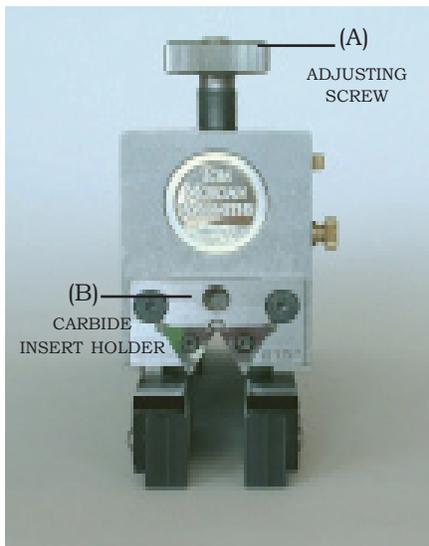


# MORGAN HAND MILL PLANE

The plane is specially designed to utilize my ideas for hand milling bamboo strips in a manner similar to a milling machine only it is operated by hand. All of the operations performed with a milling machine such as roughing strips, tapering strips, hollow fluting strips, and making swelled butt rods can be done on the Hand Mill. In addition, with the purchase of separate cutting heads 8-, 6-, 5-, and 4-strip rod construction can be easily accomplished just by changing the cutter heads. As with most milling machines the bamboo strip cutting is done with carbide inserts instead of high-speed steel providing greater cutter life. However, with the Hand Mill as well as most modern tooling the carbide inserts are replaced instead of resharpened eliminating a time consuming task. The cutting head holds a set of two carbide inserts at a fixed angle that doesn't vary so you never have to check your strips to make sure the angle is correct.

The components of the plane are stainless steel and aluminum that are vibratory finished giving them a pleasing mat finish. The plane consists of an adjusting screw with a calibrated dial to determine the depth of cut, an adjustable hard stop, a sliding head with an adjustable gib that holds the various cutter heads, a scale on the side of the sliding head that determines the overall height, black anodized aluminum side rails that constitute the body, adjustable side rails for centering the nylon pads and adjusting for nylon insert wear, and replaceable reinforced nylon inserts impregnated with molybdenum disulfide that provide a slippery surface for the plane to ride on as it slides down the base. Located on the back of the plane and on top are two 1/4"-20 tapped holes along with two 1/4"-20 x 3/4" cap head screws for mounting the handle included with the plane.

Each component will be discussed in this section along with the instructions for using it and keeping it in correct adjustment. However, I have broken the instructions into two sections: one for day-to-day use and one for adjusting since the adjusting section will be used infrequently, if at all. In addition, at the end are instructions for mounting carbide inserts.



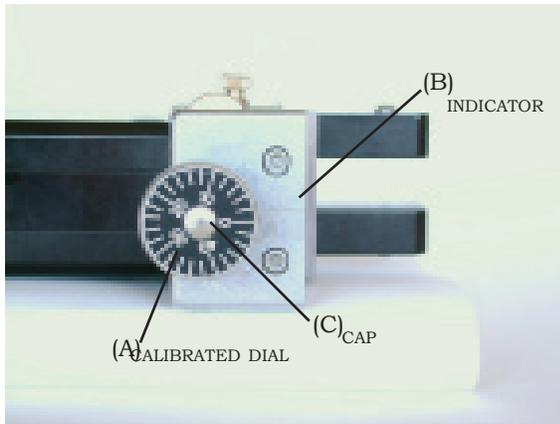
FRONT OF PLANE (photo 1.)

## DAY-TO-DAY INSTRUCTIONS

### Adjusting Screw

Looking at the front of the mill plane you will see the Tom Morgan Rodsmiths logo silver coin, the adjusting screw (A) and the carbide insert holder (B) photo #1).

The top of the adjusting screw has a calibrated dial reading from "0" to "50" in .002" increments (A) photo #2). Therefore, each clockwise revolution of the dial lowers the slide holding the cutter head .050" while a counterclockwise revolution raises the slide holding the cutter head .050".



