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# 1

## GENERAL INFORMATION

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The Phil Spoke Cutting & Threading Machine is designed and manufactured by Phil Wood & Company. This machine enables you to manually cut and place a *factory quality* thread on a spoke in a few seconds. With one rotation of our machine's handle, the spoke is sheared to the length you've selected; then, the spoke is rolled through our threading dies. Material is not removed to form the thread on the end of the spoke. The threads are formed into the spoke by rolling the spoke between a matched set of dies.

Our machine cuts 1.8 mm (15 gauge) and 2.0 mm (14 gauges) spokes and places 10 millimeters of 56 TPI thread at the end of the spoke. If necessary, a spoke can be cut on its existing threads and be re-threaded. The threaded portion remaining on the spoke will line up with the cutting surfaces on our dies to produce a uniform 10 mm of thread. Butted and aero spokes can be cut and threaded on portions of the spoke that are full diameter. The machine is not designed to be used on the narrower butted portion or on the transition portion of double butted spokes. It is also not designed to be used on the aero contour areas of a spoke.

Standard gauge spokes may be cut from 28 to 310+ millimeters in length. We recommend that double butted spokes be cut no closer than 5 mm to the narrower butted portion.

The spoke materials placed through our machine can be of standard carbon steel, stainless steel, titanium and other exotic materials. Our machine is able to cut and thread spokes that are coated with zinc, chrome, and other plating. However, placing these materials through our machine will require frequent inspection, cleaning and flushing of the dies with Phil Tenacious Oil to remove particles of the plating material.

For the standard diameter spokes, all shorter lengths can be made from an inventory of longer lengths. Over time, the number of different lengths in stock should be reduced significantly. The optimum situation is to have in bulk, those spokes commonly used in your wheel building speciality; and the longest 1.8 and 2.0 mm spokes available. These long spokes give the ability to produce any specific length required.

Double-Butted spokes create an additional inventory problem. We recommend that at least 5 mm of the double-butted portion be left below the threads. With the use of our double butted spokes with 50 mm of double butting on the threaded portion, spoke lengths from 230 to 310 mm can be obtained from an inventory of two double butted spoke lengths: *270 mm & 310 mm*.

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## 2

## INSTALLATION

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The Spoke Cutting & Threading Machine requires about 2 square feet of bench space for a permanent installation. If space is at a premium, an optional vice mount bracket is available.

Each machine is supplied with the following:

- Mounting hardware
- Required hex wrenches
- Setup spacers for 1.8 mm and 2.0 mm diameter spokes
- A long spoke holder
- A bottle of Phil Tenacious Oil and a tub of Phil Hand Cleaner
- One pair of safety goggles
- Custom Shipping Container

The following optional items are available with the machine:

- A short spoke holder
- A spoke tray
- Wheelsmith™ Spoke Length System
- Sutherland's Handbook with hub specifications & spoke length charts
- The Phil Spoke Length Gauge
- Vice-Mount adaptor



Basic Components of the Spoke Cutting & Threading Machine

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## WORKBENCH INSTALLATION

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Select a location on your workbench for the spoke machine. The right edge of the base should be located no more than  $\frac{3}{8}$ " from the edge of the bench. Install the machine 4" or 5" back from the front edge of the bench to leave room for a box of spokes in front of the machine, or for clearance for the front of our spoke tray. Drill three  $\frac{5}{16}$ " holes through your bench to match the base plate mounting holes where you will install the machine. Install the base securely using the  $\frac{5}{16}$  - 18 x 2- $\frac{1}{2}$ " bolts, washers, and nuts. Fasten the crank arm to the eccentric using the  $\frac{5}{16}$  - 18 x 1" bolts.



Normal spoke machine workbench mounting

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## VICE-MOUNT INSTALLATION

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If workbench space is at a premium, an alternate way to install the machine is to use the vice-mount adaptor. Install the vice-mount adaptor directly to the machine base plate or install the spoke tray between the vice-mount adaptor and the machine base plate. The tray is designed to hold, in front of the machine, spokes to be cut; and to capture the spokes in the back after they are threaded.



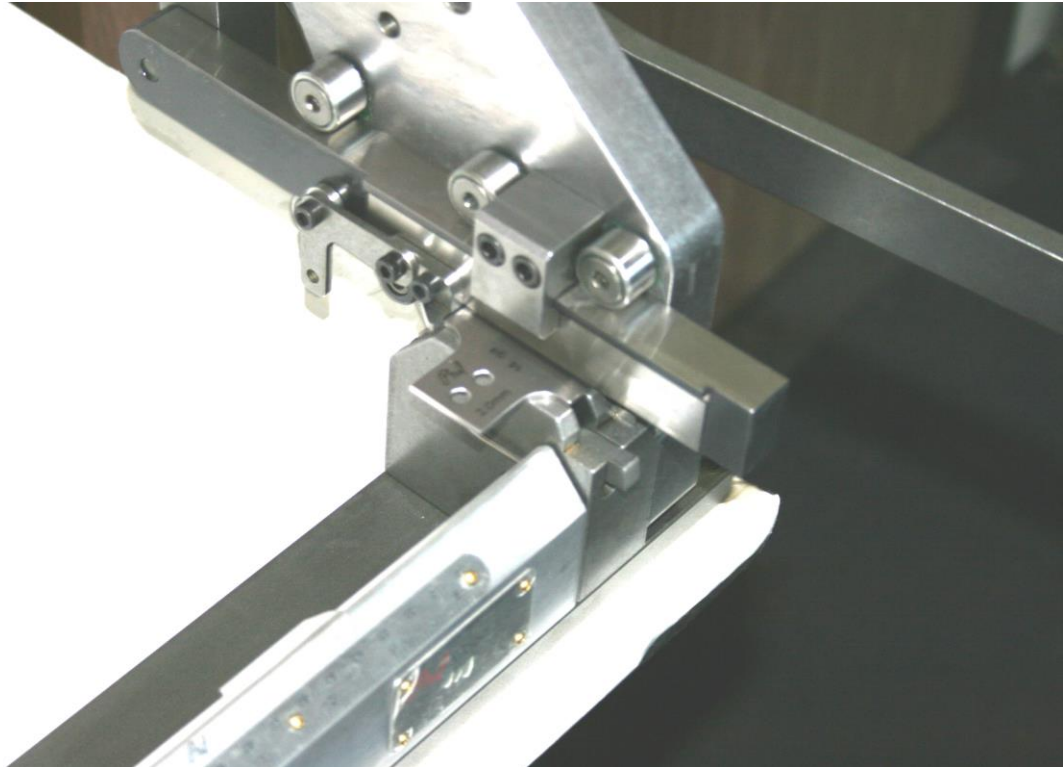
Spoke machine in vice-mount adaptor with tray

