



## **BX-288 Operator's Manual**

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# GENERAL SAFETY INSTRUCTIONS

1. **Know your power tools;** read the owners manual and labels attached to the machine. Understand the potential hazards particular to this machine.

2. **Ground all tools;** this machine is equipped with an approved 3-conductor cord and 3-prong grounding type receptacle. Never attempt to connect the power supply without properly grounding the machine.

3. **Keep all guards in place;** be sure that all guards are always in place and in proper working order.

4. **Remove all adjusting keys and wrenches;** be sure that all adjusting keys and wrenches are removed from the machine before attempting to operate the machine.

**Keep your work area clean;** cluttered areas and benches invite accidents. Floor must be clean and free from slippery substances such as wax, oil or shavings.

6. **Don't use this machine in damp or wet locations;** or expose it to rain. Keep work area well lighted. Provide adequate surrounding work space and ventilation.

7. **Keep children away during operation.**

8. **Make workshop child-proof;** use padlocks, master switches and starter keys or store machinery where children cannot get to them.

9. **Don't force machine;** the machine will do the job that it was designed to do if you do not force feed it or attempt to force the work through the machine faster than it can cut.

10. **Use the right tool;** use tools only for the jobs that they were designed to perform.

11. **Wear proper apparel;** avoid loose fitting clothing, gloves, neckties or jewelry that could get caught in moving parts. Nonslip footwear is recommended. Wear protective hair covering to contain long hair. Roll long sleeves above the elbow.

12. **Use safety glasses or goggles at all times;** use only glasses that have been designed for machinery operation. Regular glasses are not an adequate replacement for safety goggles.

13. **Secure Work;** use clamps or a vise to hold work when practical.

14. **Don't overreach;** keep proper footing and balance at all times.

15. **Maintain tools with care;** keep tools sharp and clean for best and safest results. Follow instructions for lubricating and changing accessories

16. **Disconnect Machine;** before servicing; when changing accessories such as blades, bits, cutters, etc.

17. **Avoid accidental starts;** make sure that switch is in "OFF" position before plugging it in.

18. **Use recommended accessories;** consult the owners manual for recommended accessories. Follow the instructions that accompany the accessories. The use of improper accessories may cause hazards.

19. **Never Stand on machine or machine stand;** serious injury could occur if the tool is tipped or if the cutting tool is contacted. Do not store materials above or near the machine or its stand.

20. **Check damaged parts;** before further operation of machine, a guard or other part that is damaged should be carefully checked to ensure that it will operate properly and perform its intended function. Check for alignment of

moving parts, mounting and any other conditions that may affect its operation. Guards or other parts that are damaged should be properly repaired or replaced.

21. **Direction of feed;** feed work into a blade or cutter against the direction of rotation of the blade or cutter only.

22. **Never leave the machine running or unattended;** turn power off. Don't leave machine until it comes to a complete stop.

## **SAFETY INSTRUCTIONS FOR THE BX-288**

**WARNING FOR YOUR OWN SAFETY. DO NOT OPERATE YOUR BX-288 MILLING MACHINE UNTIL IT IS COMPLETELY ASSEMBLED AND INSTALLED ACCORDING TO THE INSTRUCTIONS, AND UNTIL YOU HAVE READ AND UNDERSTAND THE FOLLOWING:**

1. **General Safety Instructions for Power Machines** pg 2-3
2. **Safety instructions for the BX-288 Milling Machine** pg 3-4
3. **Assembly of the BX-288 Milling Machine.** pg 13-15
4. **Getting to know your BX-288 Milling Machine** pg 17
5. **Basic Milling operations** pg 18-22

6. Bolt your BX-288 Milling Machine to a sturdy work table approximately 30 inches high and at least 24 inches wide by 36 inches long. Place the machine fully on the surface of the table.

### **7. Location**

Use the Milling machine in a well lit work area and on a level surface clean and smooth to reduce the risk of trips, slips or falls. Use it

where neither the operator nor a casual observer is forced to stand in line of a potential kickback.

### **8. Kickback**

A kickback occurs when the work piece is suddenly thrown in the opposite direction of the feed. This can cause serious injury. Kickbacks are most commonly caused by use of accessories not recommended for the machine.

## **DO'S AND DONT'S FOR THE BX-288 MILLING MACHINE**

### **9. Don't**

- Wear gloves
- Neckties
- Loose clothing
- Jewelry
- Operate machine if it is malfunctioning
- Place your fingers in a position where they could contact the cutting tool.
- Do any work freehand
- Move the head or table while the machine is running
- Perform layout assembly or setup work on the table while the cutting tool is rotating.

### **10. Do**

- Tie back long hair
- Support your work to avoid binding or shattering the tool
- Secure milling vise to table
- Secure lock head and support to column and table to support before operating drill press
- Before starting operation, jog the motor switch to make sure the drill or other cutting tool does not wobble or cause vibration
- Use the proper speed recommended for the type of milling or drilling you are performing
- Use only accessories designed for this machine

# BX-288 SAFETY INSTRUCTIONS (CONTINUED)

11. Make sure that the table is clean and dry before mounting holding devices for the work to be performed.
12. Check to see that the work piece is mounted properly and securely.
13. Select and mount the proper cutter and make sure that it revolves in the proper direction.
14. Be sure that the arbor, cutter and collars are clean before mounting them on the milling machine. (Use a rag to handle sharp cutters.)
15. Use only correct fitting wrenches on the machine.
16. Use the proper spindle speed, feed and depth of cut. Make adjustments to speed only when machine is completely stopped.
17. Make certain that the table, vise and workpiece will clear the arbor and arbor support during the cut.
18. When making setup adjustments, loosen only one direction table lock at a time. This prevents unwanted movement in other directions.
19. Keep clear of revolving cutter. Do not reach over, under or around cutter while it is moving.
20. Stop the cutter to remove chips. Use a brush or vacuum for chip removal.
21. When you are finished, remove and return all tools and accessories to their proper place. Brush the machine free of chips and clean up all excess oil.

**WARNING: DO NOT ALLOW FAMILIARITY (GAINED FROM FREQUENT USE OF YOUR MACHINE) TO BECOME COMMONPLACE. ALWAYS REMEMBER THAT A CARELESS FRACTION OF A SECOND IS SUFFICIENT TO INFLICT SEVERE INJURY.**

## GLOSSARY OF TERMS FOR THE BX-288

1. **Workpiece** The item on which the operation is being performed.
2. **Drill** The cutting tool used in the drill press to make holes in the workpiece.
3. **Mill** The cutting tool used to make various cuts and grooves in the workpiece.
4. **Table** The portion of the machine which the workpiece rests or is positioned via the use of a vise or clamp.
5. **Spindle** The moving portion of the mill & drill head.
6. **R.P.M.** (Revolutions Per Minute), The number of revolutions of the milling cutter during one minute.
7. **F.P.M.** ( Feet Per Minute), The distance that the cutting edge of a milling cutter tooth travels in one minute.
8. **Rate of Feed** The rate at which the work is moved past the cutter. The feed rate, in conjunction with the width and depth of cut, determines the number of cubic inches of metal removed per minute.
9. **Machinability** The ease with which the metal may be machined.

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# MOTOR SPECIFICATIONS & ELECTRICAL REQUIREMENTS

## Motor Specifications

The BX-288 Milling Machine operates on a single horsepower, single phase 20.2 amp motor that runs at 1680 RPM's.

**DO NOT ATTEMPT TO USE OTHER TYPES OF MOTORS WITHOUT FIRST CONSULTING A SMITHY TECHNICIAN.**

### CONNECTING THE POWER TO SOURCE OUTLET

The BX-288 Machine must be grounded while in operation to protect the user from electrical shock. Plug the power cord into a 110-120 Volt properly grounded outlet protected by a 20 to 30 amp dual element time delay or circuit breaker.

**NOT ALL OUTLETS ARE PROPERLY GROUNDED. IF YOU ARE NOT SURE THAT YOUR OUTLET IS PROPELY GROUNDED, HAVE IT CHECKED BY A QUALIFIED ELECTRICIAN.**

**WARNING: TO AVOID ELECTRIC SHOCK , DO NOT TOUCH THE METAL PRONGS ON THE PLUG WHEN INSTALLING OR REMOVING THE PLUG TO OR FROM THE OUTLET.**

**WARNING: FAULIRE TO PROPERLY GROUND THIS POWER TOOL CAN CAUSE ELECTRICUTION OR SERIOUS SHOCK, PARTICULARY WHEN USED IN DAMP LOCATIONS OR NEAR METAL PLUMBING. IF SHOCKED, YOUR REACTION COULD CAUSE YOUR HANDS TO HIT THE CUTTING TOOL.**

**IF POWER CORD IS WORN OR CUT, OR DAMAGED IN ANY WAY, HAVE IT REPLACED IMMEDIATLY TO AVOID SHOCK OR FIRE HAZARD.**

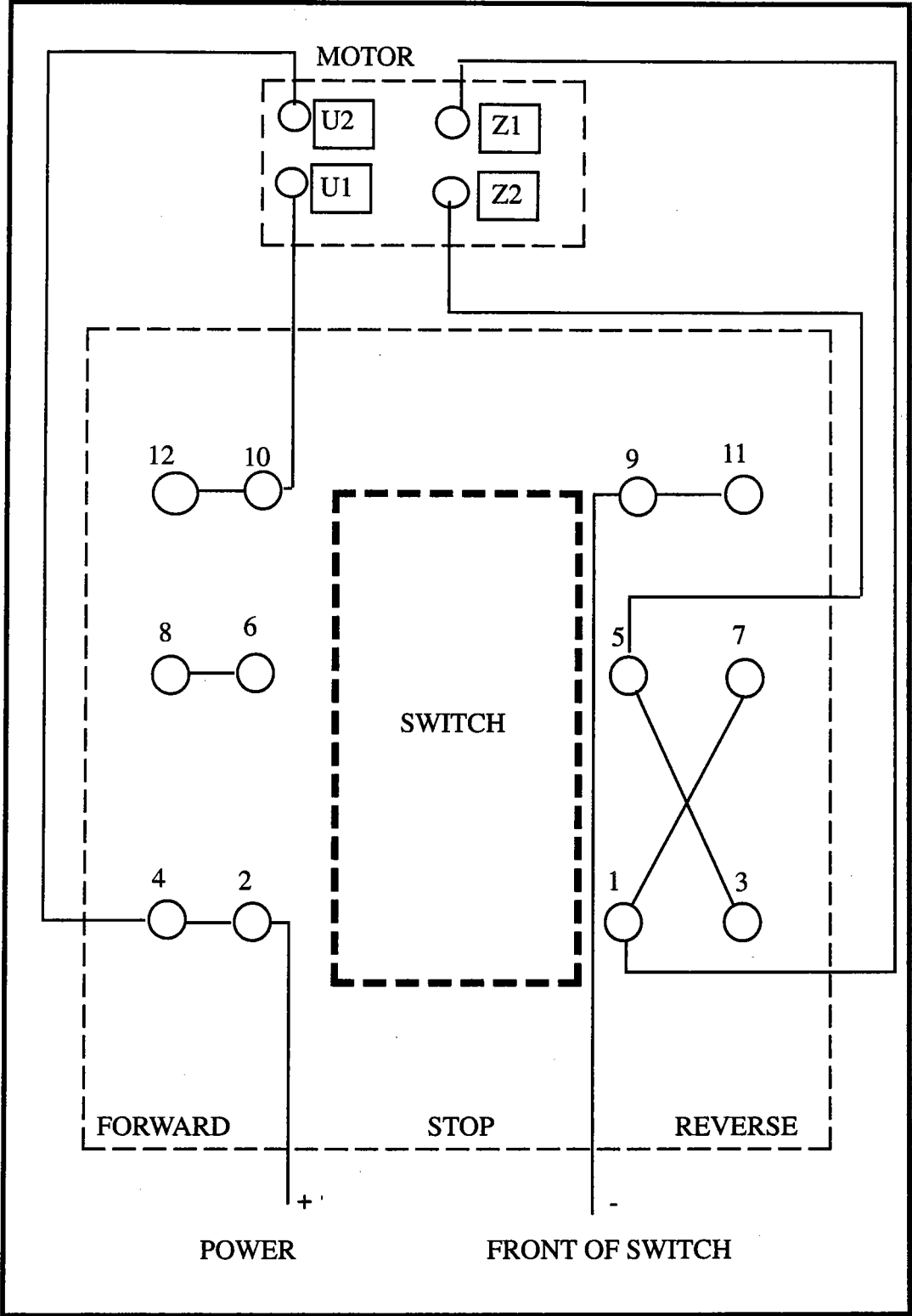
This power tool is equipped with a 3-conductor cord and grounding type plug. This plug requires a mating 3-conductor grounded type outlet.

