

(2.) SAW NOT CUTTING STRAIGHT FROM SIDE TO SIDE

A. The saw vises are not at 90" with the blade as illustrated in Fig. 5. See Section A for adjustment.

B. Long work piece is not being positioned squarely to the saw blade and flat against the saw vise.

(3.) POOR BLADE LIFE

A. Metering valve is not closing completely, allowing the cutting head to slowly bleed down, overfeeding the blade. See Section B for adjustment.

B. Blade guide rollers or carbides are too tight against the blade, preventing the blade from moving up and down freely enough to operate the metering valves.

C. Metering valve is dirty inside so that it cannot close. Test as outlined in Section C.

(4.) CUTTING HEAD WILL NOT LOWER

A. The metering valve is held closed because the guide rollers are too tight and will not permit the blade to move downward, opening the valve.

B. Metering valve control rod is adjusted too long, stopping the valve from opening. See Section B for adjustment.

C. Metering valve is held closed by dirt or other foreign material so that it cannot open. The dirt will normally be lodged between the valve bore and valve spool, causing it to become inoperative.

E. SPARE PARTS FOR MINIMUM DOWN-TIME.

QUANTITY	PART NO.	DESCRIPTION
4	901500	Guide Bearing Fafnir 5200 PP
2	901200	Guide Bearing Fafnir 200 PP
1	900083	Blade Brush

F. REPLACEMENT PARTS

A. Required for any part order:
1. Saw model.
2. Serial number.

B. Parts that can normally be obtained from local mill supply stores, etc., are not listed.

C. Parts not listed: Give a complete detailed description of what it is, where it is used, and what it does in operation. This will often give us enough information to supply the part.

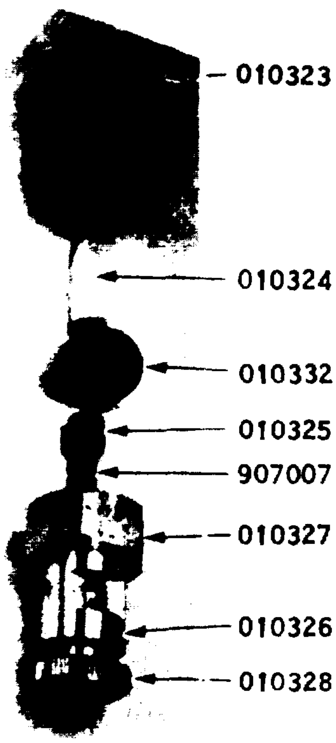
D. This parts list does not show all the parts that make up the machine. We have tried to show all the common parts that may require replacement.

Also some parts may not be shown due to machine design changes. When this occurs, order parts as described above.

SAW GUIDE PARTS

010329	CONNECTING ROD
010331	SADDLE LINK
015030	METERING VALVE ASSEMBLY
205090	TWO IDLER END CASTINGS ASSEMBLED
411030	ECCENTRIC BOLT FOR CONNECTING EITHER GUIDE TO GUIDE ARM
411050	BEARING ARM, IDLER END
411070	WORM SCREW
411090	STRAIGHT BEARING BOLT
411100	CAM BEARING BOLT
411110	CAM BEARING BOLT NUT
411120	BEARING ARM, DRIVE END
411130	BEARING ARM PIN
411140	BACK-UP BEARING BOLT
411150	BACK-UP BEARING WASHER
415220	COMPLETE IDLER END GUIDE ASSEMBLY WITH BEARINGS AND BOLTS
415220	COMPLETE IDLER END GUIDE ASSEMBLY WITH BEARINGS AND BOLTS (205090 ASSEMBLY IS LESS BEARINGS AND BOLTS)
415240	COMPLETE DRIVE END GUIDE ASSEMBLY WITH BEARINGS AND BOLTS, NO SADDLE LINK PARTS. (415300 ASSEMBLY IS LESS BEARINGS AND BOLTS)
415300	TWO DRIVE END CASTINGS ASSEMBLED
901200	BACK-UP BEARING ROLLER
901500	SIDE BEARING ROLLER
907006	IDLER END BACK-UP ARM SPRING
907011	DRIVE END METERING VALVE CUTTING FORCE SPRING