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## SPOKE DIAMETER ADJUSTMENT

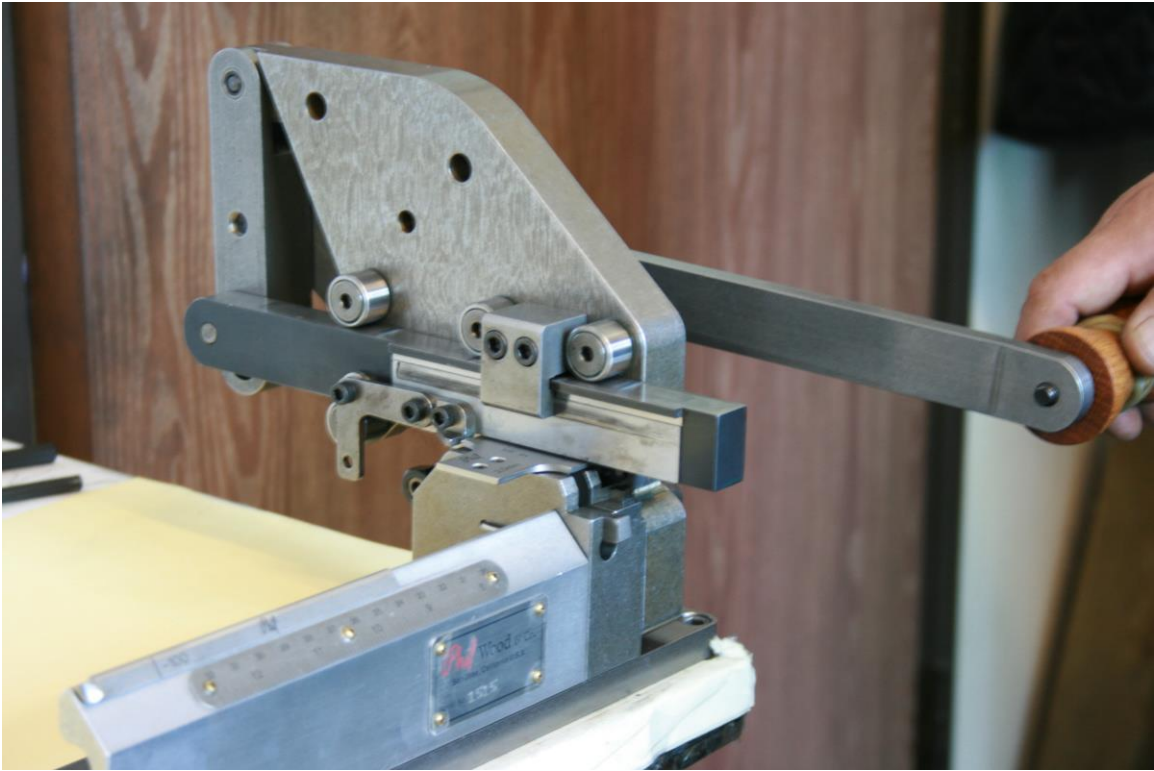
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To change between 2.0 mm and 1.8 mm spokes, the machine must be readjusted. Loosen the three  $\frac{5}{16}$ " frame bolts on the right side of the unit. Slide the setup spacer under the slide as shown with the spoke diameter indicator on the setup spacer showing the desired size.



Setup spacer fitted between slide and block

It may be necessary to lift the frame assembly slightly to fit the spacer under the slide. Turn the crank arm until it is horizontal. It should stop at this point, as the spacer is gripped at the front by the fixed cutter, at the back by the spoke alignment guide and with the side flush against the large frame.



Proper position of crank arm and spacer



Press down very firmly on the forward edge of the slide support. The threading dies will contact the top and bottom of the spacer while you press down with one hand and thoroughly tighten the frame screws with the other. *For machines with serial numbers up to 188, rocking the frame back and forth gently as you continue to apply the downward pressure will indicate how well the spacer is fitted between the dies. You should feel a central position as you rock the frame. That is the position to hold the adjustment as the screws are tightened.* After the three frame bolts are tight, lower the crank handle enough to allow slight movement of the setup spacer. The setup spacer, just like a feeler gauge, should feel snug over its entire length. If not, repeat the procedure.



Press down on the slide support while tightening frame bolts

After tightening the bolts, remove the spacer as you turn the crank back down to vertical. Do not allow the spacer to move back with the slide. It is tapered and would wedge tightly against the dies. The machine is now set for the selected spoke diameter.



Remove the spacer to avoid jamming it against the dies when the crank is returned to it's starting position



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# 3

# OPERATION

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All machines are shipped ready to cut & thread 2.0 mm (14 gauge) spokes. Spoke length is set by sliding the spoke holder until its right hand edge is in line with the desired length on the scale. To adjust the holder for much shorter spokes, a line is placed on each spoke holder with an indication of what the reduction in length is when that line is placed above a measurement on the spoke length scale.

