

# PANTOGRAPH ROUTER

af  
Harris Knudsen

Please note, the text  
in this magazine  
is computer translated  
so please bear with errors  
and incorrect formulations.  
It is an experiment that  
hopefully can be useful  
to anyone.

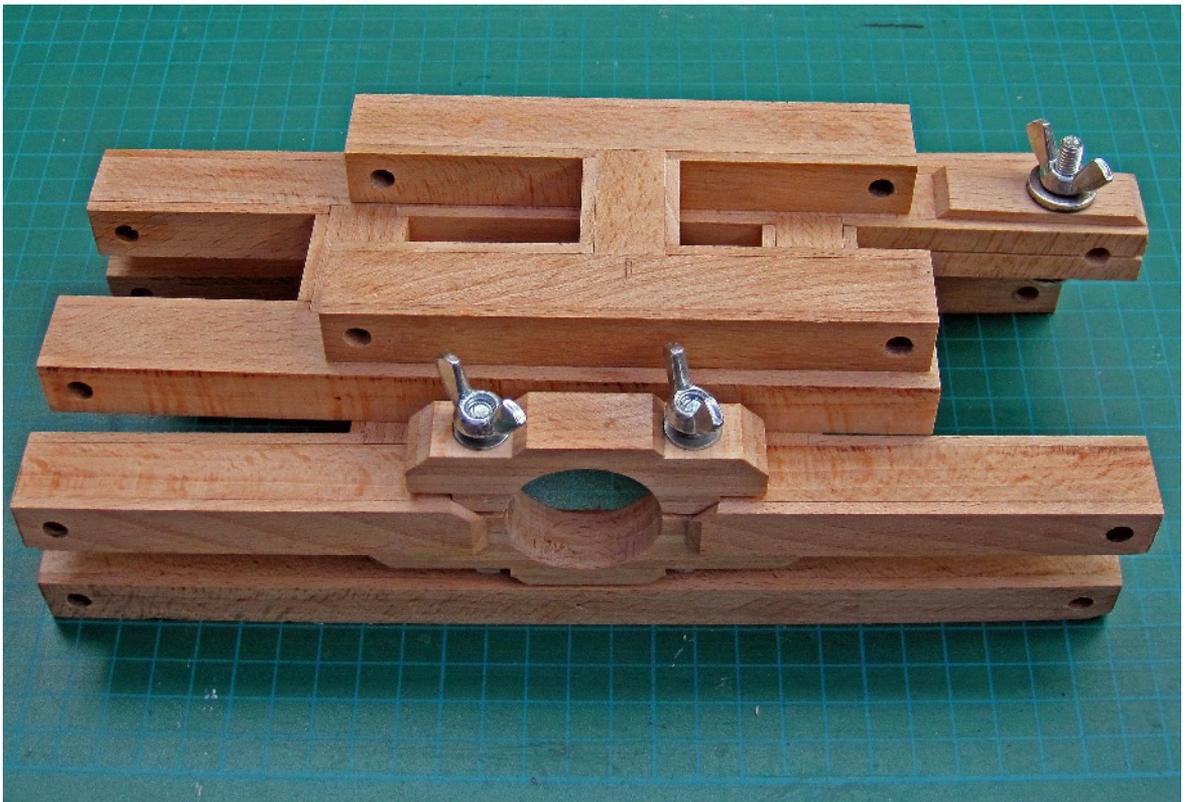