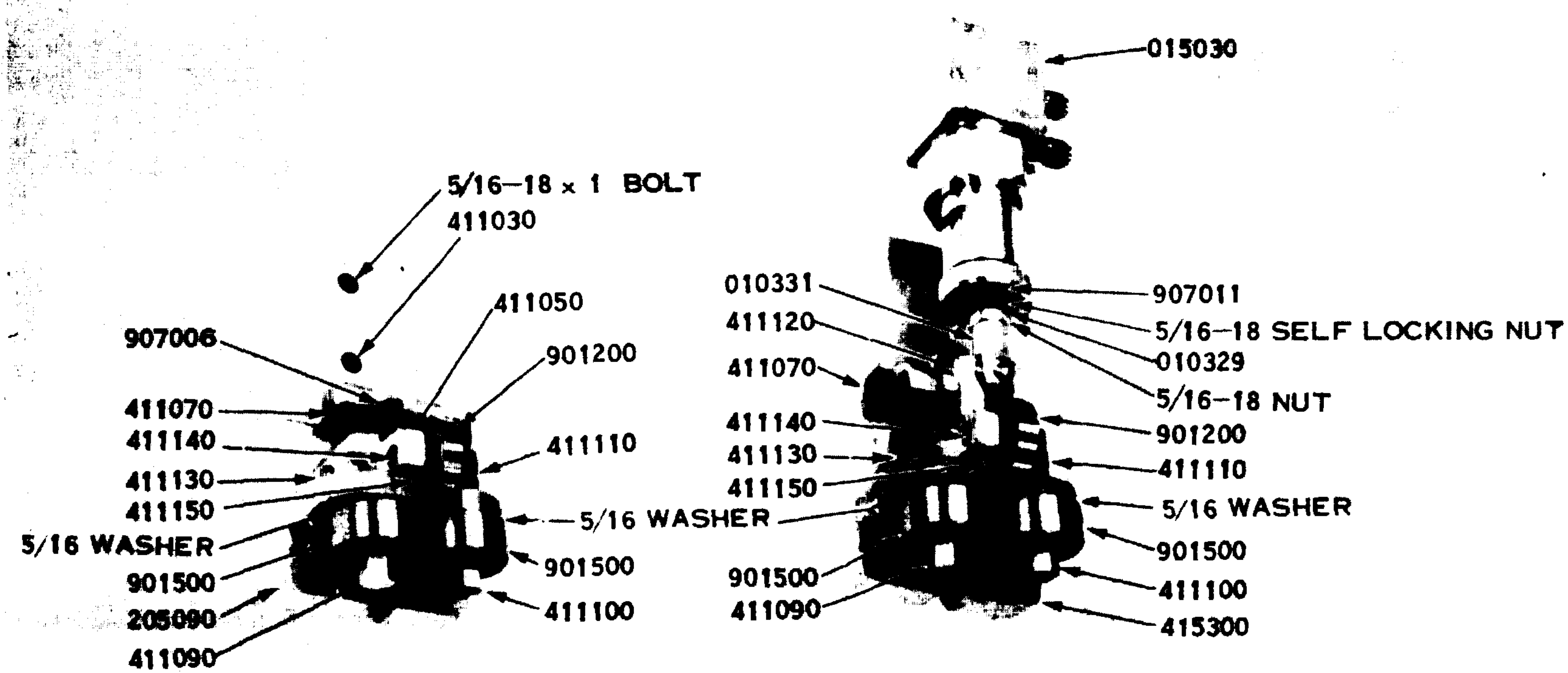
015030 METERING VALVE ASSEMBLY



METERING VALVE PARTS

010323	VALVE BODY
010324	NYLON VALVE PLUNGER
010325	OVERRIDE SPRING CUP
010326	CUTTING FORCE SPRING TUBE
010327	TUBE NUT
010328	CUTTING FORCE THIMBLE
010332	DIAPHRAGM
015030	COMPLETE METERING VALVE ASSEMBLED
907007	OVERRIDE SPRING
907011	CUTTING FORCE SPRING (NOT ILLUSTRATED)