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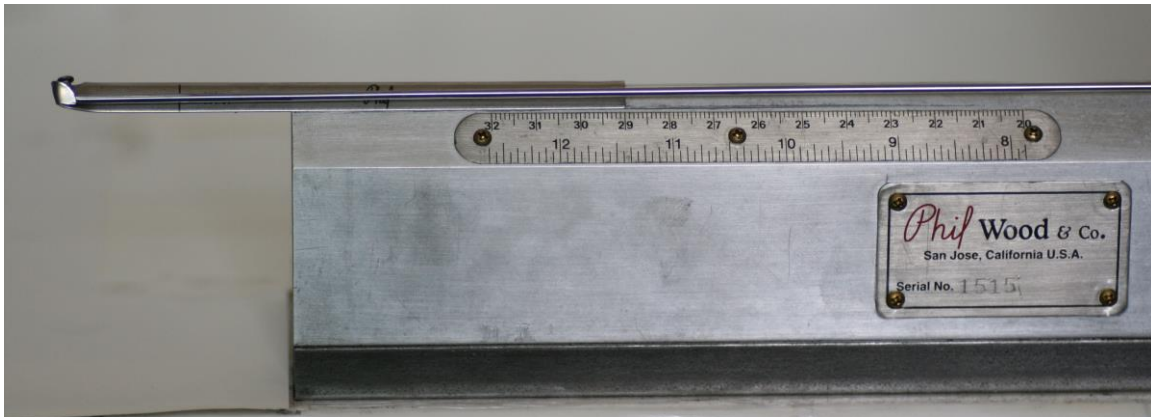
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## SPOKE POSITIONING WITH THE LONG SPOKE HOLDER

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The long holder is capable of indicating lengths from 154 to 320 mm. For short spokes, there is a line near the left end of the long holder, which when aligned with the scale will reduce the spoke length by 100 mm of what is indicated on the scale.



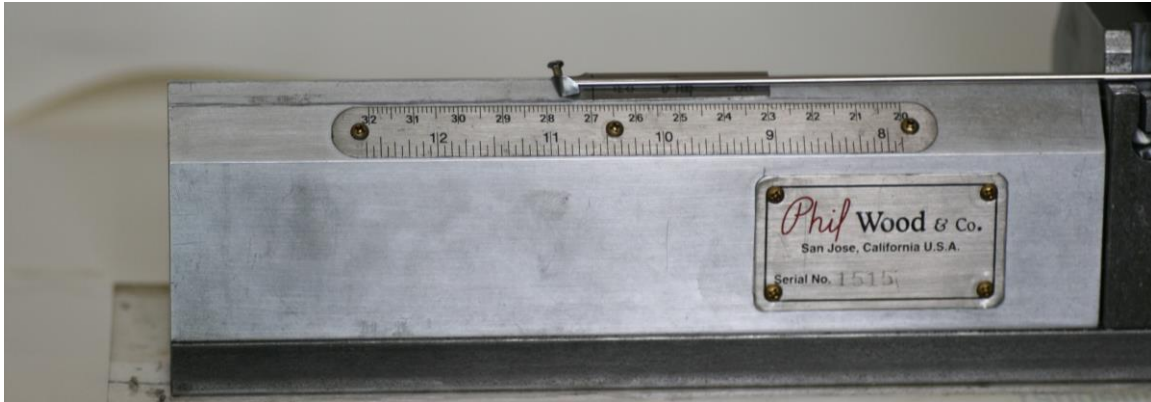
The spoke holder is set to cut spoke at 290 mm length

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## SPOKE POSITIONING WITH THE SHORT SPOKE HOLDER

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For extremely short spokes use the optional shorter holder. The short holder is capable of indicating lengths from 80 to 240 mm. Its right edge reduces the spoke length 80 mm and its left mark reduces the spoke length 120 mm of what is indicated on the scale. Holders are installed by sliding them on the left end of the gauge rail.



The short spoke holder is set to cut a spoke to a 150 mm length

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## SPOKE CUTTING

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To begin the cutting & threading of a spoke, the crank should be at the bottom of its stroke. Place a spoke into the spoke holder pocket with the head of the spoke upright. The segment to be cut is positioned above the groove in the (lower) movable cutter.