**TOP OF PLANE HEAD** (photo 2.)

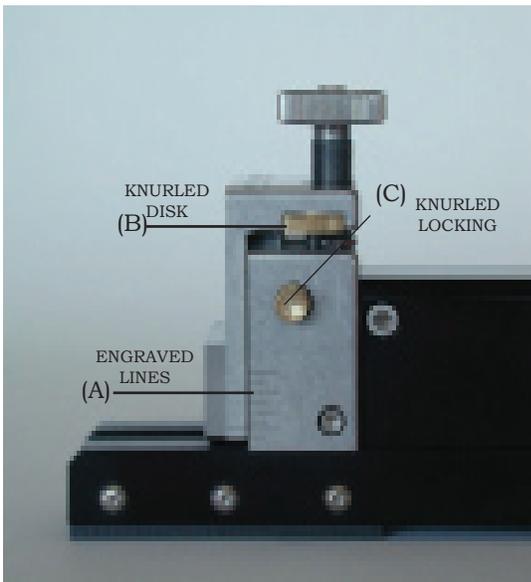
Centered on the top of the slide and under the front of the dial is an engraved line that serves as an indicator for adjusting the slide (B) photo #2). With careful adjustment accuracy of .001" can be achieved by interpolating 1/2 the distance between hash marks on the dial. There is also an anodized metal plug covering a hole that provides access to a cap head screw (C) photo #2). This will be discussed later in the adjusting section.

Correlating to the calibrated dial are engraved lines with .050" increments on the side of the slide and head (A) photo #3). These are reference lines so you can determine the height of the slide when adjusting it.

The adjusting screw is specially designed to eliminate end play and backlash in the adjusting threads. The reason for this is to eliminate "play" in the adjusting screw so that when you adjust the sliding head up or down it moves immediately without the traditional backlash of most hand adjustment screws.

### Adjustable Hard Stop

The purpose of the hard stop is to limit downwards travel of the cutter head to a preset height when cutting strips. The adjustable hard stop consists of a knurled disk (B) photo #3) attached to an adjusting screw, a locking brass bushing, and a knurled locking nut (C) photo #3).



**PLANE REFERENCE LINES AND ADJUSTABLE HARD STOP** (photo 3.)

Behind the knurled locking nut is the brass bushing that pushes against the stainless steel adjusting screw to lock it. If you remove the knurled locking nut be careful that the brass bushing isn't lost.

To use the hard stop you first determine the final depth of cut on your finish strip. Then you loosen the knurled locking nut, screw the knurled hard stop disk up against the bottom of the cutter slide, and retighten the knurled locking nut. This stops the cutter head from dropping below this preset depth and automatically insures that each strip is cut exactly to the same height as the previous one. The knurled locking nut only has to be finger tight to hold the hard stop in place.

A Hand Mill user, Joe Byrd, designed the original hard stop and it's with his generous permission that I'm using it on the new plane design.

## Hand Mill Storage

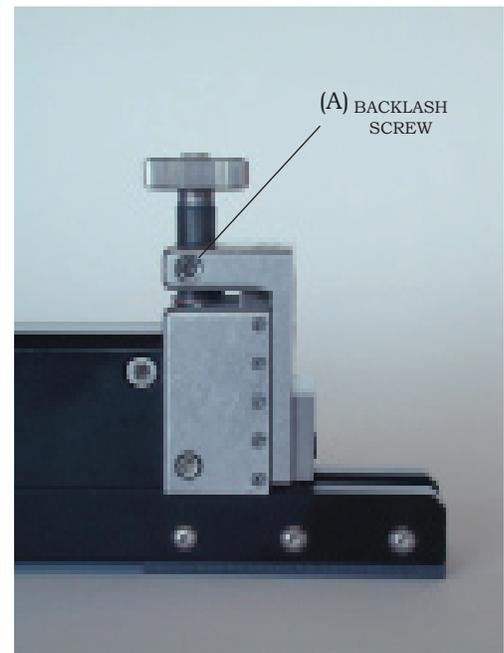
The Hand Mill is machined from stainless steel and aluminum that is black anodized so it is not subject to rusting. The cutter heads themselves are machined from tool steel so they are subject to rusting in moist climates. They should be kept in a warm and dry environment. When the cutter heads are not being used regularly wiping them with a lightly oiled cloth will help prevent rusting. Before starting to mill strips be sure to wipe off any oil so your bamboo won't be contaminated.