# Pantograph Router

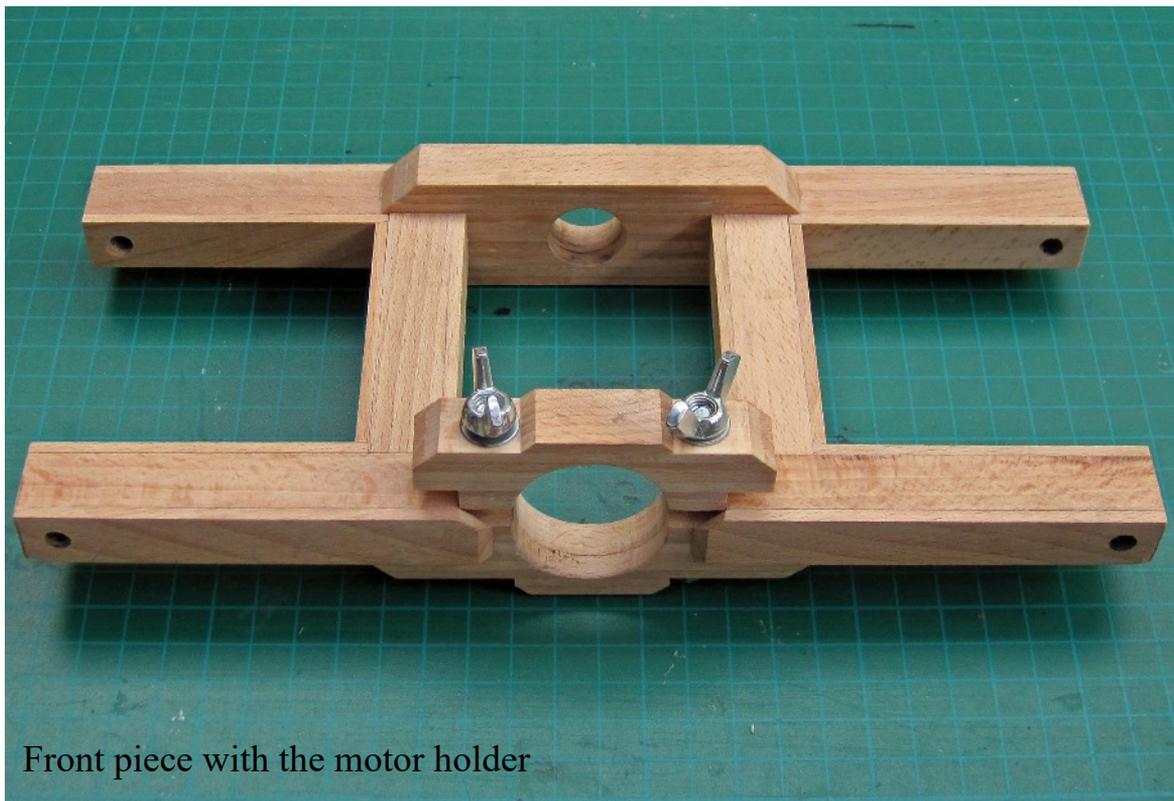


Copy or pantograph cutter is my first attempt to build usable machine tools of materials that don't cost much and a construction method where a minimum of tools is needed.