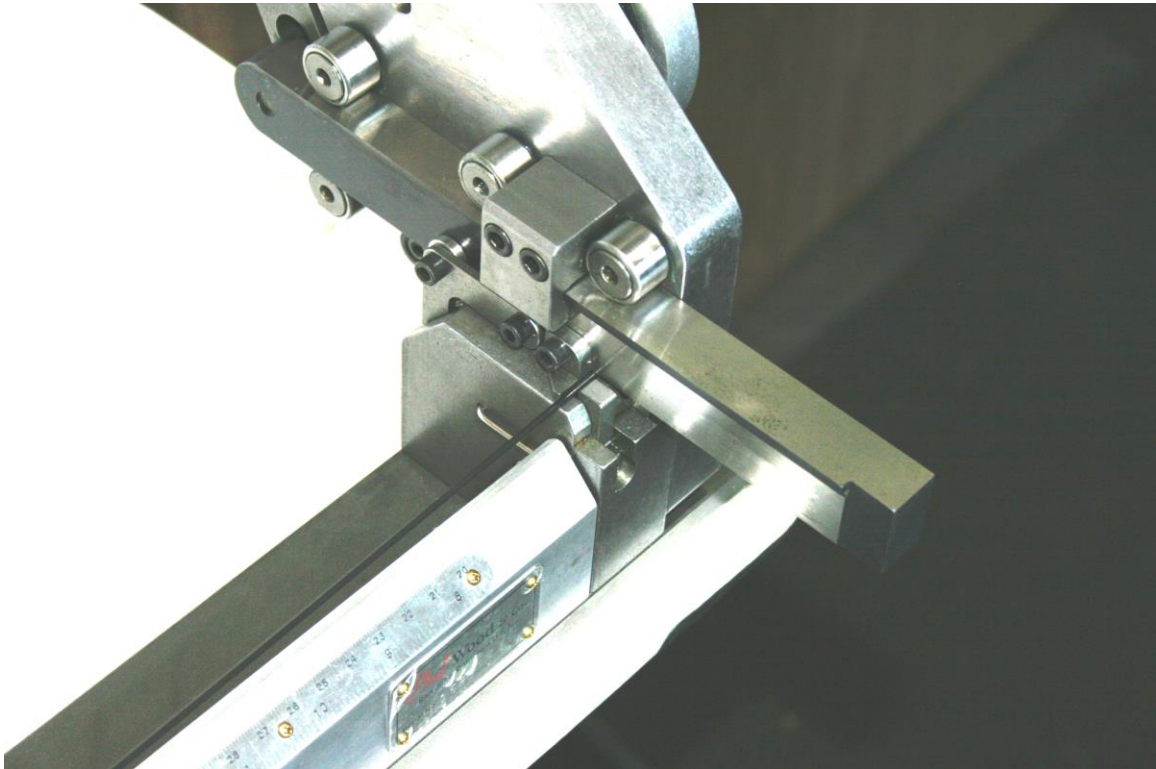
Spoke in position to be cut



Holding the spoke ready to cut

Hold the spoke in the holder as you turn the crank clockwise  $\frac{1}{4}$  turn. In that first 90° of crank movement, the spoke will be sheared by the (lower) moveable cutter and the upper fixed cutter. Continue to turn the crank clockwise. The spoke will be lifted by the flipper into the threading section of the machine. The flipper will push the spoke against the spoke alignment guide bolted onto the slide.

At this time you should release the left end of the spoke because, from this point on, the spoke will be rolled through the machine without the need of external support. Practice will enable one to get the timing of releasing the spoke smoothly.



The flipper feeds the spoke up into the thread rolling dies

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## SPOKE THREADING

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Continuing the rotation of the crank after the spoke is cut brings the spoke into contact with the thread dies and then rolls it between them, forging the threads. At the end of the cycle, the spoke drops out the back of the machine and the crank is back at the bottom of its stroke.



Flipper beginning to release the spoke. Thread dies now firmly grip the spoke.

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## 4

## MAINTENANCE

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Standard maintenance of the Spoke Cutting & Threading machine consists primarily of lubrication. The section on lubrication covers the locations to lubricate and when the lubrication should be performed.

The bearings used in the Spoke Cutting and Threading machine are packed with Phil Waterproof Grease™ and should not require any maintenance. Experience has shown that they should last through several hundred thousand spokes before any replacement is required.

Die replacement may be required after about one hundred thousand spokes. Dies are matched side for side. After about fifty thousand spokes, it may be necessary to rotate both surfaces to present new surfaces for threading.

The cutters need to be maintained to present sharp cutting edges to the spoke. The fixed cutter is designed to be rotated for eight usable cutting edges.



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## LUBRICATION

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The threading dies need Phil Tenacious Oil every 50 cycles or so. They can be lubricated by bathing a spoke in oil and feeding it through the machine. Once a week the slide should be oiled on both vertical faces. Also weekly put a drop of oil on top of the movable cutter so oil will flow into the cutter slot. Other moving parts should be oiled monthly as follows: a drop of oil at the back of the flipper, on the swing hinge, in the swing slot (both at the top of the machine) and on the outside of the eccentric, (between the eccentric and the eccentric bolt).



Lubricating the movable cutter

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## DIE REPLACEMENT

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Die thread life is about 50,000 spokes per side. Worn dies will make the threading procedure feel rough and will not forge threads deep enough into the spoke. The illustration shows the difference between good and bad threads.

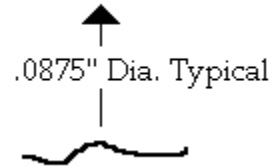
Good Thread Section



Worn Thread Section

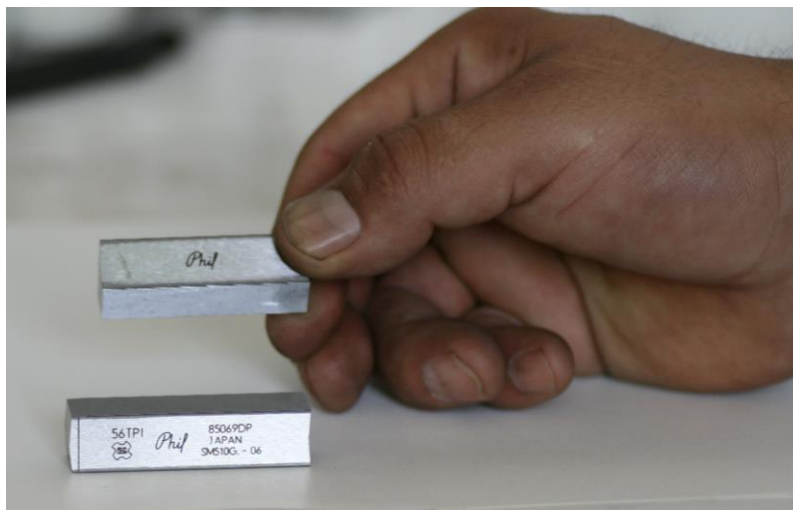


For 2.0mm Spoke



Comparison of good spoke threads and those formed on worn dies

The dies are double sided so they can be rolled over. Note that they should be rolled as shown below. They must not be flipped end over end. The machine will come out of adjustment if this is done, and the lower die could be damaged.



Each die is labeled on one of the vertical faces. The labeled sides must both face the same direction because the threading surfaces of the dies are precisely matched.