If the outlet you are planning to use for this power tool is of the two prong type, **DO NOT REMOVE OR ALTER THE GROUNDING PRONG IN ANY MANNER.** Use an adapter. Always connect the grounding plug to a known ground. It is recommended that you have a qualified electrician replace all two prong outlets with a properly grounded three prong outlet.

The use of any extension cord will cause some loss of power. To keep this to a minimum and to prevent overheating and motor burn-out, use the table below to determine the minimum size wire (A.W.G.) extension cord. Use only 3 wire extension cords which have 3 prong grounding type plugs and 3 pole receptacles which accept the tools plug.

Extension cord length:	Wire size A.W.G.
0-25 feet	16
26-50 Feet	14
51-100 Feet	12

# BX-288 ELECTRICAL SYSTEM SCHEMATIC



SWITCH THE WIRES ON U1 & U2 TO REVERSE THE ROTATION



# RECEIVING THE BX-288

The BX-288 is shipped complete in one wooden crate.

1. Examine the crate for any damage that may have occurred during shipping.

2. **Unpacking and checking the contents**

Remove the wooden box from the skid by removing the 8 penny nails along the bottom of the box.

Remove the crate from the wooden platform by lifting the box straight up. The BX-288 Milling Machine is approximately 48 inches high. The crate must be lifted over the

machine. You will need two people to remove the wooden crate, it weighs approximately 60 lbs.



After you have removed the wooden crate from the wooden platform which the machine rests on, examine your BX-288 Machine for any damage.

3. **DO NOT REMOVE MACHINE FROM SKID** before moving machine to the location where it is to be used.

4. Remove all loose parts and boxes from the skid. Packed with the BX-288 Milling Machine, you will find two boxes marked "Box#1" and "Box #2". You will also find your Adjustable Drill Press Vise and a 3/8 inch drawbar. The 7/16 inch drawbar is in the spindle of the machine. Remove the white bag containing the drying agent and discard it.

Remove all loose parts and boxes from the skid and place them aside for now.

After you have separated all loose parts from inside the box, check each item with the BX-288 checklist in Box #1 (see page 9) to make sure all items are accounted for, before discarding any packing material.

**WARNING: IF ANY PARTS ARE MISSING, DO NOT ATTEMPT TO ASSEMBLE MACHINE, PLUG IN THE POWER CORD OR TURN THE SWITCH ON UNTIL THE MISSING PARTS ARE OBTAINED AND ARE INSTALLED CORRECTLY.**

## SETTING UP THE BX-288

To remove the machine from the skid, remove the bolts that are attached to the skid from the machine base.

The machine may be removed from the skid by either a hoist or Come-A-Long. **NEVER LIFT MACHINE WITH ROPE OR CABLE AROUND TABLE OR HEADSTOCK.** The rope or cable must be capable of withstanding a weight of 750 lbs or more.

Secure rope or cable to machine base and support the headstock to prevent tilting the machine during lifting. Check to see that the table is centered and the headstock is adjusted to its lowest position before attempting to lift the machine. Lift machine slowly checking to see that the correct balance is maintained.

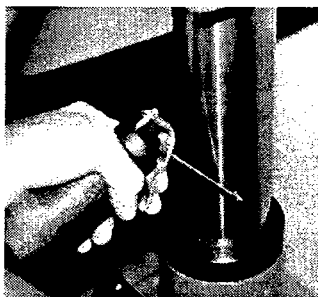
If you do not have access to a hoist or come-a-long the BX-288 can be set up by hand by following these procedures:

1. Remove the headstock from the column. This is accomplished by removing the cap from the column. To remove the cap, loosen the Allen screw on the cap and lift the cap off the column.
  2. Loosen the two black headstock bolts on the right side of the headstock and raise the headstock to the top of the column.
  3. Lift the headstock off the column. The rack will also come off with the headstock. You may still need at least two people to lift the headstock.
  4. Set the base in the desired location and replace the headstock, rack and cap.
- It is best to bolt the base to a sturdy surface that can support the weight of the machine.

Once you have the machine secured to your work station you can remove the protective oil that is applied to the machine.

Any ordinary household type grease or spot remover may be used.

**WARNING: TO AVOID FIRE OR TOXIC REACTIONS, NEVER USE GASOLINE, NAPHTHA OR SIMILAR HIGHLY VOLATILE SOLVENTS.**



Apply a light coat of oil (any grade oil will suffice) to the table, base and column to prevent rust.

*Refer to the Maintenance section on page 23 for more detailed oiling instructions.*

### CLEANING MACHINE

Use a cloth or brush to clean the BX-288 Milling Machine. Do not clean machine with compressed air. The use of compressed air for cleaning reduces the life of the machine as particles of dirt and other foreign matter may be forced into seals and bearings. To properly clean the machine after use, use a brush to remove metal shavings from the table. Brush the shavings from the table into the trough on either side of the table. Lift the metal shavings out of the table trough. After the shavings are removed clean the oil from the trough with a cloth.

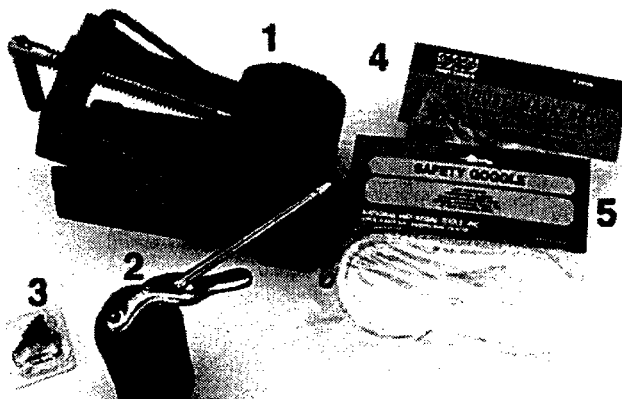
## TAKING INVENTORY OF YOUR BX-288 MILLING MACHINE PARTS

Open Box #1 and locate The Smithy Basic Tool Pack Checklist for the Smithy BX-288.

With the list, check off the vise and 3/8 inch drawbar. Open the spindle cover on the machine and determine that the 7/16 inch drawbar is in the spindle.

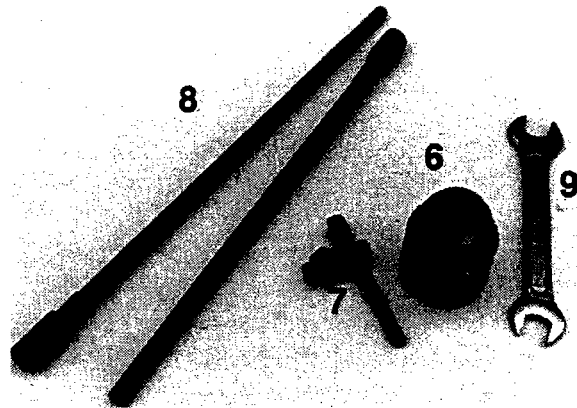
Open Box #1 and lay out the items in this box. Open Box #2 and lay out the items in this box.

Following, you will find pictures of the items that you have received with your Smithy BX-288 Milling Machine. Mark these items off on your checklist as you locate them.

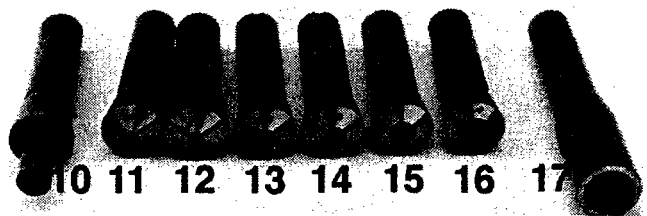


1. Vise
2. Oil Can
3. Ear Plugs
4. Dust Mask
5. Safety Goggles

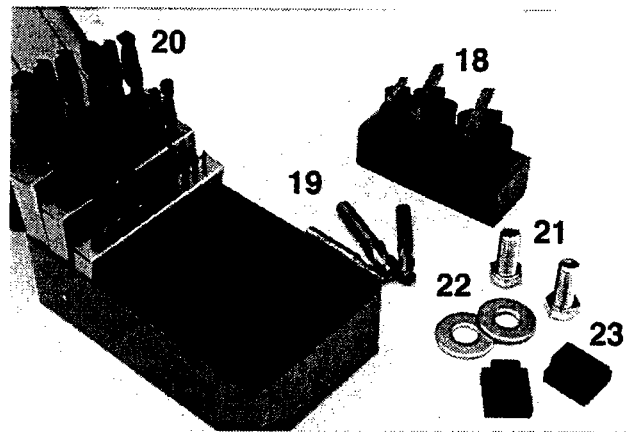
- 6. Drill Chuck
- 7. Chuck Key
- 8. Drawbars 3/8" & 7/16"
- 9. Metric Wrench



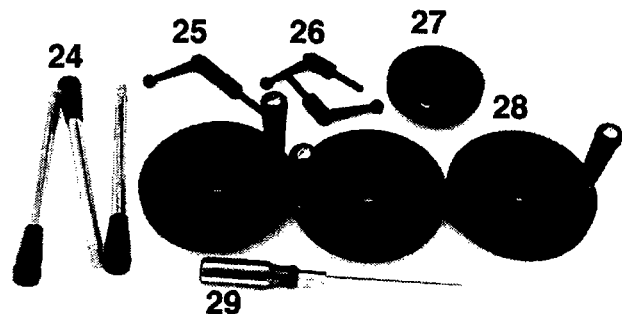
- 10. Drill Chuck Arbor
- 11. 3/16" Collet
- 12. 1/4" Collet
- 13. 5/16" Collet
- 14. 3/8" Collet
- 15. 1/2" Collet
- 16. 5/8" Collet
- 17. R8 Morse Taper 3 Adapter



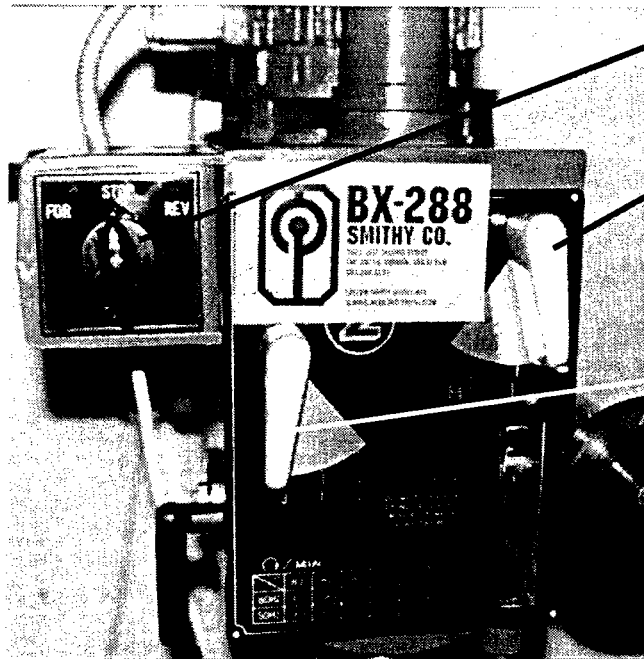
- 18. Flytool Cutter Set
- 19. High Speed Steel End Mills
- 20. 29 Piece Drill Set
- 21. 1 1/4" Bolts
- 22. 1 1/4" Washers
- 23. 5/8" T-Slot Nuts



- 24. Drill Press handles
- 25. Crossfeed Table Locking Handle
- 26. Longitudinal Table Locking Handles
- 27. Finefeed Drill Press Handwheel
- 28. Longitudinal & Crossfeed Handwheels
- 29. Screwdriver
- 30. 4mm Allen Wrench (not pictured)



# BX-288 CONTROL FUNCTIONS

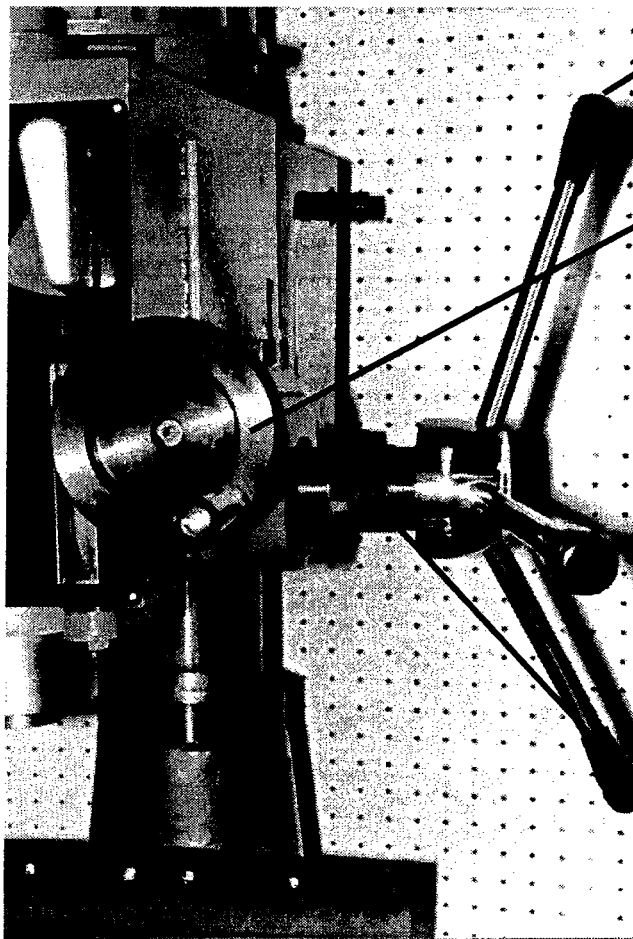


1. **POWER SWITCH.....**Turns milling machine to forward or reverse. White line on dial indicates the forward or reverse movement.