The Hand Mill should be stored at room temperature. It should not be left in direct sunlight for extended periods of time or subjected to high temperatures.

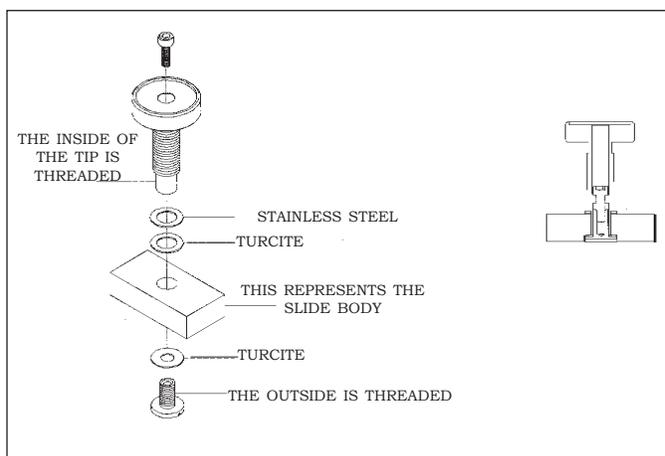
## ADJUSTING INSTRUCTIONS

There are two components of the lead screw that I will discuss so you understand how it works and, if necessary, how to correctly adjust it.

The backlash screw adjustment assembly is located on the side of the sliding head (A) photo #4). This consists of a 5/16-18 tapped hole, a set screw, a stiff spring and a 1/4" Teflon plug. The spring provides pressure against the Teflon plug pushing it against the adjusting threads forming it to the thread shape. The Teflon plug fits tightly against the threads removing the backlash when the adjusting screw moves the slide up or down. This unit should last indefinitely without adjustment. It is highly recommended that this unit never be removed or tightened as this could change the relationship of the Teflon plug to the threads.

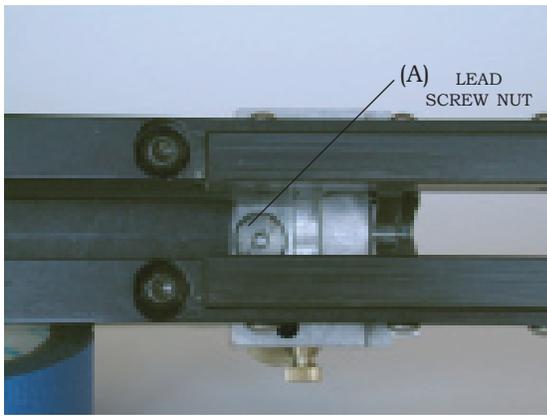


BACKLASH SCREW (photo 4.)



BACKLASH SCREW ADJUSTMENT (diagram #1.)

The adjusting screw consists of the main lead screw, the calibrated dial with a hole plugged with a removable metal plug (not shown in diagram), an access hole drilled down the center with a locking cap head screw at the bottom, a stainless steel washer, two Turcite washers, and a nut threaded inside and outside with a screwdriver slot on the bottom (diagram #1).



LEAD SCREW NUT (photo 5.)

The purpose of this assembly is to be able to remove any end play so that when you are adjusting the slide up or down you don't feel backlash. When the Hand Mill plane is delivered it has been adjusted so there is virtually no end play in the adjusting screw assembly. Even though this design will result in very long durability during use it's possible that end play may develop and have to be adjusted out by the user. These instructions will detail how to remove excessive end play.