Left: Die set for machines numbered up to 188  
Right: Die set for machines numbered 189 and up

**!!! IMPORTANT !!!**

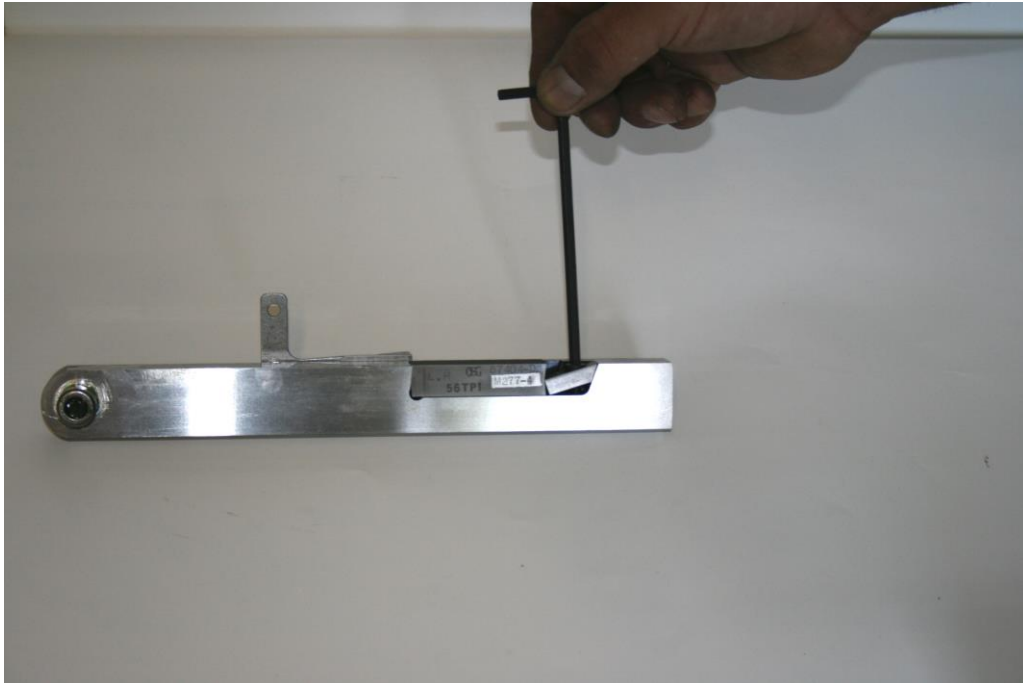
*ON MACHINES WITH SERIAL NUMBERS **189 AND ABOVE**, THE DIES HAVE CONCAVE AND CONVEX ENDS. (THEY ARE "ARROW" SHAPED) THE "ARROW" SHAPE MUST POINT FROM THE FRONT TO THE BACK OF THE MACHINE .*

To change dies, first remove the slide. This is accomplished by first removing the bolts holding the slide support to the frame. Next remove the slide support and pull the slide away from the frame. Care must be taken to not lose the roller bearing in the swing arm slot which fits the dowel pin at the back of the slide.



Bearing in swing slot

Loosen the die clamp in the slide and pull the die out of its pocket, roll it over and reset it in the die pocket. Hold the die firmly in place as you re-clamp it. Only light pressure is needed to clamp this die in place. Place the long arm of the hex wrench in the die clamp screw. Hold the wrench at the 90° bend with two fingers and snug down the screw approximately ¼" turn past "finger tight". Do not over tighten the clamp as this can fracture the slide and deform the die clamp.



Gripping the hex wrench to tighten the top die clamp

Next, remove the lower die clamp. Slide the lower (fixed) die out of the block.

Roll the die over and re-install it in the block above the .010" thick shim. Pull the die into the pocket in the block while re-tightening the die clamp. Put the short arm of the hex wrench into the die clamp screw and tighten approximately ¼" of a turn past "finger tight".

When reinstalling the slide, oil the frame where contact is made, the roller bearing in the swing arm slot, and the slide support where it contacts the slide.



Apply oil to the slide bearing and the frame

Push up on the slide support, as you tighten the screws. This draws the slide up against the rollers to eliminate vertical play. This promotes consistency of timing during the threading procedure.



Tightening the slide support bolts



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## CUTTER REPLACEMENT

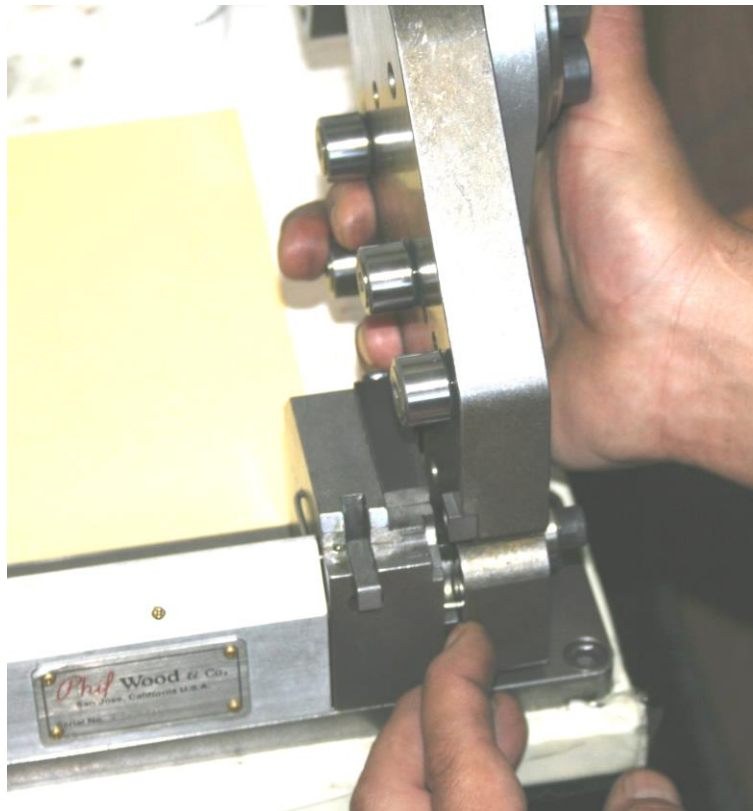
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Fixed cutter replacement: With the crank in the down position, remove from the side of the frame, the 10 - 32 SHCS which retains the cutter. Slide the cutter out the front of the machine. Rotate the cutter to present a fresh cutting edge and replace it in the frame. Re-install the retaining screw.