2. **HI-LO SWITCH.....**Adjusts the gear speed to either "high speed" or "low speed." See table on page 15 for R.P.M. of milling machine and the six speeds available.

3. **GEAR SPEED SWITCH.....**Controls the speed of the milling machine.

**MAKE SURE THAT THE MOTOR IS OFF AND SPINDLE IS STATIONARY BEFORE ADJUSTING THE GEAR SPEED AND HI-LO SWITCH.**



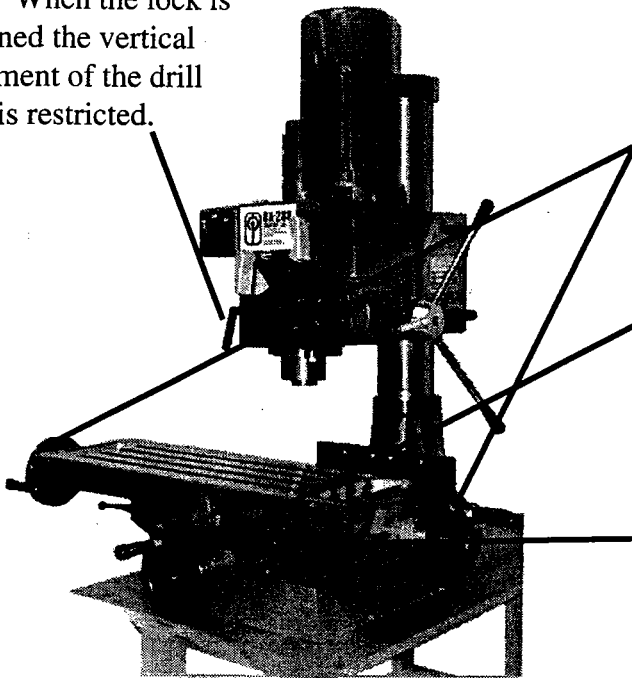
4. **DRILL PRESS HANDLE.....**Allows for rapid feed of the drill press. Total drill press throw is 2 3/4 inches.

5. **FINE FEED HANDWHEEL.....**When clutch on Drill Press Handle shaft is engaged, the fine feed handwheel will control fine adjustment of the drill press movement.



Engage the fine feed clutch by sliding it toward the headstock. To disengage the clutch, pull it away from the headstock.

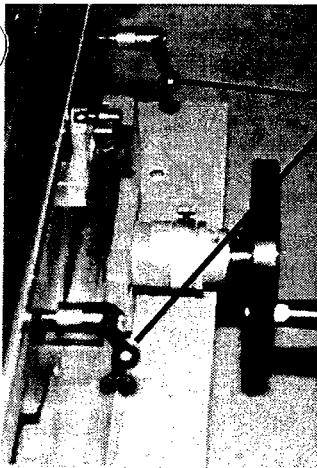
6. Drill Press Handle  
lock. When the lock is  
tightened the vertical  
movement of the drill  
press is restricted.



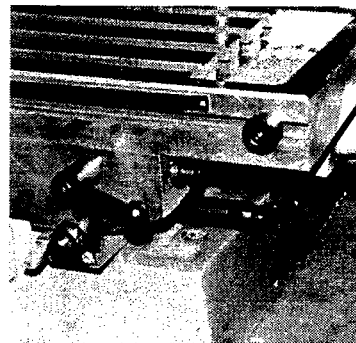
7. LEFT AND RIGHT LONGITUDINAL  
HANDWHEELS.....Moves the table from side  
to side. Total longitudinal travel is 17 3/4  
inches.

8. CROSSFEED HANDWHEEL.....Controls  
the movement of the table's cross travel. (front to  
rear) The total cross travel is 9 7/8 inches.

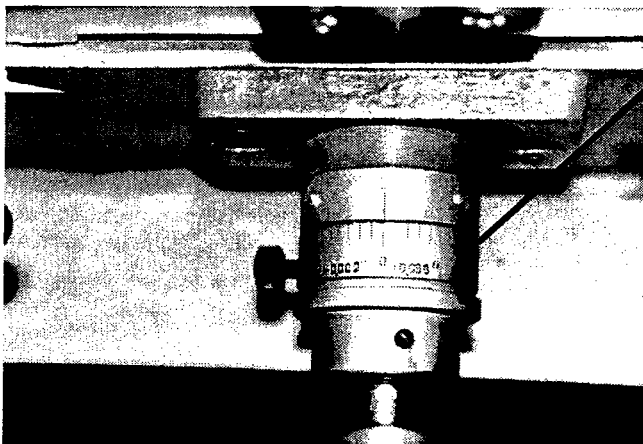
9. CROSSFEED TABLE LOCK.....Restricts cross  
table movement when it is tightened down.



10. LONGITUDINAL  
TABLE LOCKS.....  
Locks the longitudinal  
movement of table to  
ensure that the work  
piece is milled to exact  
specifications.



11. CROSSFEED  
TABLE LOCKS.....  
Locks the cross table  
movement to ensure that  
the workpiece is milled to  
exact specifications



12. LONGITUDINAL AND CROSSFEED  
HANDWHEEL DIALS. On each handwheel  
you will find dials that measures longitudinal or  
crossfeed travel of the table. The fine feed drill  
press handwheel is also equipped with a dial.  
The dial measures travel in .0002" increments.  
The small knob on the left allows you to adjust  
the dial to your work so that you may readjust  
the dial back to "0" at any point.

See page 25 for further details on these dials.

# BX-288

## ASSEMBLY INSTRUCTIONS

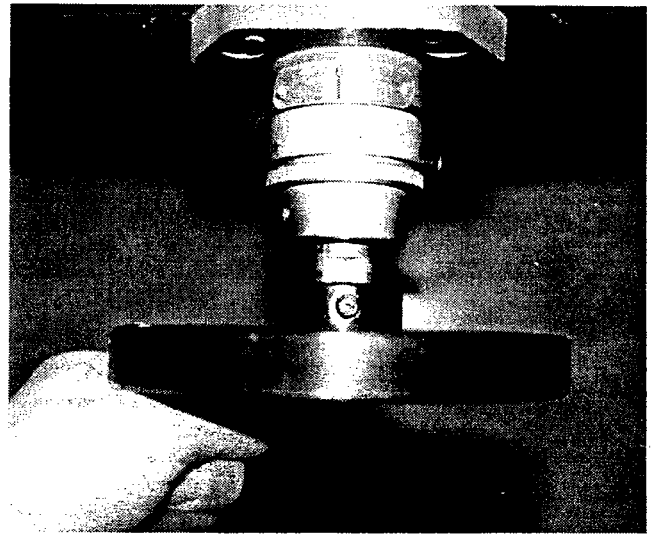
### TOOLS NEEDED:

SCREWDRIVER (STANDARD)  
4MM ALLEN WRENCH  
17 & 19 MM OPEN END WRENCH

### INSTALLING THE LEFT & RIGHT LONGITUDINAL HANDWHEELS

Insert one of the **large** hand wheels on the hand-wheel shaft at the left end of the table. When the handwheel is snug against the dial, tighten the Allen screw on the hand wheel with the 4mm Allen Wrench

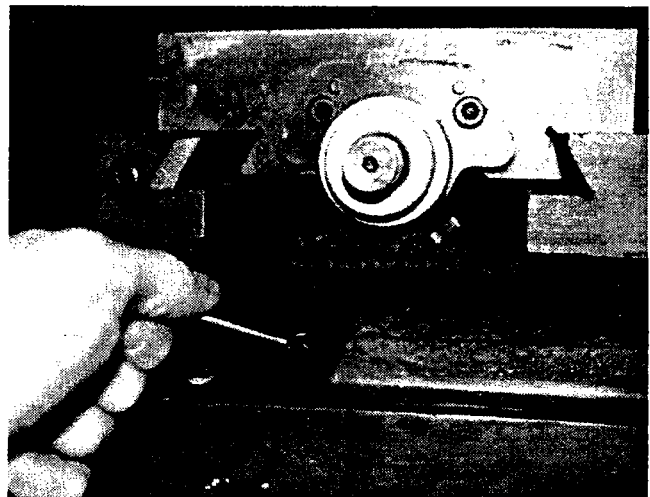
**Turn the hand wheel so that the table is moved as far as possible to the left.** This allows for proper installation of the crossfeed table lock.



### INSTALLING THE CROSSFEED TABLE LOCK

Screw the threaded end of the crossfeed table lock (large locking handle) into the base under the table on the right side of the machine. Screw the locking handle into the base until it stops. (These threads may be very tight, however the locking handle must be screwed in until it stops.) After the locking handle has been screwed into the base at maximum depth, turn the locking handle back one revolution. At maximum depth, the lock secures the cross feed from moving. Releasing the locking handle one turn allows for complete freedom of movement. After installing the crossfeed table lock, **RETURN THE TABLE TO ITS CENTER POSITION.**

Install the right longitudinal hand wheel in the same manner as the left longitudinal hand wheel.

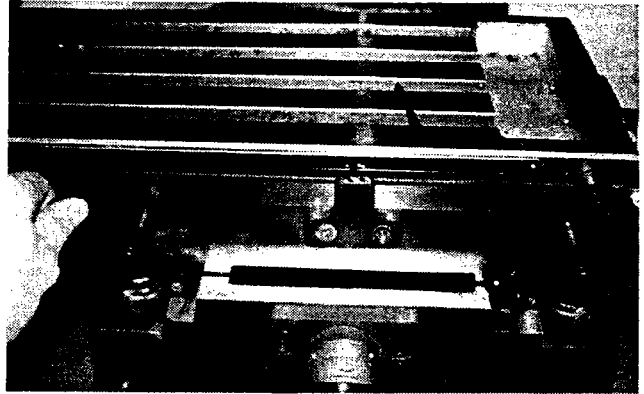


The locking handles are ratchet operated to allow for freedom of movement in tight quarters. Pull the handle to release the ratchet. The spring loaded handle will automatically engage the ratchet once the handle is moved to the desired position. The screw on the end holds the ratchet device together and provides no adjustment to the ratchet.

## **INSTALLING THE RIGHT AND LEFT TABLE LONGITUDINAL LOCKS**

Take one of the two remaining smaller locking handles and screw it into the left threaded hole on the side at the front of the table. Screw the locking handle in until it stops. Back the locking handle off one turn.

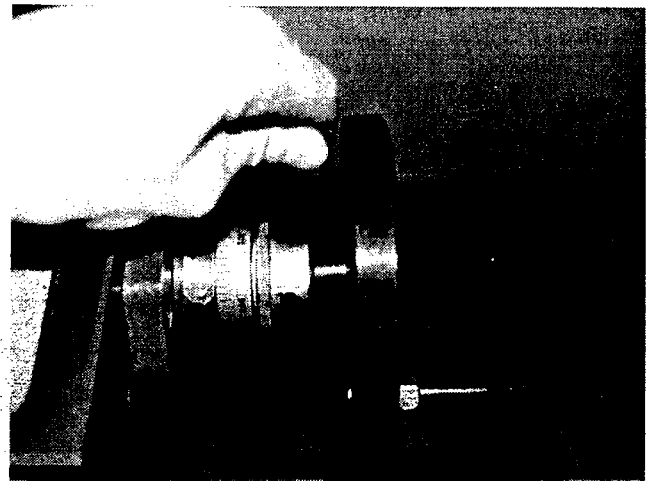
Install the last locking handle into the right side threaded hole. Screw it in until it stops and back it off one turn.