SAW GUIDE PARTS

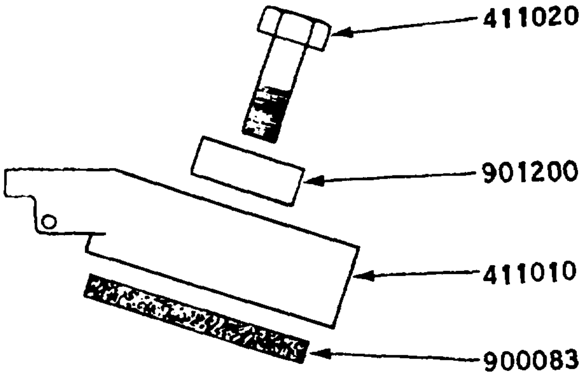


IDLER END GUIDE

COMPLETE IDLE END GUIDE ASSEMBLY
WITH BEARINGS 415220

DRIVE END GUIDE

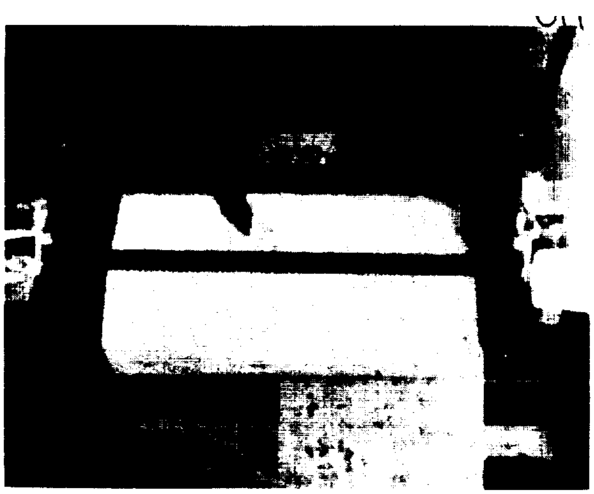
COMPLETE DRIVE END GUIDE ASSEMBLY
WITH BEARINGS 415240

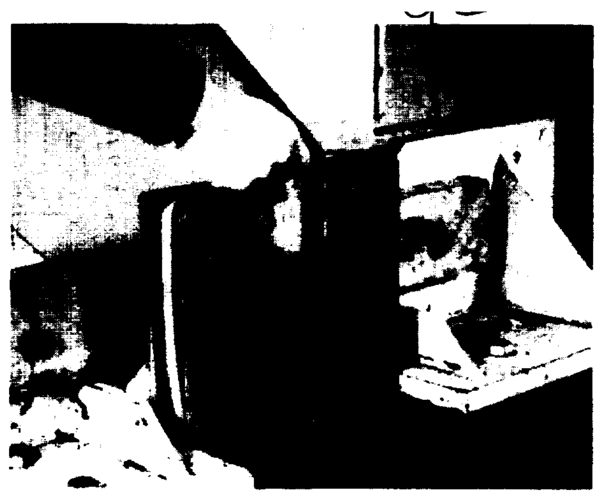


BLADE BRUSH ASSEMBLY

411020	BRUSH BOLT
411010	BRUSH HOUSING
900083	WIRE BRUSH
901200	BEARING

CUTTING FORCE CHECK BULLETIN NO. 900414





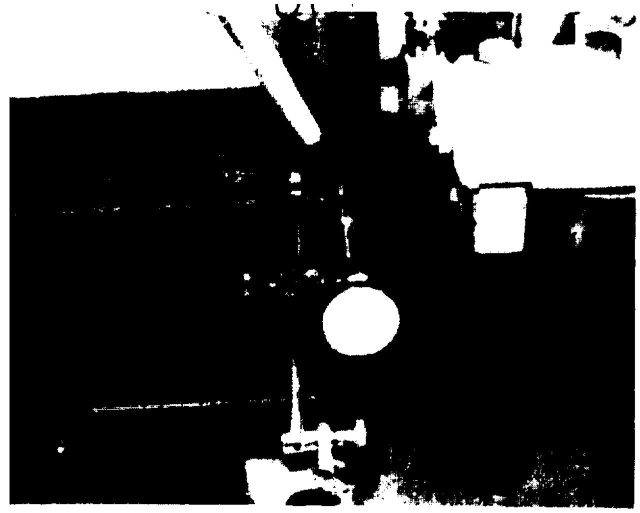
The hydraulic control system or spring balance mechanism of a band saw machine applies uniformly controlled pressure to the saw blade. After being cleaned and adjusted, the machine must maintain an applied pressure at the saw blade of 50 lbs. or less.

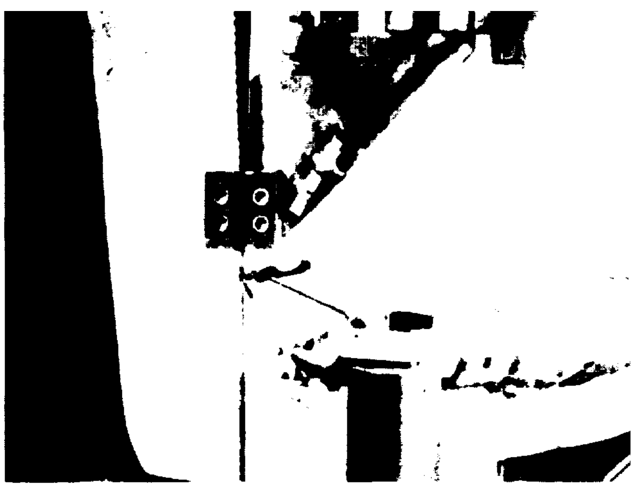
If the band saw applies 50 lbs. of cutting pressure at the minimum setting of the cutting pressure control, the pressure can readily be increased as required for heavier cutting. Excessive pressure causes the blade to deflect or strip teeth.