Moveable Cutter replacement: To change the movable cutter, the frame assembly must be removed from the base. Remove the three frame screws. Together, slide the frame, the cutter lever and the movable cutter off. If these are not removed together, the cutter spring and link will be disconnected and will need to be hooked back on.

Remove the worn movable cutter and install the replacement. Be careful to seat the "U" pin link between the cutter and cutter lever into the pocket in the frame.

Lubricate the cutter with Phil Tenacious Oil and re-assemble the frame to the machine body.



Removing the frame from the base



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# 5

# TROUBLESHOOTING

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This section has been developed to assist you in keeping your Spoke Cutting & Threading machine as productive as possible. The topics covered in this section comprise the most common problems observed in units returned to our service department for repair. Additionally, we have included those items that our technical support department has reported as being typical of the topics and problems discussed with a number of users of our machine.

In the event that you encounter a problem not covered in this section, be sure to call our service department. We are able to answer most of the questions over the phone. In the event that the machine needs to be returned to the service department, keep the original shipping container.

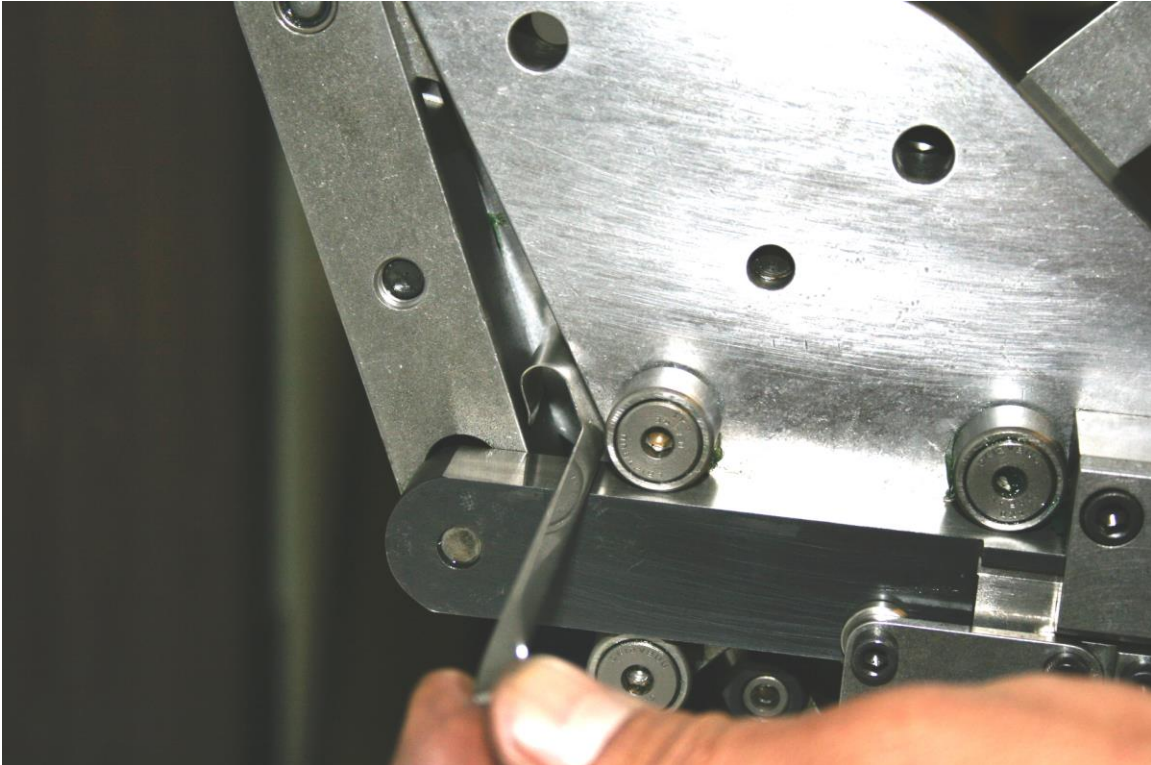
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## INCONSISTENT SPOKE LENGTH

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*SYMPTOM:* Length of spoke changes

The spoke holder should fit snugly on the gauge bar. If it is loose, slide it off the end of the bar and squeeze the curl between the frame and swing arm. Slide the spoke holder back on to check the fit.



Tightening the holder

When cutting less than 10 mm off a spoke, the threads will fit between the cutters. As the cutters come together, they will force the spoke to shift slightly so that the thinnest section will be cut. This shifting can gradually push the spoke holder out of position. To avoid this, always turn the crank **QUICKLY** through the first quarter turn. This shears the spoke quickly, which eliminates the tendency to move the spoke holder. Check the spoke holder position every 20 strokes or so to confirm that it has not moved.

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## BAD THREAD QUALITY

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**SYMPTOM** : Bad threads on cut spokes

This can be caused by worn dies, improper adjustment for the spoke diameter, or die misalignment.

If the dies are not worn (see Maintenance) there are other items to check.

First, always be sure the machine is set for the diameter of spokes you are using. Next, be sure that the problem is not just at the very end of the thread. Sometimes during the transition from cutting to threading the spoke can be inadvertently pushed to the right after it passes the fixed cutter. That puts the very end of the spokes beyond the working edge of the thread dies so it will not be threaded. If this is not corrected it can eventually dig into the face of the frame, raising a burr which could interfere with the setup operation.