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## **INSTALLING THE CROSSFEED HANDWHEEL**

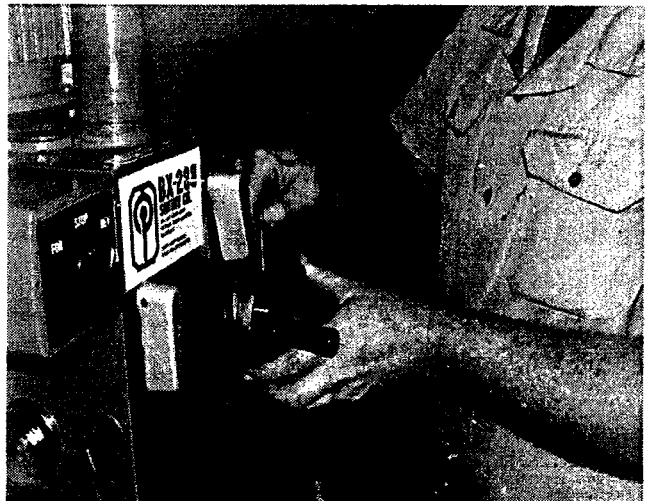
Place the last large handwheel on the crossfeed shaft until it fits flush with the dial and secure it with the 4mm Allen Wrench.



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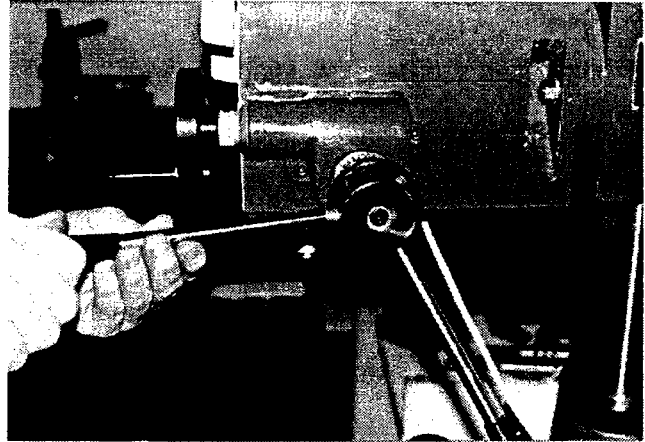
## **INSTALLING THE FINE FEED HANDWHEEL**

Place the small hand wheel on the fine feed shaft next to the drill press handle shaft. When it is flush with the dial, tighten the Allen screw with the 4mm Allen wrench.



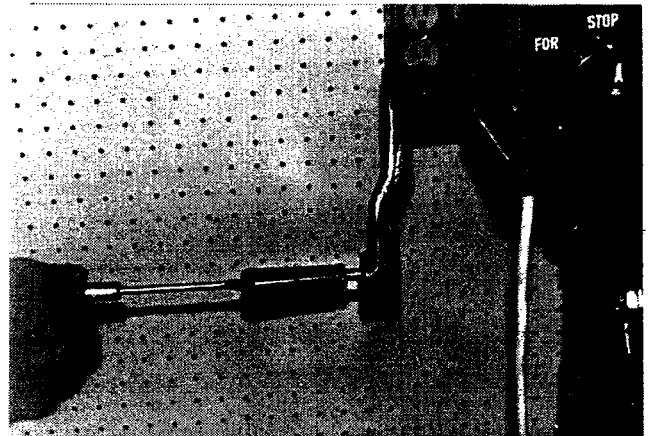
## INSTALLING THE DRILL PRESS HANDLES

Screw the three chrome handles into the three holes on the drill press feed cam. Hand tighten only.



## INSTALLING THE ELEVATING HANDLE

With a standard screwdriver, screw the elevating handle knob into the elevating handle and tighten the nut on the handle.



## CONTROLLING GEAR SPEEDS

The BX-288 Milling Machine has 6 speed adjustments available. The speed ratios are registered on the front of the name plate next to the gear adjustment levers. The BX-288 will operate at the speeds listed for 60 Hz. They are as follows:

	1	2	3	
High	1625	1065	620	RPM
Low	255	165	95	RPM

When changing speeds, be sure that the motor is off and not rotating. **DO NOT ATTEMPT TO CHANGE GEARS WHILE THE MOTOR IS RUNNING.**

Changing gears while motor is running will damage drive gears. Damaged gears in this manner are not covered under your warranty.





# ADJUSTING THE HEADSTOCK HEIGHT & TILT ANGLE

You can adjust the head stock so it is perpendicular with the table by loosening the three 19MM bolts one on each side and one underneath the head stock. First loosen the left side nut with the 19mm wrench, (photo #1) then the underside nut.(photo #2) Loosen the right side nut next to the degree scale. (photo #3)

You can adjust the degree of angle by lining the red line up with the degree indicator on the left side of the head stock. (photo #4) Tighten the three bolts after you have the desired angle.



Left side nut



Underside nut



1 2  
3 4



Right side nut



Degree indicator

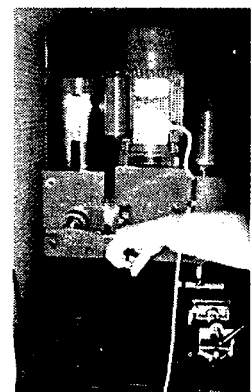
## ADJUSTING THE HEADSTOCK HEIGHT

You can adjust the height of the head stock by loosening the two black bolts on the right side of the head stock. After the bolts are loose, raise or lower the head stock with the elevating handle to the position you desire.

There is no indicator gauge that tells you the exact height of the head stock. This is your rough height adjustment. Any fine tuning of the height adjustment will be done with the drill press handle and the fine feed hand wheel.

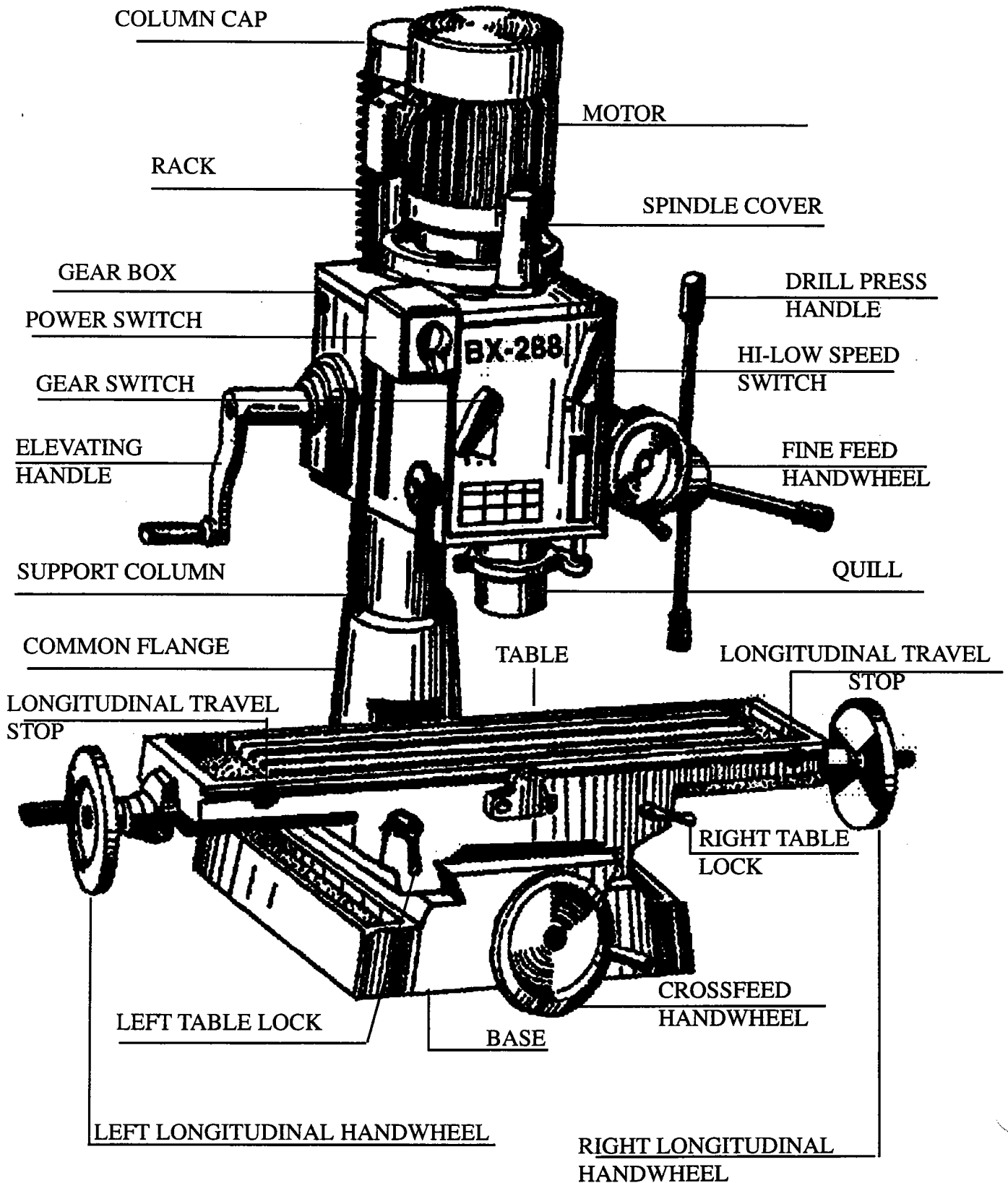


Loosening headstock bolts



Raising or lowering headstock

# GETTING TO KNOW YOUR SMITHY BX-288 MILLING MACHINE



# BASIC BX-288

## MILLING/DRILLING OPERATION

### Calculating Milling Cutter RPM and Feed Rates

Milling machine operators must know how to calculate correct milling cutter RPM and feed rates. The cutter RPM rate to be used in an operation varies according to the diameter of the cutter, the kind of tool material the cutter is made of and the cutting speed for the kind of material to be cut. The feed rate varies according to the type of cutter, the size of the cutter teeth, the rigidity of the machine and work setup and whether a rough or finish cut is to be made.

### Cutting Speed

Cutting speed, for milling, is the circumferential speed of the milling cutter expressed in feet per minute (FPM). It is the distance that the total cutting edge of a milling cutter tooth travels in one minute. If the cutting speed is too high during milling, the cutter becomes overheated and dulls rapidly. If the cutter speed is too low, the production rate is low and inefficient.

### RPM

RPM refers to the number of revolutions per minute of the milling cutter. To cut at a given speed, a small milling cutter must rotate at a higher RPM than a larger cutter. To cut at 50 FPM, a 1" diameter cutter must rotate at 191 RPM while a 3' diameter cutter must rotate at only 64 RPM. To prevent cutter damage, the milling machine operator must know how to calculate or select the correct RPM for a cutter of any size to run at any cutting speed.

### Cutting Speed Selection

There are ranges of cutting speed generally used for milling different types of material. It is common practice to start with an average cutting speed, which is then increased or decreased according to the results desired.

### Machinability

One of the most important factors determining cutting speeds is the machinability of the metal. Machinability refers to the ease with which the metal may be machined.

Machinability ratings are normally compared with that of 1112 steel, which is rated at 100 percent. 1015 steel ( a low carbon steel ) is rated at 50 percent. A satisfactory cutting speed for milling this steel is about 80 FPM. As the machinability rating increases, the cutting speed also may be increased. Since the rating for 1112 steel is double that for 1015 steel, the cutting speed may be doubled also. Hence a cutting speed of 160 FPM generally will produce satisfactory results with 1112 steel. Some leaded free-machining steels have ratings as high as 300 percent. Steel of this type, therefore, may be machined at about six times the cutting speed for 1015 steel.

The following factors affect cutting speeds (and also feeds) selected for milling operations:

1. Machinability rating of the material being machined.
2. Kind of cutting-tool material to be used (carbon steel, high-speed steel, cast alloy or cemented carbide.)
3. Whether cutting fluid is used and if so the kind of fluid.
4. Type of cutter, it's size and the coarseness of the teeth.
5. Amount of metal being removed(rough cut or finish cut.)

### Suggested Cutting Speeds

The range of cutting speeds recommended for milling different metal with high-speed steel cutters and with carbide cutters is given in Table 35-1 on Page 35

For heavy roughing cuts, use the lower end of the recommended speed range. For light finishing cuts, use the upper end of the recommended range. For carbon steel cutters, use half the cutting speeds recommended for high-speed steel cutters. Cutters made of cast alloys may be run at cutting speeds 50 to 75% higher than those recommended for high-speed steel cutters.

When cutting fluids are not used, the lower range of the suggested cutting speeds should be selected. Cast iron is an exception, since it generally is machined dry. Further specific cutting speed recommendations are included in standard handbooks for machinists.