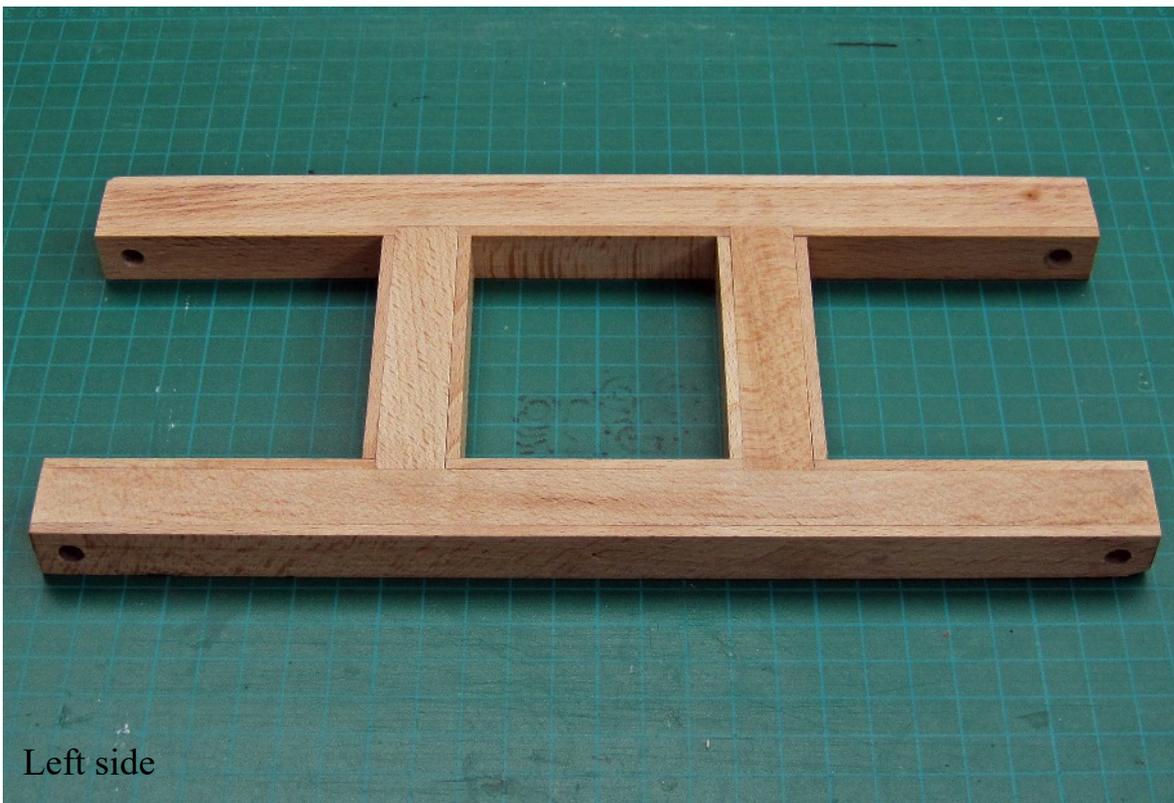
As the building material is chosen "paint sticks" which together in the right way gives a very strong and stable construction, does not require special tools, machines or space.

Here are the four parts of the pantograph itself, which are assembled with rods in the corners and mounted in a tiltable holder on a plate of appropriate size. As a milling machine a Proxxon mini drill is chosen but other brands are equally applicable.