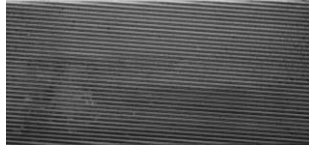
It is possible that a spoke can be jammed crooked between the dies. If forced, the spoke may knock one of the dies out of alignment. Inspect the dies to ensure they are properly seated in the pockets (see maintenance). Rather than force a jammed spoke through the cycle, reverse the crank direction and back the spoke out of the dies and cut of the threaded portion. If a jammed spoke will not back out of the machine easily, loosen the three frame bolts. Remove the spoke and re-adjust the machine for the proper spoke size.

## PICTURES

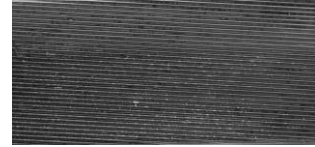
### Die Wear:



No wear

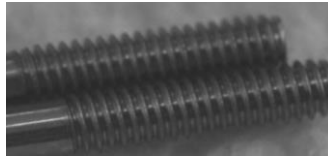


Moderate wear



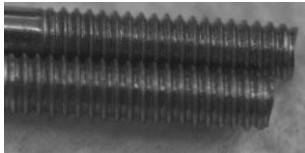
Worn out

### Spoke Threads:

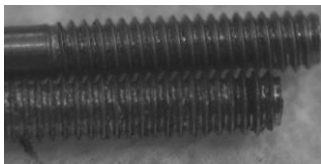


New Die, Proper Die Alignment

### Die Wear Problems:

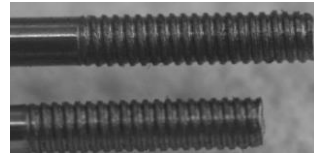


Moderate Die Wear

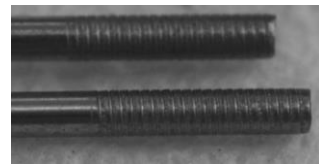


Worn Out Dies

### Alignment Problems:



Moderate Misalignment



Severe Misalignment

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## SPOKES NOT PICKED UP BY THREADING DIES

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***SYMPTOM*** : Spokes do not feed into the threading dies.

This can be caused by a loose slide, the improper placement of the spoke for pickup by the dies, die misalignment, or by the lower (fixed) die being installed backwards.

*SLIDE SUPPORT ADJUSTMENT:*

Always check your spokes for proper diameter and reset the spacing if you question it. Next, be sure there is no vertical clearance between the slide and the nearest of the three top rollers. Play at this point causes inconsistent spoke feed.



Checking vertical play between slide and front cam follower

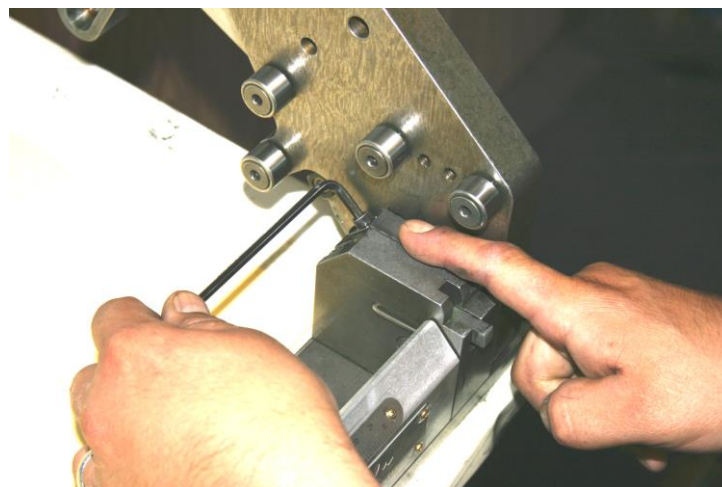
### *PLUNGER PUSHER ADJUSTMENT:*

Loosen the slide support screws and pull up gently on the slide support as you tighten the screws. Rotate the crank once to be sure the slide is not too tight against the roller. Another way to adjust the timing of the threading operation is to change the position where the spoke is placed for the thread rolling dies. Loosen the two plunger pusher screws and pivot the bottom of the plunger pusher towards you slightly while you tighten the screws. This retards the release timing of the flipper so it will hold the spoke in place longer before backing off.