### Calculating Revolutions Per Minute.

With the cutting speed selected, the problem is to determine the RPM of the cutter, so that the machine spindle speed can be set accordingly. The RPM for a given cutting speed may be calculated with the following formulas:

$$\text{Inch: } \text{RPM} = (\text{cutting.speed. (FPM)}) \times 12 / D'' \times 3.1416$$

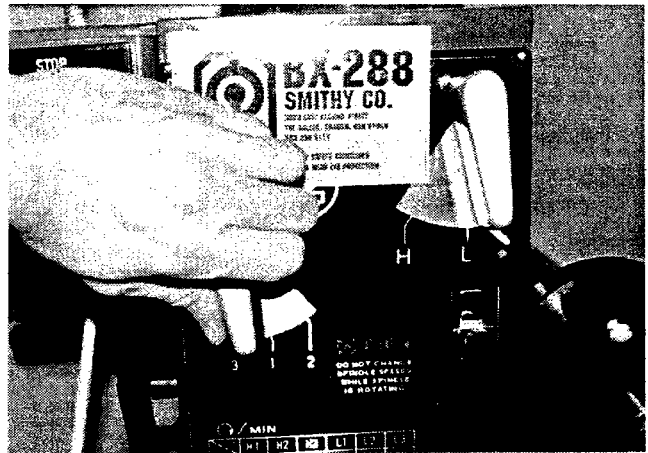
Example: Calculate the cutter RPM for a 3" diameter cutter which is to mill steel at 80 FPM.

$$\text{Inch Solutions: } \text{RPM} = 80 \times 12 / 3 \times 3.1416 = 960 / 9.4248 = 101.86 \text{ or } 102.$$

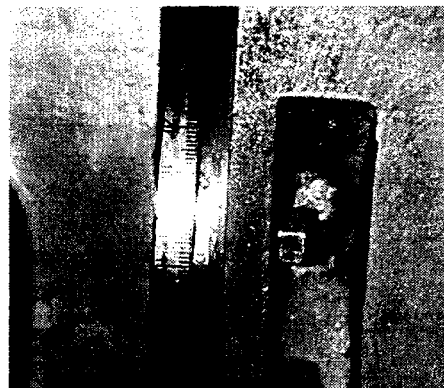
The need to calculate cutter RPM, can be practically eliminated by the use of an RPM chart. Table 34-1 on page #34 gives the correct RPM for selected diameters at different cutting speeds.

### OPERATION OF THE BX-288 MILLING MACHINE MILLING

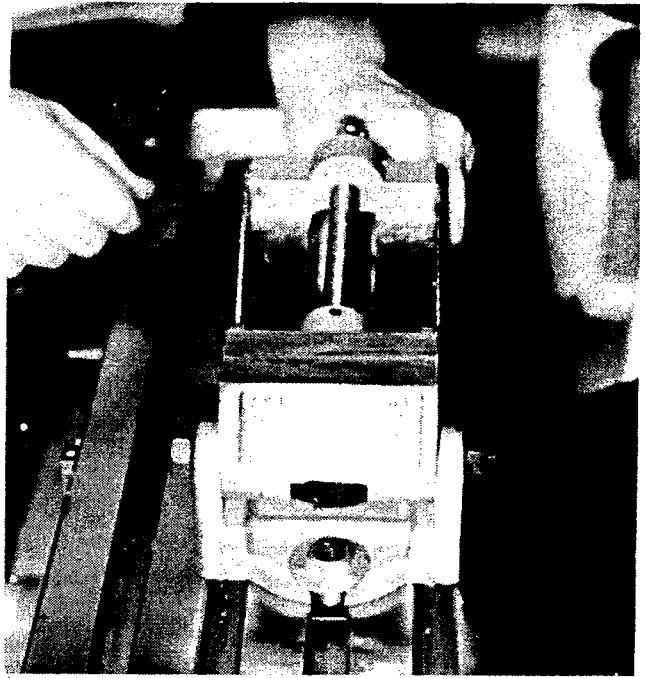
Once the speed of the cutter is determined, adjust the gear levers to accommodate that closest speed.



Also check that the headstock is in the correct angle for proper milling.



Install the vise onto the table with the use of the two t-slot nuts, the bolts and washers. The vise should be tightened to the table so that there is no movement possible from the vise during milling operation.



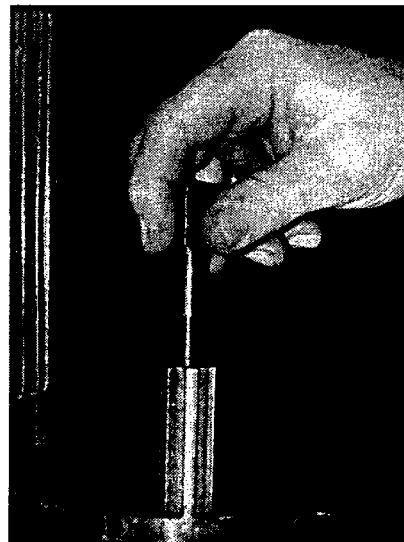
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### **PROPER SETUP FOR MILLING.**

Step 1 Based on the project that you are doing; select the proper size mill and place it into the collet which fits the mill shank.



Step 2 Remove the spindle cover to expose the Drawbar. Check to see that the drawbar thread size is the same size as the collet threads.

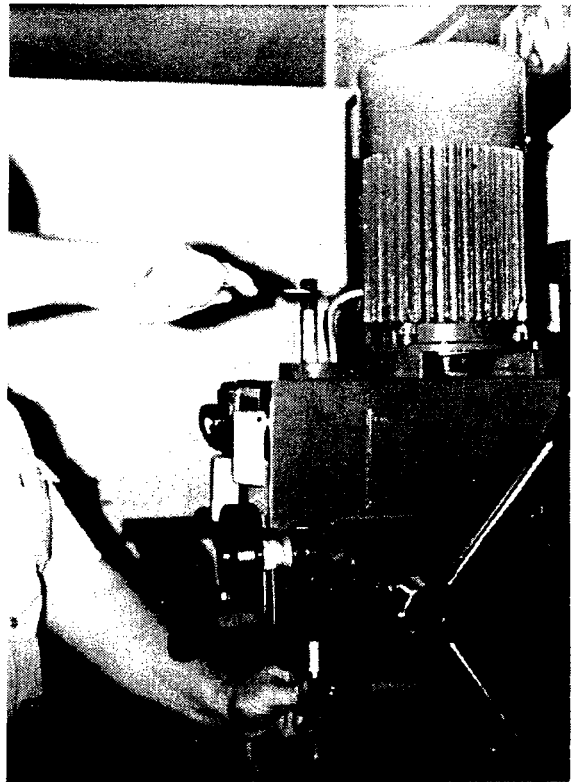


Step 3 Reinstall the drawbar and slide the collet into the quill. Thread the drawbar into the collet and tighten it down with the 9MM wrench.

Step 4 Replace the Spindle cover. **Caution: do not operate the milling machine without the spindle cover in place.**

Step 5 Place your work in the vise and adjust the depth of cut with the fine feed handwheel.

Step 6 Upon completion remove the collet from the quill and the end mill from the collet. Place the end mill back in it's protective case. This prevents accidental injury from an exposed cutter blade.



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## DRILL

The drill operation is much the same as the mill operation.

Step 1 Slide the drill chuck into the drill arbor.

Step 2 Intall the drill arbor into the quill and screw the drawbar into the arbor.

Step 3 Tighten the arbor down with the 9mm wrench and replace the spindle cover.

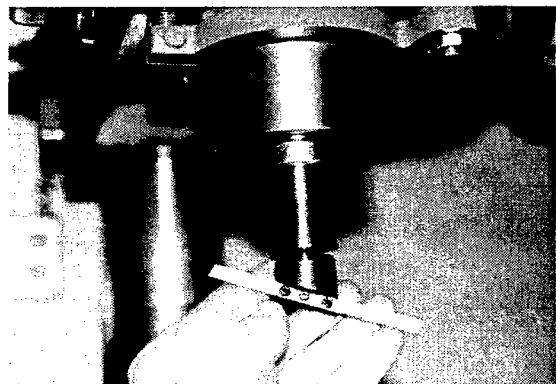
Step 4 Install your drill bit and complete your project.



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## FLYTOOL CUTTER

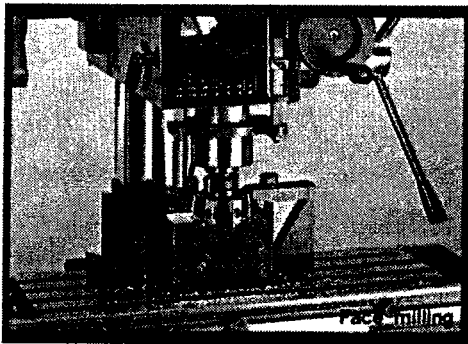
The flytool cutter is attached in the same manner as the end mill bits, they simply slide into the collets and are attached to the drawbar.



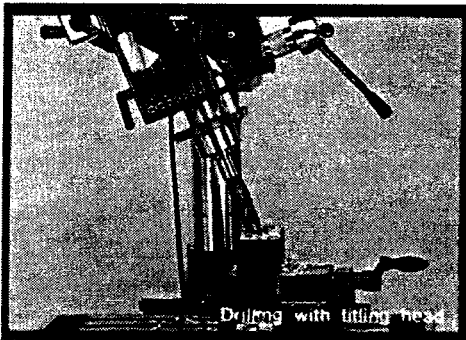
These are the basic operations that are performed with the BX-288 Milling Machine. If you are an experienced machinist, you understand the versatility this machine can provide. If you are new to the machining process, you will find that your BX-288 Milling Machine can perform many functions that previously you may have not believed possible without more expensive equipment.

Some of the applications that the BX-288 can perform are:

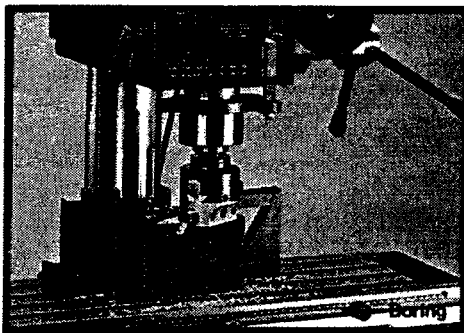
### Face Milling



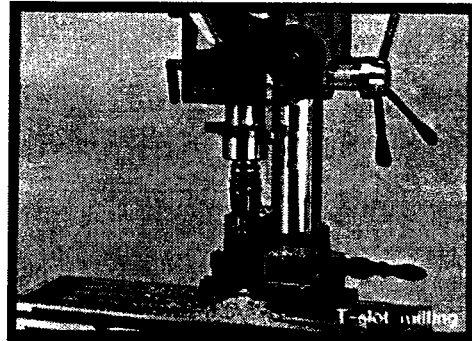
### Tilt Head Drilling



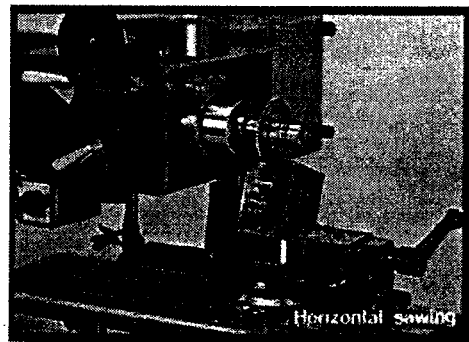
### Boring



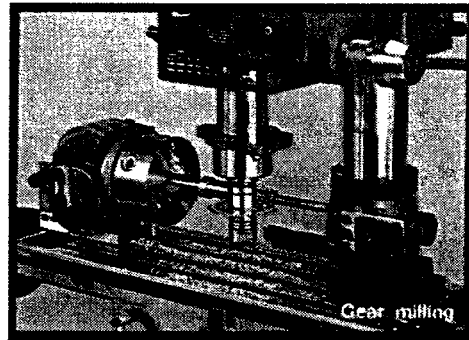
### T-Slot Milling



### Horizontal Sawing



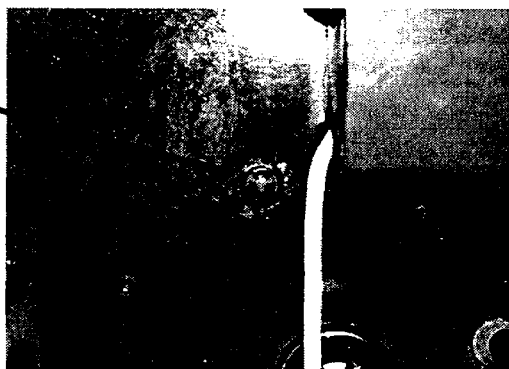
### Gear Milling



These are a few of the applications in which your BX-288 Milling Machine can be used. There are many others. With modifications and the accessories available for your BX-288, you can perform almost any milling or drilling operation that can be performed in a professional machine shop.