Step 1. Remove the metal plug in the top of the calibrated dial by gently prying it out with a thumb nail or other appropriate dull object.

Step 2. Lay the plane on its side so the nut with the screw slot is visible at the bottom of the adjusting screw (A) photo #5). This nut is quite large so you will need a screwdriver with a big blade to properly adjust the nut.

Step 3. Insert a 9/64" hex wrench into the cap head screw and slightly loosen the cap head screw while holding the bottom nut with the screwdriver.

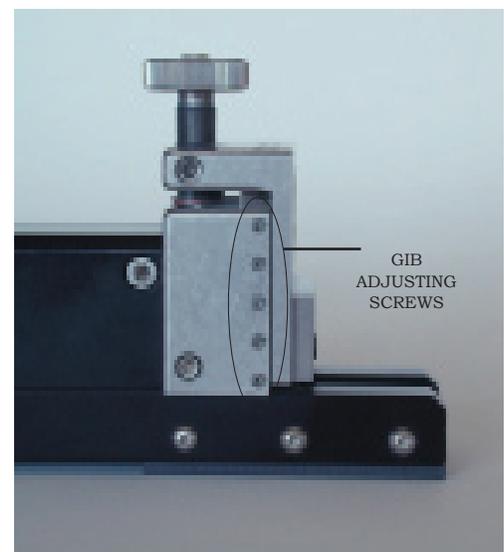
Step 4. Hold the top of the lead screw with one hand while firmly tightening the slotted nut with the other. This nut only need be good and snug to remove the end play so don't over-tighten it.

Step 5. Continue to hold the slotted nut with your screwdriver and tighten the cap head screw with the 9/64" hex wrench.

Step 6. Replace the metal plug in the top of the calibrated dial.

### Sliding Head Assembly

The sliding head has a traditional dovetail slide, an adjustable gib, and five set screws (A) photo #6) to maintain proper tension on the gib. The dovetail slide assembly and gib are within the unit and not accessible to the user since any adjustment is made with the setscrews on the sliding head itself. The dovetail slide is lubricated with a long lasting Teflon enhanced lubricant that should not need replacement or augmentation.



GIB ADJUSTING SCREWS (photo 6.)

The adjustable gib only needs a light tension on it since the backlash and end play has been taken out with other components. Therefore, the five set screws that are factory set may never need to be adjusted

since the dovetail slide and gib should not experience any appreciable wear. In the event that the gib does need to be tightened the setscrews should be only lightly tightened allowing the dovetail slide to move easily.

### Aluminum Side Rails, Adjustable Side Rails, and Nylon Pads

The black anodized aluminum side rails are shown as (A) and the black anodized adjustable aluminum side rails as (B) in photo #7). The nylon pads are shown as (A) photo #8).

The aluminum side rails are permanently attached to the aluminum divider bar and the stainless steel cutter head assembly with various cap head screws. The adjustable aluminum side rails provide a method to center the nylon pads on the plane and to adjust for side-to-side wear of the nylon pads should it occur. The adjustable side rails would also allow you to center new nylon pads in the event that you have to replace the originals. We have found the replaceable reinforced nylon inserts impregnated with molybdenum disulfide to be extremely slippery and long wearing so it's unlikely that they will need to be replaced under normal use. However, if they need to be replaced the mechanism to do so properly is built into the plane design.

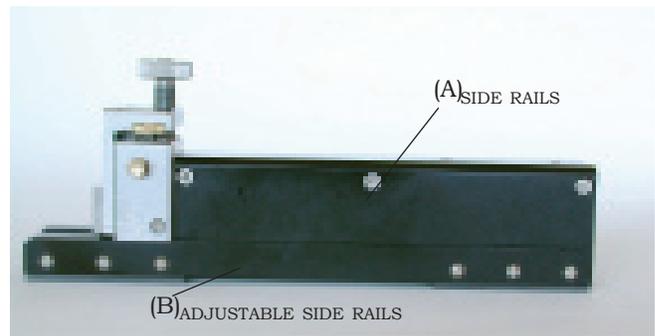
In addition to the adjustable side rails the Hand Mill plane is provided with an anodized aluminum jig to assist in properly setting the width of the side rails and nylon pads (photo #9). The bottom of the jig fits closely between the aluminum side rails whereas the center step is .628", the correct width between the nylon pads. The top is approximately .500" and is used only to hold the jig.