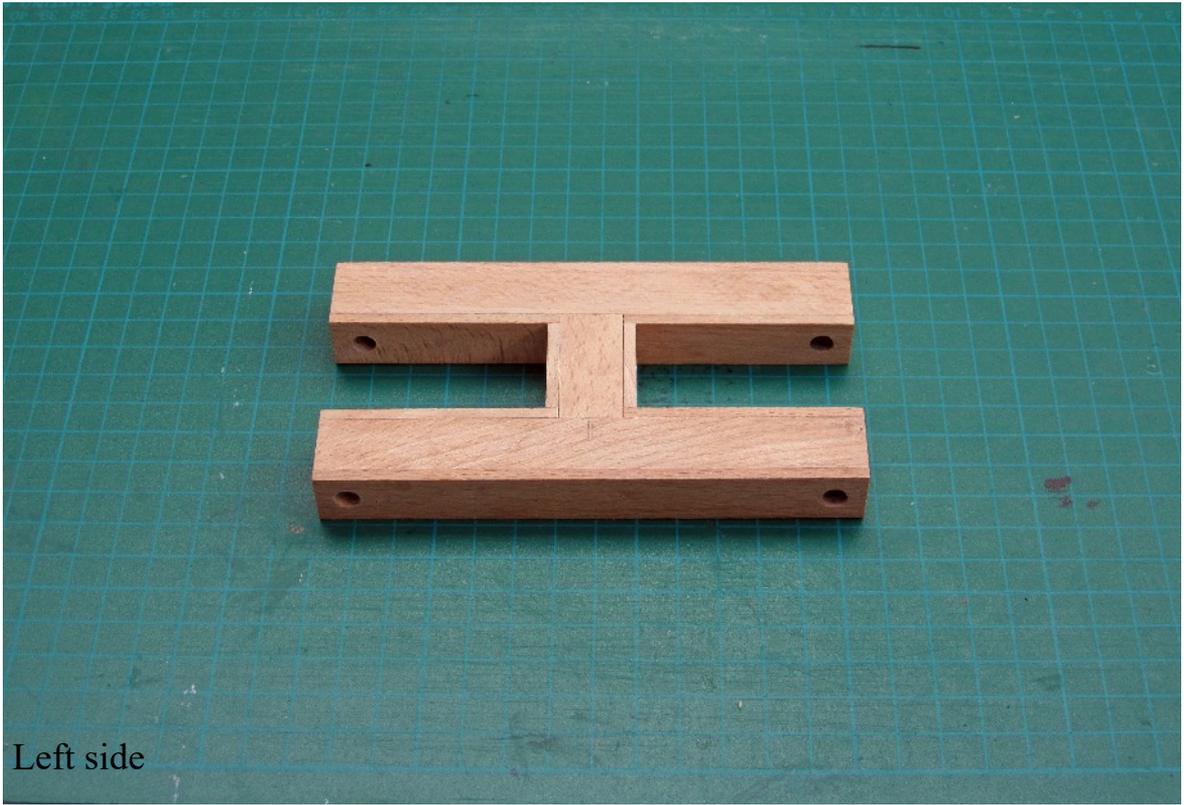




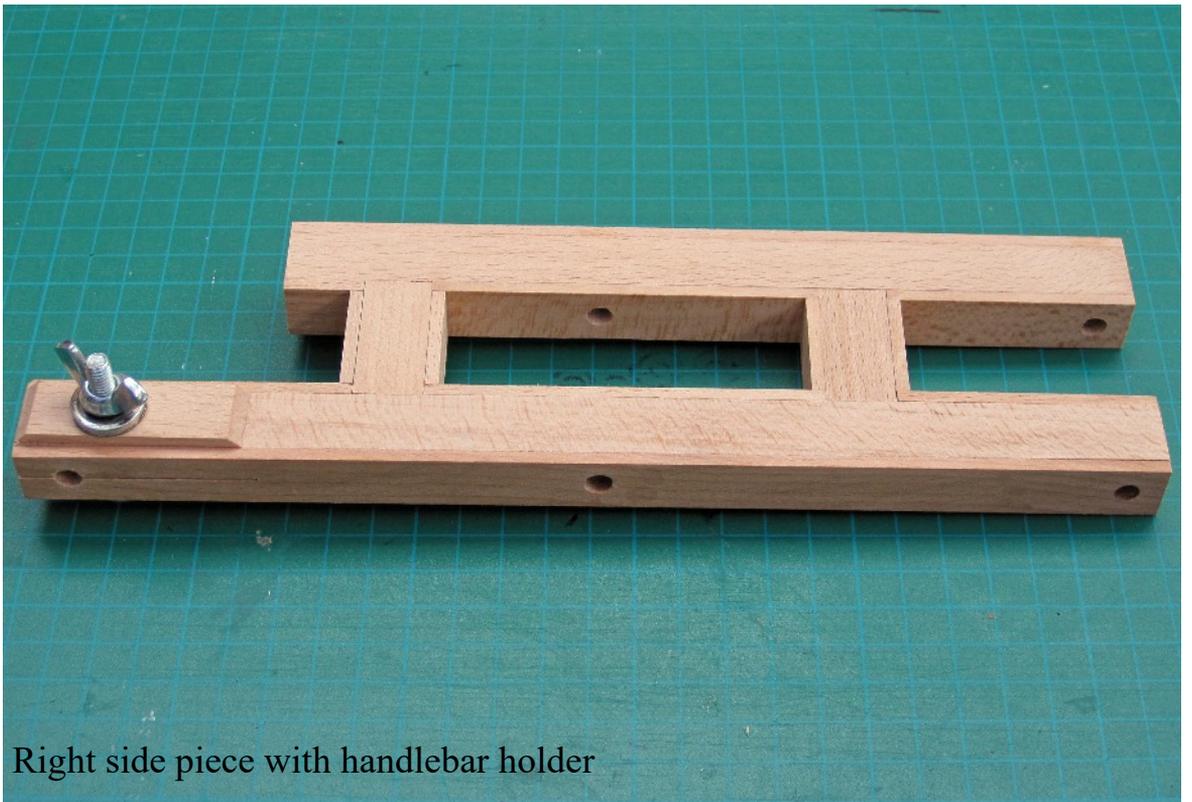