# MAINTAINING THE BX-288 MILLING MACHINE

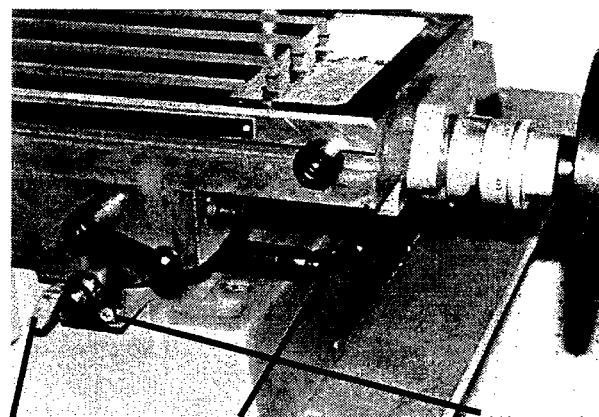
Maintenance of the BX-288 Milling Machine is fairly simple and straight forward. The sight glass on the left side of the machine must have oil in it at all times. This glass will register that the gear box has ample oil in it when the glass shows half full. Use any light grade oil for the gear box, 30 weight motor oil is completely acceptable. Your BX-288 has been serviced prior to shipment and should be filled with oil. If it is not, or if the sight glass shows that the oil level is low, add more oil until the glass shows half full. To fill the gear box with oil, unscrew the black knurled knob on top of the gear box behind and to the right of the spindle cover. Add only enough oil to fill the glass 1/2 full.



To prevent rust and reduce friction, keep a light weight oil on all moving mechanism.

## TABLE

To keep the table moving freely, oil the "cross-feed ways" and the "longitudinal ways." Also use the "oiling nipples" on the front of the table.



Crossfeed Way, Longitudinal Way, Oiling Nipple

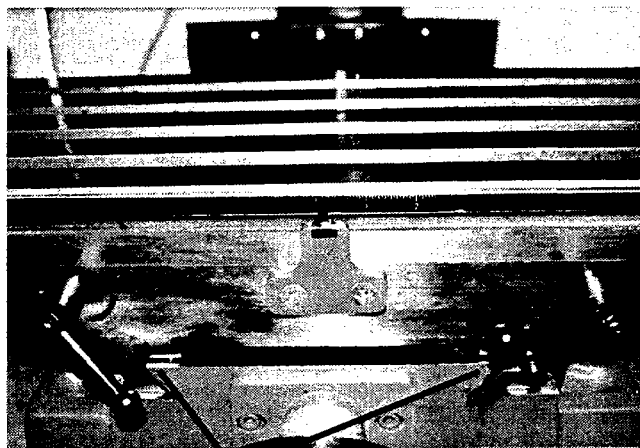
## HEADSTOCK COLUMN

The "headstock height adjustment column" should always have a light coat of oil. This will allow freedom of movement of the up and down motion of the headstock in relation to the rough adjustment and fine feed adjustment.

## TABLE SCREWS

Oil the crossfeed screw and longitudinal screws under the table.

The motor and spindle bearings are sealed and thus do not need lubrication.



Cross table Ways



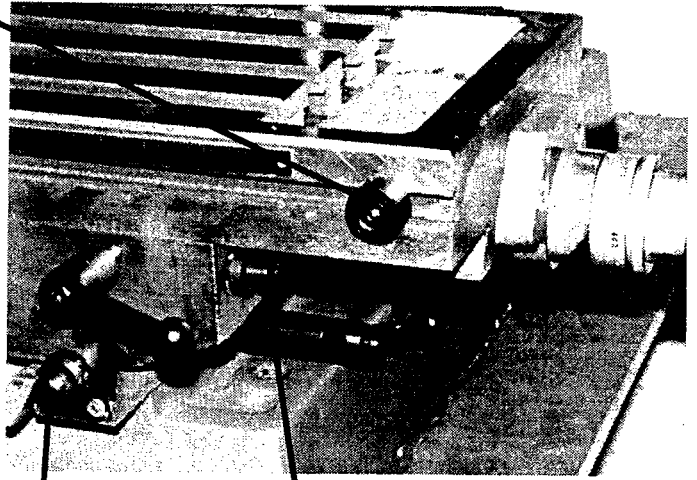
# ADJUSTMENTS FOR YOUR BX-288 MILLING MACHINE

## LONGITUDINAL TRAVEL STOPS

The longitudinal travel stops can be positioned along the entire length of the front of the table. They restrict the movement of the longitudinal (side to side) travel of the table for repetitive cuts.

## CROSS FEED AND LONGITUDINAL GIB STOPS

The longitudinal and cross-feed gibs adjust unwanted play in the table. The gib stops should be adjusted upon receiving your BX-288 Milling Machine and will only need minor adjustments from time to time. To set the gib stops, tighten the gib screws until the ways no longer have any play. Do not over tighten the gib stops as this will cause the longitudinal or cross-feed travel to be restricted. Restricted travel will interfere with the precise movement necessary for exact cuts.



Cross feed Gib Stop    Longitudinal Gib Stop  
Turn the gib screw to adjust the tension on the cross-feed and longitudinal screws.

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## DRILL PRESS STOP

The Drill Press Stop allows for BLIND holes (not all the way through) to be drilled to exact specifications. The drill press stop is gauged in both inch and metric measurements .

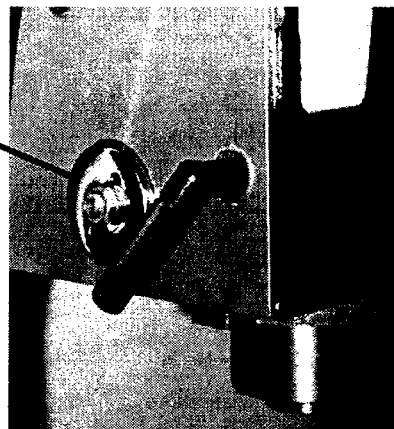
To drill a BLIND hole, proceed as follows:

1. Mark the depth of the hole on the side of the work piece.
2. Loosen the drill press stop
3. With the switch OFF, bring the drill down until the tip of the drill is even with the mark.  
Tighten the drill press stop nut.  
The drill will now be stopped at this depth until the drill press stop nut is readjusted.



## SPRING TENSION ADJUSTMENT

The spring tension adjustment allows for the drill press movement tension to be increased or decreased. To adjust the tension, loosen the 19mm nut until it is flush with the outer edge of the bolt. **DO NOT REMOVE IT FROM THE BOLT.** Pull the chrome cover plate out until it turns freely. The tension spring is attached to the chrome plate. Turn the plate Counter clockwise to increase the tension and clockwise to relieve the tension. After you have adjusted the tension to your satisfaction, replace the chrome plate back into the gear box and tighten the nut.



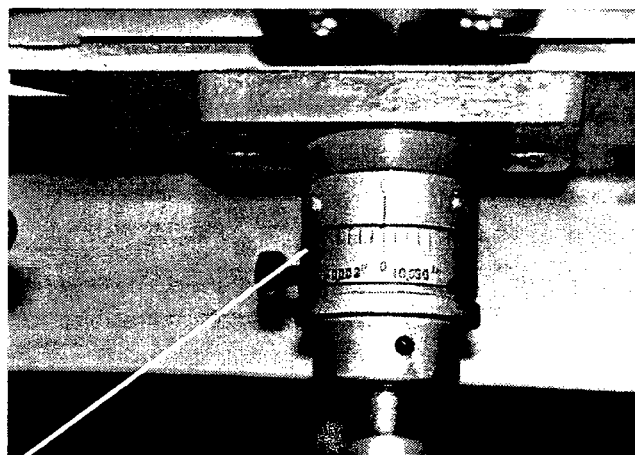
## DIAL GAUGE ADJUSTMENT (METRIC VS STANDARD)

The BX-288 milling machine was manufactured in China. The Republic of China uses the Metric System of measurement. The BX-288 is manufactured for use throughout the entire world. As most of the world uses the metric system of measurement, certain quirks are bound to occur when transferring to the standard measurement system or the "inch". Although the Chinese manufacturer makes every attempt to standardize the BX-288 Milling Machine, certain parts must remain metric.

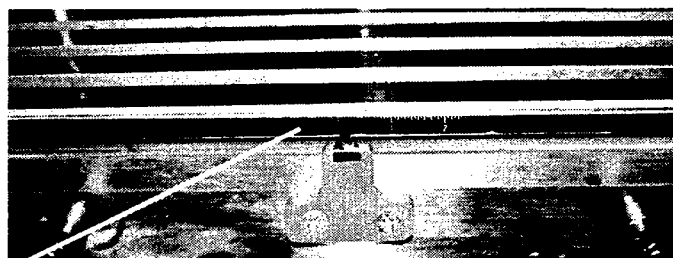
Such is the case with the longitudinal and cross-feed screws. The dials that appear in front of the handwheels are calculated in thousandths of an inch. Each mark represents 2 thousandths of an inch movement (shown as .002). The screw that moves the table is metric, therefore a deviation exists. For every .100 of an inch movement, the deviation is .002.

This has been compensated, however, as you will note that the dial in front of the handwheel shows only .098 of an inch turn. This dial is for very close measurements. For longer measurements, the inch ruler along the front of the table is provided.

**You will not have to adjust your movements to compensate for the difference** if you use the ruler and dials as described above. The dial takes the difference into consideration. The ruler is exact.

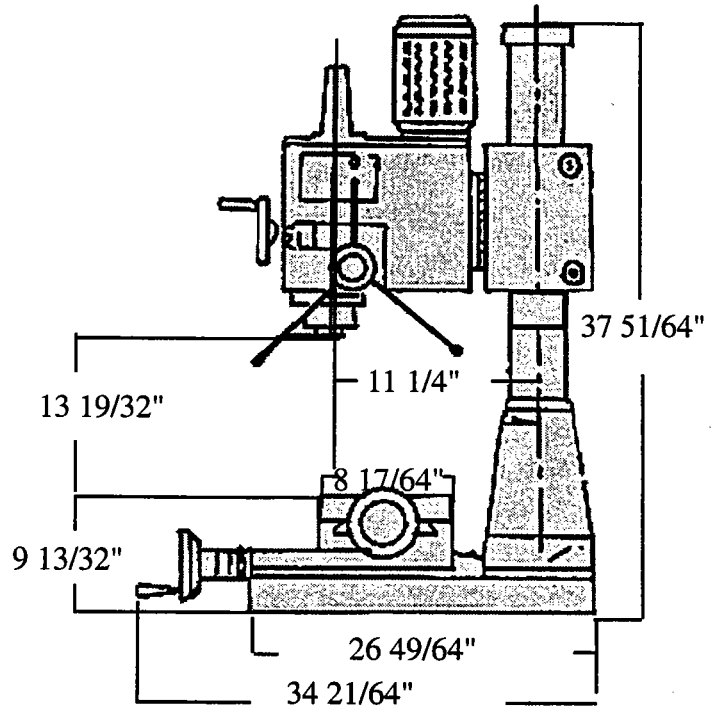
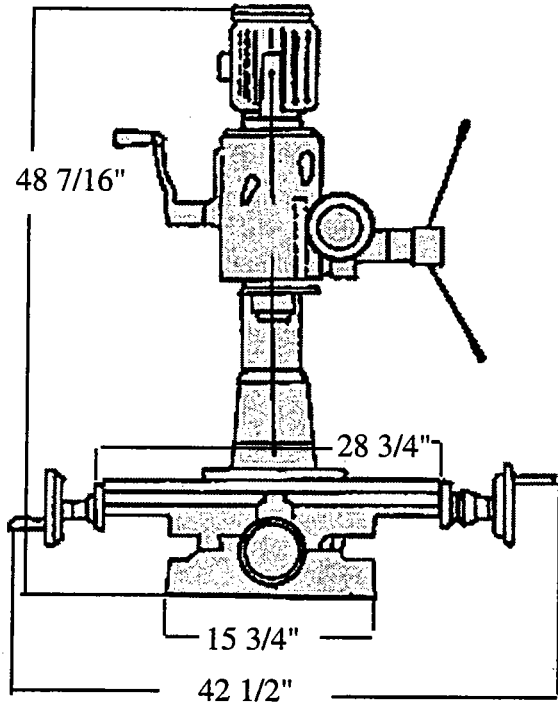


Handwheel dial; Note that one complete turn on the handwheel dial equals .098 of an inch. Not .100. This compensates for the deviation between metric to standard movement.



Ruler along the front of the table with marker. Use this ruler for measurements longer than .098 of an inch movement.