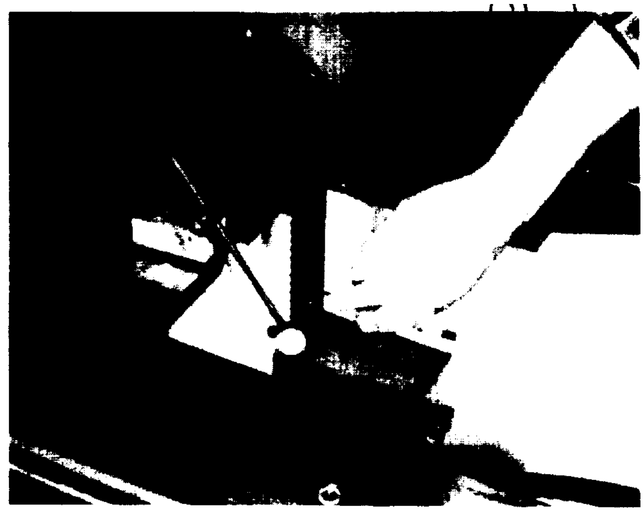
For the cost of a bathroom scale (which is less than the cost of one saw blade), the actual applied cutting pressure may be determined. To check the machine, stop the blade and lay the scale on the saw bed. Place a block of wood on the scale and lower the saw blade onto the block. Repeatedly tap the saw blade lightly with a screw driver while lowering it. If the hydraulic system or spring balance mechanism is working properly, a minimum setting on the cutting pressure control will register 50 lbs. or less on the scale.

If the pressure on the scale continues to increase, this indicates either a leak in the hydraulic system or improper adjustment. This must be corrected before the machine is operated. Unless the above procedure is followed, applied pressure is unknown and the machine may destroy several blades before the problem is recognized.

BLADE ALIGNMENT CHECK BULLETIN NO. 900413







To check the vertical alignment of the band saw blade, raise the cutting head several inches above the bed. Place the contact point of a dial indicator against the side of the blade, directly above the tooth gullet near the right guide assembly. Open the control valve to allow the cutting head to descend, moving the blade slowly past the indicator point. Adjust the guide as required to align the blade to within .005 T.I.R.

Raise the cutting head and move the indicator near the left guide assembly. Repeat the above procedure. If the left guide assembly requires more than .010 T.I.R. adjustment to be within the .005 T.I.R. allowance, recheck the right guide assembly.

This procedure should be used to check blade alignment on all hinged, horizontal, or vertical cut-off machines. It will eliminate problems normally caused by cutting head misalignment, bed twist, or operator error.

By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Brigadier General United States Army
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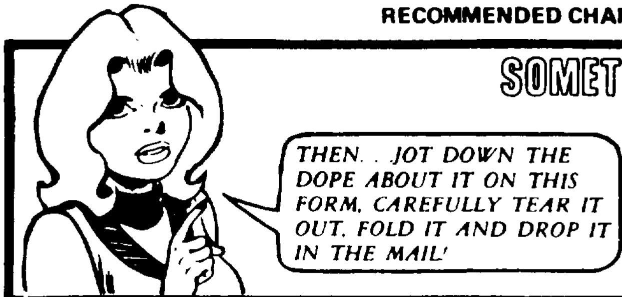

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THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 Lb
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches
1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet
1 Sq Kilometer = 1,000,000 Sq Meters = 0.386 Sq Miles

CUBIC MEASURE

1 Cu Centimeter = 1000 Cu Millimeters = 0.06 Cu Inches
1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

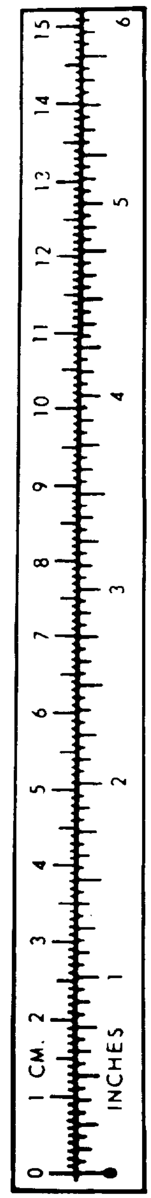
TEMPERATURE

$5/9\,(^{\circ}F - 32) = {}^{\circ}C$
212° Fahrenheit is equivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
$9/5\,C^{\circ} + 32 = F^{\circ}$

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621



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