Front piece with the motor holder



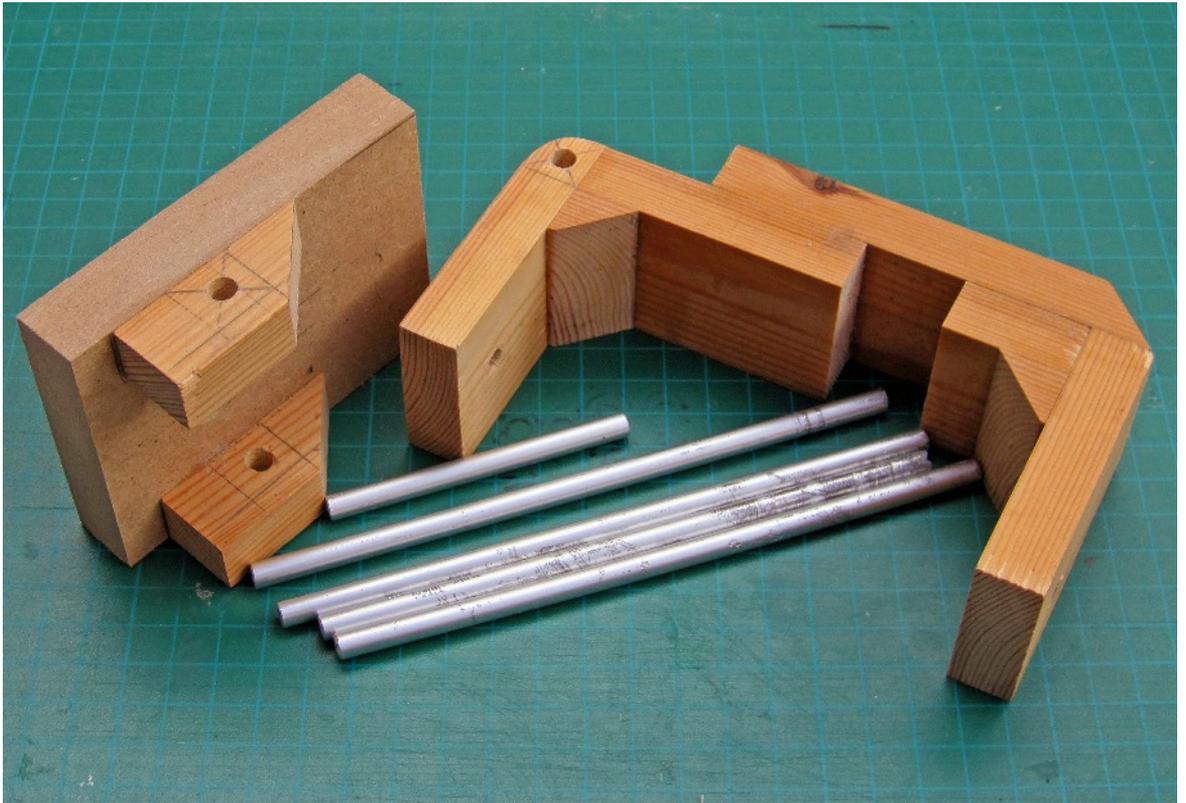