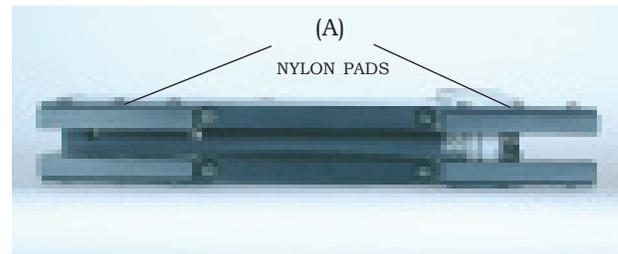
**WIDTH SETTING JIG** (photo 9.)

The plane comes with the nylon pads centered and approximately .628" apart. If the nylon pads wear so that the distance between them is greater than .630"-.631" they should be readjusted. One comment about wear is important to note here. The pads should not wear much side-to-side if the milling pressure is down as it should be. In the event that one set of pads is wearing more on the side surfaces than the other set you may inadvertently be pushing the plane to one side as you mill your strips. If so, try to correct the side pressure so that it is only down as you mill.

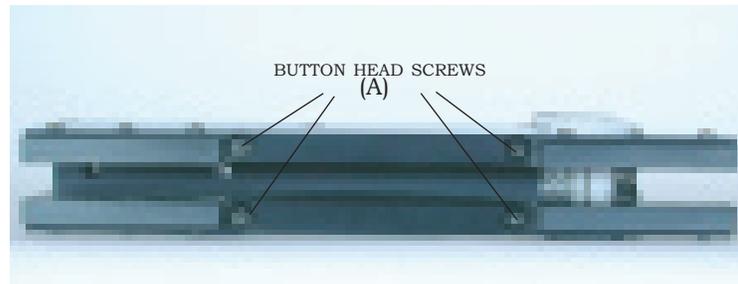
The procedure for adjusting the pad width follows. The button head screws are shown as (A) photo #10).



**SIDE RAILS AND ADJUSTABLE SIDE RAILS** (photo 7.)



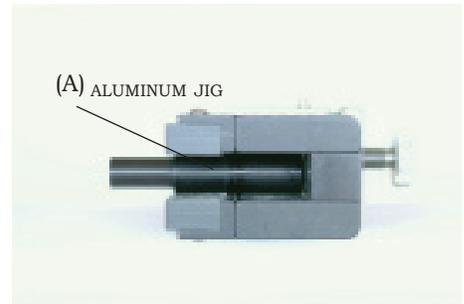
**REPLACEABLE NYLON PADS** (photo 8.)



**BUTTON HEAD SCREWS** (photo 10.)

Step 1. Slightly loosen the four button head screws so the adjustable aluminum rails will move side-to-side.

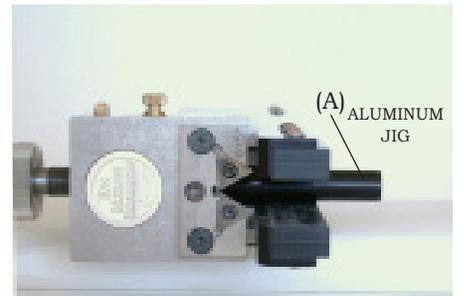
Step 2. Insert the aluminum jig with the wide portion between the rear aluminum side rails and the narrow portion sticking above the center of the rear nylon pads (A) photo #11).