# BX-288 SPECIFICATIONS



**ITEM                    MM                    INCHES**  
**WORKING AREA**

Vertical Movement of Head Stock	345	13 9/16
Throat	285	11 3/16
Worktable Size	730 x 10	28 3/4x8 1/4
Worktable Longitudinal Travel	450	17 3/4
Worktable Cross Travel	250	9 7/8

**HEAD STOCK & COLUMN**

Spindle Speeds	60 Hz	95, 180, 320, 635, 1100, 2000
R.P.M.	50 Hz	80, 150, 270, 530, 920, 1650
Number of Spindle Speeds		6 Steps
Spindle Nose Taper		R8
Spindle Quill Stroke	70	2 3/4

**ITEM                    MM                    INCHES**

Spindle Quill Diameter	70	2 3/4
Swivel of Head Stock		360 degrees
Rotation of Head Stock		360 degrees
Column diameter	102	4
Main Motor		1 h.p. Single Phase

**CAPACITY**

Drilling Cap.	40	1 9/16
End Mill Cap.	32	1 1/4
Drill Depth	76	3

**SHIPPING DATA**

Net Wt.	265 kg's	583 lbs
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# BX-288 PARTS LIST

(ALL PARTS START WITH "BX", THEN THE PART NUMBER)

PART #	DESCRIPTION	NO. PARTS
BX-001 512735	Bolt (M8X85)	4
BX-002	Handle grip	4
BX-003	Nut (M8X10)	4
BX-004	Handwheel	3
BX-005	Set screw (M8X10)	3
BX-006	Pin	2
BX-007	Zero dial bracket	2
BX-008 use X50008	Gaduated dial	2
BX-009 511957	Dial set screw <i>Screw, Oversized</i>	2
BX-010	Thrust bearing	4
BX-011	Bolt (M8X22)	2
BX-012	Cross travel leadscrew flange	1
BX-013	Dial angling plate	2
BX-014	Rivet (2X5)	4
BX-015	Cross travel leadscrew nut	1
BX-016	Bolt (M8X64)	1
BX-017	Cross travel leadscrew	1
BX-018	Machine base	1
BX-019	Cross table	1
BX-020	Pointer	1
BX-021	Rivet (2X5)	1
BX-022	Bolt (M8X20)	2
BX-023	Pointer plate	1
BX-024	Cross travel gib	1
BX-025	Gib adjusting screw	2
BX-026	Cross table clamping bolt <i>X59027L</i>	2
BX-027	Handle grip	3
BX-028	Stop pin	3
BX-029	Spring	3
BX-030	Bolt (M6X22)	3
BX-031	Bolt (M8X20)	3
BX-032	Collar	4
BX-033	Longitudinal leadscrew flange	2
BX-034	Longitudinal leadscrew	1
BX-035	Longitudinal leadscrew nut	1
BX-306	Bolt (M8X25)	2
BX-037	Bolt (M6X10)	2
BX-038	Stopper	2
BX-039	Stopper block	2
BX-040	Work table	1
BX-041	Straight rule	1
BX-042	Rivet (2X5)	1
BX-043	Bolt (M8X16)	2

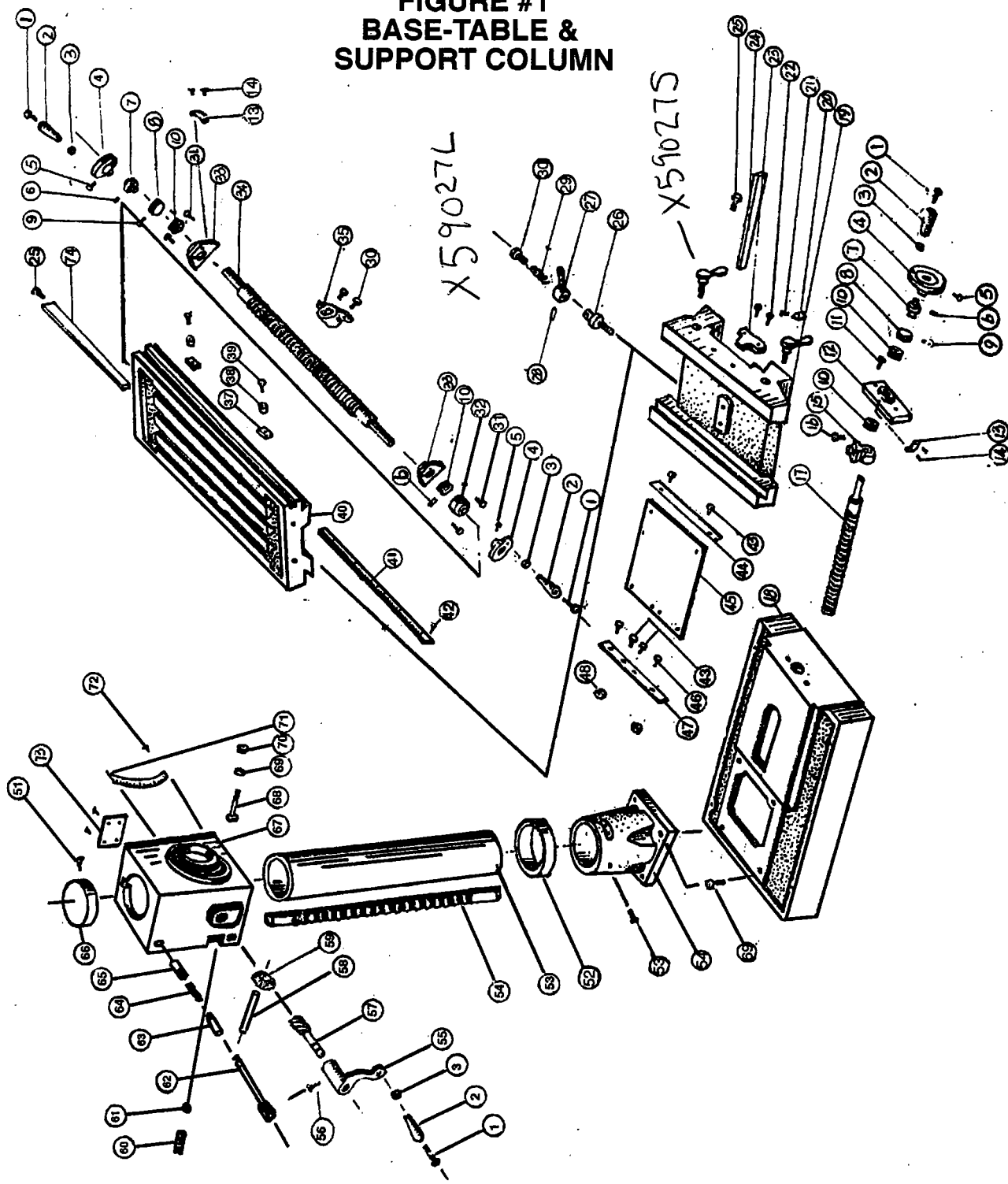
BX-044	Clamped plate	1
X-045	Protection cover	1
X-046	Bolt (M6X12)	1
BX-047	Clamped plate	2
BX-048	Nut M6	2
BX-049	Bolt (M6X55)	4
BX-050	Column flange	1
BX-051	Bolt (M10X12)	3
BX-052	Flange ring	1
BX-053	Column	1
BX-054	Gear rack	1
BX-055	Headstock elevating handle	1
BX-056	Bolt (M10X12)	1
BX-057	Worm gear	1
BX-058	Gear fixing shaft	1
BX-059	Gear	1
BX-062	Clamping bolt shaft	2
BX-063	Clamping guide pipe	2
BX-064	Spring	2
BX-065	Clamping guide pipe nut	2
BX-066	Column top cover	1
BX-067	Elevating swivel case	1
BX-068	Clamping bolt (M12X45)	3
X-069	Spring washer	3
BX-070	Nut (M12)	3
BX-071	Headstock tilting graduated plate	1
BX-072	Rivet (2X5)	6
BX-073	Mark plate	1
BX-074	Longitudinal travel	1
BX-075	Oil seal	1
BX-076	Spindle	1
BX-077	Ball bearing	1
BX-078	Bracket	1
BX-079	O-ring	1
BX-080	Quill	1
BX-081	Tension spring	1
BX-082	Ball bearing	1
BX-083	Nut (M30X1.5)	2
BX-084	Fixing washer	1
BX-085	Gland cover	1
BX-086	Oil seal	1
BX-087	Gear (M 1.75X 50T)	1
BX-088	Ball bearing (60106)	2
BX-089	Snap ring	1
X-090	Snap ring	1

Note: Items #60 & 61 are deleted as they are no longer included with the BX-288.

BX-091	Spindle top cover	1
BX-092	Draw bar	1
BX-093	Clamping handle	1
BX-094	Solid pin	1
BX-095	Clamping rod	1
BX-096	Clamping guide pin	1
BX-097	Clamping guide pin nut	1
BX-098	Set screw	1
BX-099	Nut (M10)	1
BX-100	Nut (M12)	1
BX-101	Spring cover	1
BX-102	Disc spring	1
BX-103	Pinion shaft (M1.5X15T)	1
BX-104	Steel ball	1
BX-105	Spring	1
BX-106	Key (6MMX25MM)	2
BX-107	Worm gear	1
BX-108	Snap ring	1
BX-109	Worm gear case	1
BX-110	Worm	1
BX-111	Ball bearing (101)	1
BX-112	Snap ring	2
BX-113	Sleeve	1
BX-114	Cover	1
BX-115	Micro feed graduated dial	1
BX-116	Set screw	1
BX-117	Handwheel	1
BX-118	Nut (m8)	1
BX-119	Handwheel handle	1
BX-120	Bolt (M8X75)	1
BX-121	Rivet (2x5)	7
BX-122	Dial aligning plate	1
BX-123	Micro fast feed clutch knurling ring	1
BX-124	Handle bracket	1
BX-125	Handle rod	3
BX-126	Handle grip	3
BX-127	Bolt (M8X30)	3
BX-128	Set screw (M6X6)	2
BX-129	Spindle speed change lever	2
BX-130	Front name plate	1
BX-131	Spring positioning rod	1
BX-132	Spindle positioning block	1
BX-133	Nut (m3)	1
BX-134	Connecting rod (left)	1
BX-135	Gear change lever (left)	1
BX-136	Pin	1
BX-137	Nut (M6)	1
BX-138	Set screw (M6x16)	2

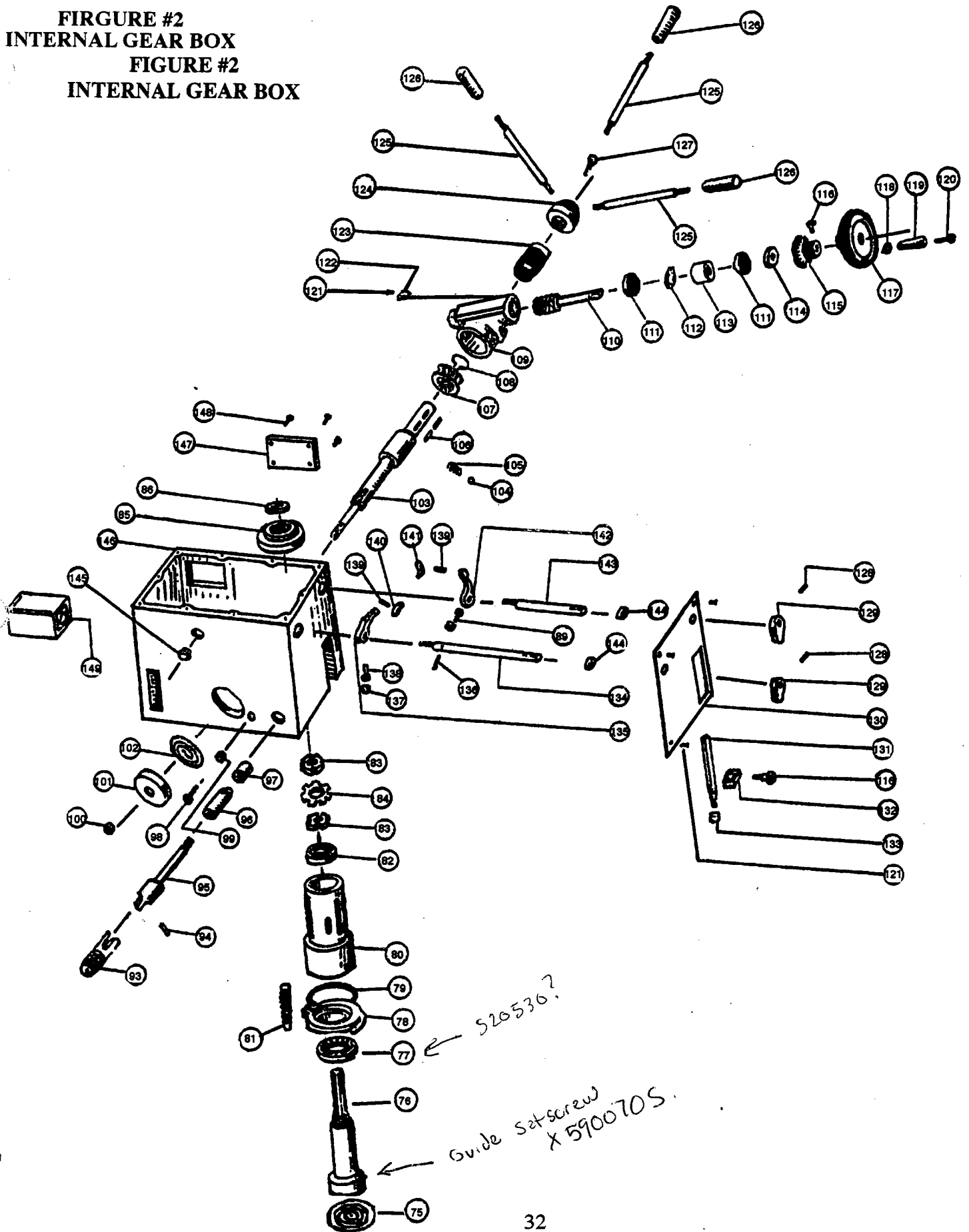
BX-139	Pin	.125 x .800.	2
BX-140	Block		1
X-141	Block		1
BX-142	Gear change lever (right)		1
BX-143	Connecting rod (right)		1
BX-144	Oil seal		2
BX-145	Oil pilot	Sight Glass	1
BX-146	Headstock casting case		1
BX-147	Side cover plate		1
BX-148	Bolt (M6X12)		4
BX-149	Forward-Stop-Reverse Switch		1
BX-150	Ball bearing (60103)		5
BX-151	Shaft		1
BX-152	Key (6X35)		1
BX-153	Gear (M 1.75 X 53T)		1
BX-154	Gear (M 1.75 X 21T)		1
BX-155	Sleeve		1
BX-156	Snap ring		2
BX-157	Rubber cap		2
BX-158	Adjusting washer		1
BX-159	Gear (M1.5 X 58T)		1
BX-160	Gear (M 1.5 X 41T)		1
BX-161	Gear (M 1.5 X 49T)		1
X-162	Shaft		1
BX-163	Spring		1
BX-164	Key (6X60)		1
BX-165	Key (5X50)		1
BX-166	Snap ring		2
BX-167	Set screw (M6X6)		1
BX-168	Gear (M1.75 X 21T)		1
BX-169	Gear (M1.75 X53T)		1
BX-170	Set screw (M6X8)		2
BX-171	Adjusting washer		2
BX-172	Washer		1
BX-173	Gear (M1.5 X 20T)		1
BX-174	Gear (M1.5 X 37T)		1
BX-175	Gear (M1.5 X 26T)		1
BX-176	Key (5X85)		2
BX-177	Shaft		1
BX-178	Ball bearing (80107)		1
BX-179	Snap ring		1
BX-180 X 50180	1 HP motor		1
BX-181	Marker plate		1
BX-182	Bolt (M6X2)		6
X-183	Headstock top cover		1
BX-184	Oil bolt		1
BX-185	Bolt (M10X30)		4
BX-186	Top cover taper pin		2
BX-187	Oil discharge bolt		1