Left side



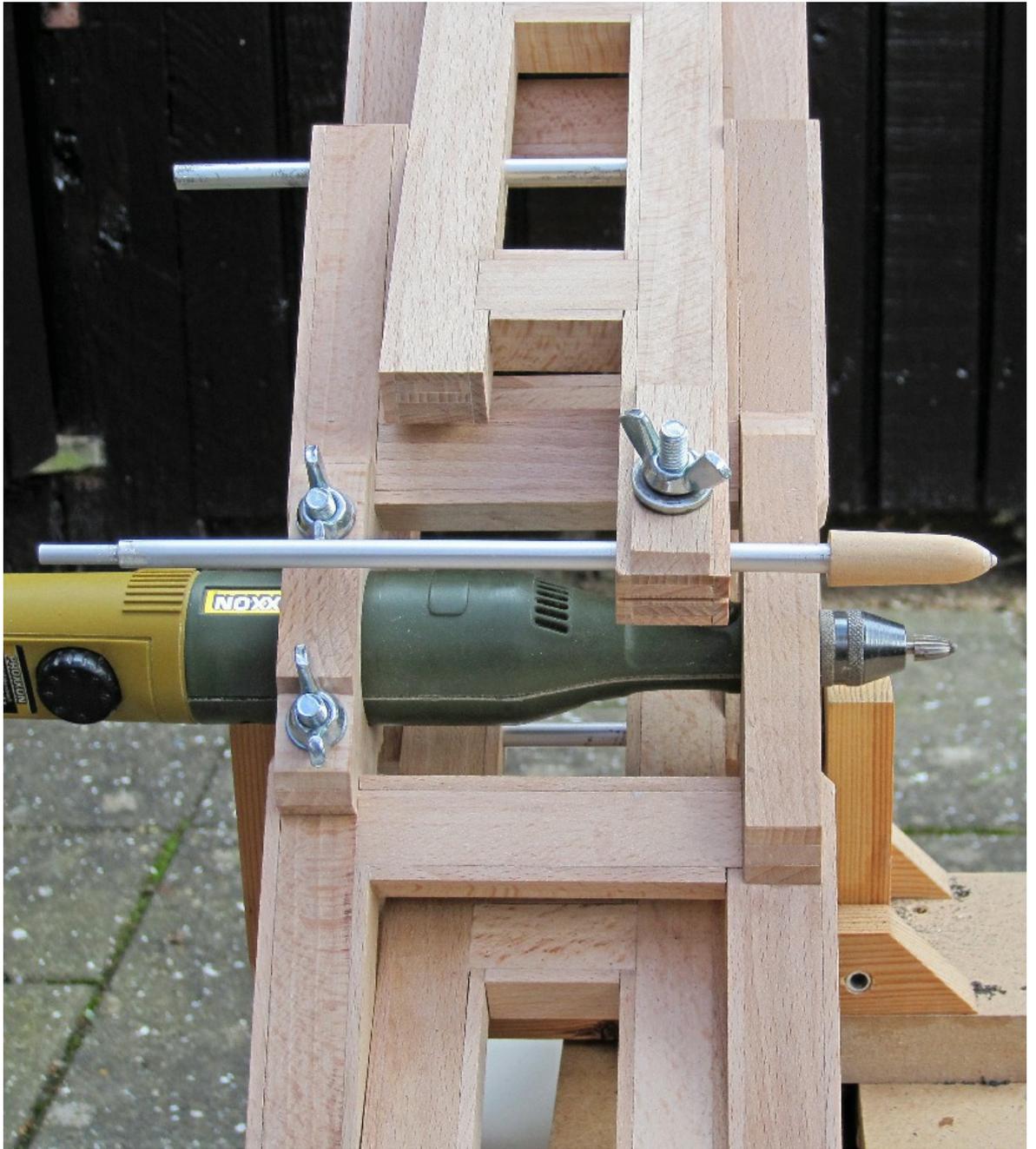
Left side