**REAR JIG PLACEMENT** (photo 11.)

Step 3. Pinch the adjustable aluminum rails holding the nylon pads firmly together and lightly tighten the rear button head screws.

Step 4. Insert the aluminum jig with the wide portion between the front aluminum side rails with the narrow portion sticking above the center of the front nylon pads (A) photo #12).



**FRONT JIG PLACEMENT**  
(photo 12.)

Step 5. Pinch the adjustable aluminum rails holding the nylon pads firmly together and lightly tighten the front button head screws.

Step 6. Repeat steps 2 and 3 only firmly tighten the rear button head screws.

Step 7. Repeat steps 4 and 5 only firmly tighten the front button head screws.

Step 8. Measure with a caliper the width between the two sets of nylon pads to make sure they are within the range of .628”-.629”.

The nylon pads stick out past the adjustable aluminum side rails approximately .035” on each side. The slots on the adjustable aluminum side rails allow each side to move approximately .030” so they can move in approximately .060” before the pads would need to be replaced for side-to-side wear. The vertical pad should wear down long before the side wear should exceed the built in reserve.

In the event that the nylon pads need to be replaced for wear the following procedure should be followed. First, the nylon pads are machined to  $\pm .0005$ " for vertical height making sure that they are very close to each other in size. However, before replacing them you should accurately measure the vertical height of each and separate them into two sets where the height of each set is closest to each other. Also carefully check each one for any burrs that would prevent them from fitting flat into the pockets. Then each one of the sets would be used either in the front or back. The pads also have a specific orientation because one long side does not have a chamfer. The side with one sharp edge needs to be located on the inside top towards the center of the plane. The chamfered sides either allow the pad to fit into the aluminum pocket completely or to allow the plane to run down the base and adjustable bed freely.



**NYLON REPLACEMENT PAD SCREWS** (photo 13.)

The nylon pads are held in with three button head screws (A) photo #13). Remove these screws, remove the worn nylon pads, and carefully clean out each pocket in the adjustable aluminum side rails. You will notice that the holes for the button head screws are slotted to make sure the nylon inserts can be pushed tightly against the top of the pocket. Install the sets front and rear and tighten the button head screws making sure the pads are tight against the top of the pockets. The screws don't need to be overly tight because you are screwing into nylon and the planing force is down against the nylon pad and not against the screws.

Once the nylon pads are installed you would go through the procedures outlined above for centering them and setting the correct width.

## INSTALLING CARBIDE INSERTS



The carbide inserts must be carefully installed in order to insure that the correct cutting angle is maintained. The top of the insert holder pocket is milled at the correct angle to properly align the carbide inserts for an 8-strip, 6-strip, 5-strip or 4-strip rod depending on which cutter head you are using. When you install a set of carbide inserts make sure the top of the inserts are parallel to the insert pocket when they are screwed down.

One set of cutters will mill from three to five complete rods from start of roughing to finish milling of the heat-treated strips. Determining when you need new edges on your cutters is trial and error. If they cut hard or you are not getting clean cuts then they need to be changed. When you make a cut on unheat-treated strips you should get a long shaving of bamboo. You should always put on cutters you are using for finishing cuts before you finish-mill heat-treated strips. When these cutters start getting too dull for heat-treated strips, they can be used to rough cut raw strips. I have found that rough cutting wet strips prolongs the life of the cutters substantially.

I recommend that you mark the backs of the carbide cutters with a felt tip pen in order to know which edges have been used. In addition to rotation each individual carbide cutter to expose new cutting edges, you can also change the cutter's relative position. Move the left one to the right side and the right one to the left side. This will double your cutting edges. You should mark them to insure that you keep track of their relative positions. It's extremely important that you use two inserts that are of equal sharpness together otherwise they won't cut properly.

I think it is also helpful to maintain a log showing usage of the cutter edges. It is also my recommendation to use one set of cutters just for finishing cuts on heat treated bamboo to make sure you have sharp edges. This will insure good, clean strip edges for gluing.