FIGURE #1  
BASE-TABLE &  
SUPPORT COLUMN

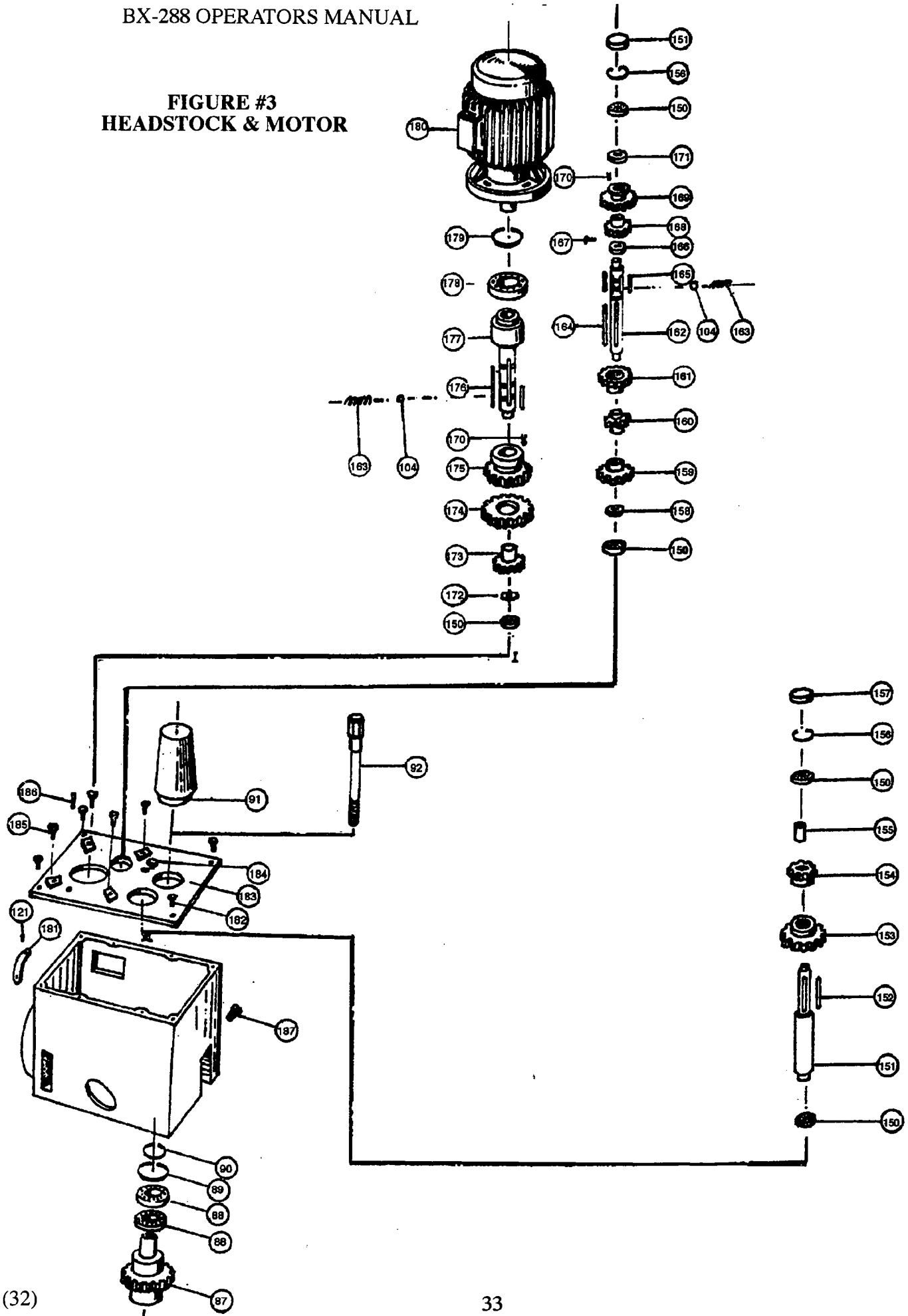




**FIRGURE #2**  
**INTERNAL GEAR BOX**  
**FIGURE #2**  
**INTERNAL GEAR BOX**



**FIGURE #3  
HEADSTOCK & MOTOR**



**TABLE 34-1**  
**CUTTING SPEEDS FOR VARIOUS DIAMETERS**

FEET PER MINUTE	50	60	70	80	90	100	110	120	130	140	150	200	300
DIAMETER INCHES													
1/16"	3056	3667	4278	4889	5500	6111	6722	7334	7945	8556	9167	12229	18344
1/8"	1528	1833	2139	2445	2751	3056	3361	3667	3973	4278	4584	6115	9172
3/16"	1019	1222	1426	1630	1833	2037	2241	2445	2648	2852	3056	4076	6115
1/4"	764	917	1070	1222	1375	1538	1681	1833	1986	2139	2292	3057	4586
5/16"	611	733	856	978	1100	1222	1345	1467	1589	1711	1833	2446	3669
3/8"	509	611	713	815	917	1019	1120	1222	1324	1426	1528	2038	3057
7/16"	437	524	611	698	786	873	960	1048	1135	1222	1310	1747	2621
1/2"	382	458	535	611	688	764	840	917	993	1070	1146	1529	2293
5/8"	306	367	428	489	550	611	672	733	794	856	917	1223	1834
3/4"	255	306	357	407	458	509	560	611	662	713	764	1019	1529
7/8"	218	262	306	349	393	426	480	524	568	611	655	874	1310
1 1/8"	191	229	267	306	366	372	420	458	497	535	573	764	1146
1 1/4"	170	204	238	272	306	340	373	407	441	475	509	679	1019
1 1/4"	153	183	216	244	275	306	336	367	397	428	458	612	918
1 3/8"	139	167	194	222	250	278	306	333	361	389	417	556	834
1 1/2"	127	153	178	204	229	255	280	306	331	357	382	510	765
1 5/8"	117	141	165	188	212	235	259	282	306	329	353	470	705
1 7/8"	102	122	143	163	183	204	224	244	265	285	306	408	612
2"	95	115	134	153	172	191	210	229	248	267	287	382	573
2 1/4"	85	102	119	136	153	170	187	204	221	238	255	340	510
2 1/2"	76	91	107	122	137	153	168	183	199	214	229	306	459
2 3/4"	69	82	97	111	125	139	153	167	181	194	208	278	417
3"	64	76	89	102	115	127	140	153	166	178	191	254	371

This table provides exact R.P.M. speeds for bit sizes, based on Feet Per Minute; The mathematical calculation does not take into consideration machine speed limitations. The BX-288 has 6 speeds available ranging from a high of 1625 to a low of 95 R.P.M. Use the table to determine the exact rate of speed you should use for your cut and set the speed to the closest speed available on the BX-288. The range of speeds available on the BX-288 will enable you to cut most material properly without difficulty.

**TABLE # 35-1**  
**CUTTING SPEEDS RECOMMENDED FOR**  
**MILLING IN FEET PER MINUTE**

MATERIAL		Brinell Hardness	High Speed Steel Cutters	Carbide Cutters
Free Machining Low Carbon Steel resulphurized 1111,1112		100-150 150-200	120-160 120-180	400-600 400-900
Free Machining low carbon Steel Leaded, 10L18, 12L14		100-150 150-220	100-225 110-250	250-500 250-600
Plain Low Carbon Steels	1006 1026	100-125 125-175	80-150 80-140	300-600 250-500
Plain Medium Carbon Steels	1030 1052	125-175 175-225	80-140 70-130	250-500 225-400
Plain high Carbon	1060 1095	125-175 175-225	70-120 60-110	250-450 225-400
Tool Steels	W1-W7	150-200	80-120	300-350
Tool Steels	H20-H43	200-250	40-85	175-300
Tool Steels	D1-D7	200-250	30-60	100-200
Stainless Steel	302	135-185	70-100	225-350
Stainless Steel	430F	135-185	100-140	350-450
Gray Cast Iron: ASTM Class 20 Through Scale: Under Scale:		100-140 -----	80-120 110-150	325-500 400-600
Malleable iron, Ferritic, 32510 Through Scale: Under Scale:		110-160 -----	140-200 130-225	350-700 400-800
Aluminum, Cold-drawn Wrought Alloys		-----	500-800	1000-1800
Aluminum, Casting alloys (as cast)		-----	600-1000	1200-2000
Brass, 360 free-cutting, cold drawn		-----	300-500	600-1000
Bronze, 220 commercial, annealed		-----	80-140	180-275

# BX-288 TROUBLE SHOOTING GUIDE

TROUBLE	PROBABLE CAUSE	SOLUTION
Noisy Operation	1. Gear box low on oil	Fill oil reservoir with light grade oil. See Maintenance Section on Page 23
Drill/Mill Burns	<ol style="list-style-type: none"> <li>1. Incorrect speed</li> <li>2. Chips not coming out of hole</li> <li>3. Dull drill</li> <li>4. Feeding too slow</li> <li>5. Not lubricated</li> <li>6. Turning wrong direction</li> </ol>	<p>Change speed, see page 15</p> <p>Retract drill to clear chips</p> <p>Resharpen drill/mill</p> <p>Feed faster to allow drill to cut</p> <p>Use cutting or tapping fluid</p> <p>Reverse direction</p>
Drill leads off..... hole not round	<ol style="list-style-type: none"> <li>1. Drill cutting lips and/or angles are not equal</li> <li>2. Bent drill bit</li> </ol>	<p>Resharpen drill correctly</p> <p>Replace drill bit</p>
Excessive drill runout or wobble	<ol style="list-style-type: none"> <li>1. Bent drill</li> <li>2. Worn spindle bearings</li> <li>3. Drill not properly installed</li> <li>4. Chuck not properly installed</li> </ol>	<p>Use a straight drill</p> <p>Replace bearings</p> <p>Center drill in chuck</p> <p>Check chuck to drawbar installation</p>
Quill returns too slow or fast	1. Spring has improper tension	Adjust spring, see page 25 "spring tension adjustment"
Inconsistent cuts or distortions in workpiece	<ol style="list-style-type: none"> <li>1. Excess tension on cutting tool</li> <li>2. Improper clamped workpiece</li> </ol>	<p>Slow down cut to allow tool to make a proper cut</p> <p>Reset clamping to avoid binding or distortion</p>
Cutting action too coarse or rough	<ol style="list-style-type: none"> <li>1. Using the wrong bit</li> <li>2. Forcing bit through workpiece too fast.</li> </ol>	<p>Use bit designed for fine cutting</p> <p>slow travel down to allow bit to make a proper cut</p>

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