Adjusting plunger pusher

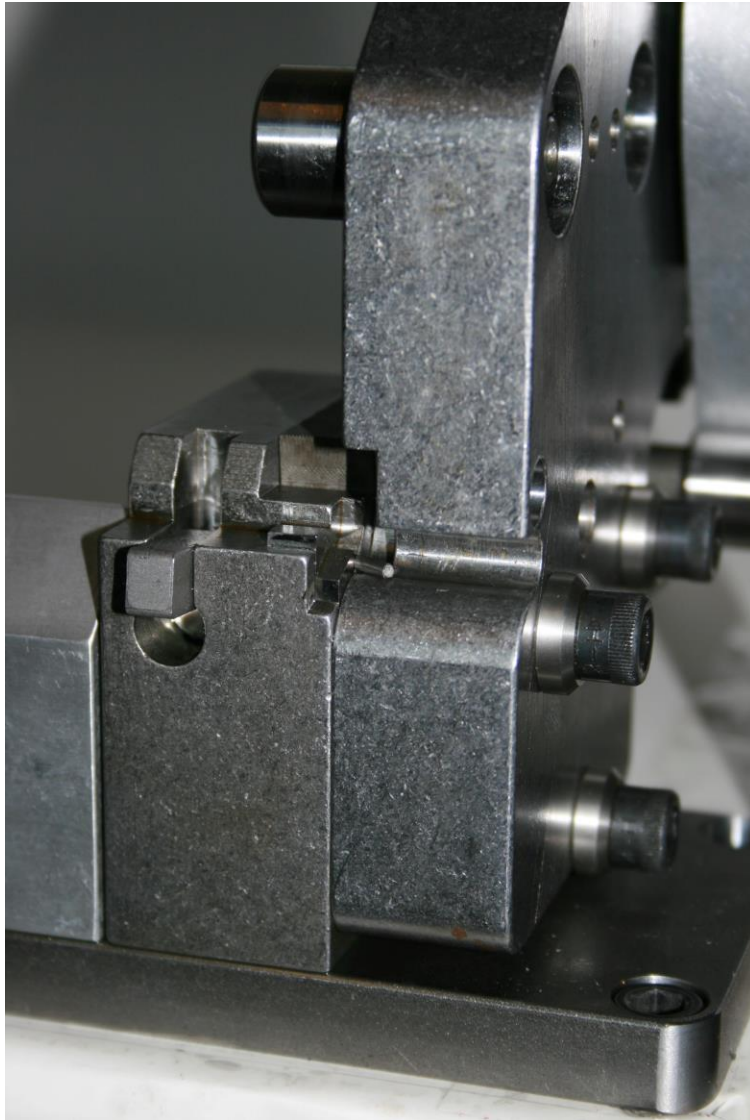
If the spoke still does not get a start onto the leading edge of the die, the bottom die itself might be cocked. Remove the slide so you can see the bottom dies and its clamp. Verify that the lower (fixed) die is properly oriented. Grip the thread face with your fingers while you loosen the clamp screw slightly. If you feel the die move, it was probably out of position. Press on the thread face to pull it into its pocket while you tighten the clamp.



Realigning the bottom die



There are two other things to check if the feed is not right. First, remove the fixed cutter so you can inspect the space directly below it. Bits of cut spokes can lodge in that space. They could keep the thread dies from being properly spaced by prohibiting the frame assembly from dropping far enough to allow the dies to grip the spacer.



Spoke chip under fixed cutter

*(Cutter and slide removed for this illustration)*

Next check the frame below the slide. You will need to remove the slide to do this. If the spokes have dug into the frame, the burr they raised could interfere with setting the dies spacing. Remove the frame from the base ("Cutters" in Maintenance) and file off any burrs.



Check the frame for burrs

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## LIMITED FLIPPER MOVEMENT

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**SYMPTOM:** Limited Flipper Movement

This can be caused by a burr on the flipper, a burr on the block in the slot for the flipper, or debris in the flipper gear.

After extended use, a burr may develop on the vertical face of the flipper. It is caused by the pressure of thousands of spokes pushing against it during the feed cycle. File the corner of the flipper to remove the burr.



Filing burr on flipper

Another cause of a stuck flipper is loose spoke bits accumulated in the flipper gear. Sometimes they can be blown out with compressed air. If that doesn't work, the flipper should be removed to get at the chips. Unbolt the machine from the bench. On the bottom of the base you'll find two  $\frac{1}{4}$  - 20 x  $\frac{3}{4}$ " bolts which hold the gauge rail on the base. Remove them and the gauge rail. Now you have exposed the pin on which the flipper pivots. Pull this pin straight out (you might need pliers to grip it).

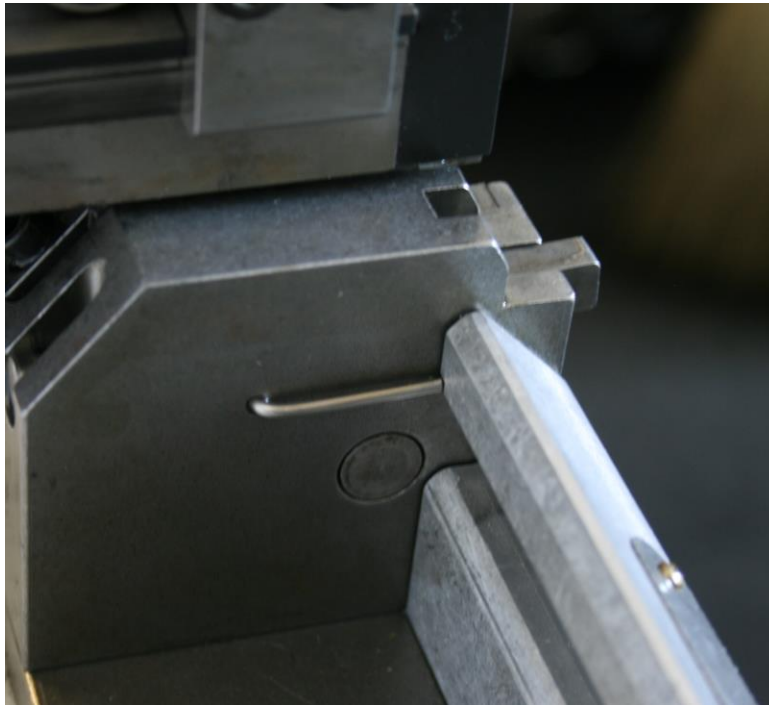
The flipper can be lifted out of its slot to expose the gear. Clean out any chips, oil the gear, and the pivot pin and reinstall the flipper.



Oiling the flipper gear

Work the flipper up and down by hand to test it. If there is a tight position in the flipper travel, tap lightly on the end of the flipper with a hammer to smooth out the motion. This will help mess the gear teeth on the flipper with the teeth on the lower rack.

When reinstalling the gauge bar, be careful to engage the plunger retainer pin in its slot.



Plunger Retainer pin installed in gauge bar

Note: When ordering replacement parts, specify the machine's serial number so we can match it exactly. Many parts have undergone changes as we modify and improve the design.

If you still have a problem with the machine, be sure to call us. We can answer most of the questions by phone. Save the original shipping carton in case you need to send your machine to us.

If you need to return the machine to us and cannot locate the original shipping carton, remove and retain the crank arm and its mounting bolts. Pack the machine carefully and include the set-up spacer.