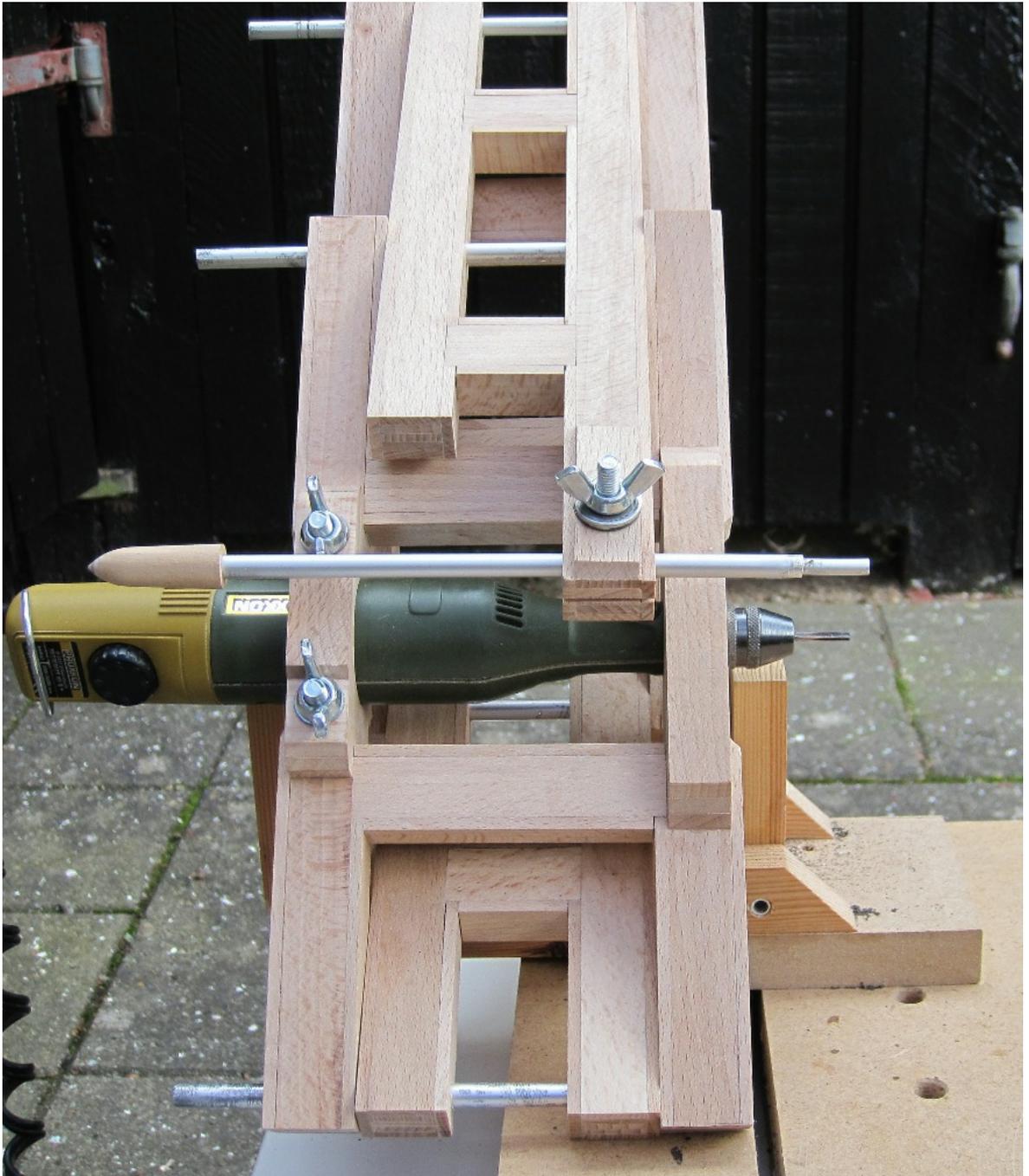


Right side piece with handlebar holder

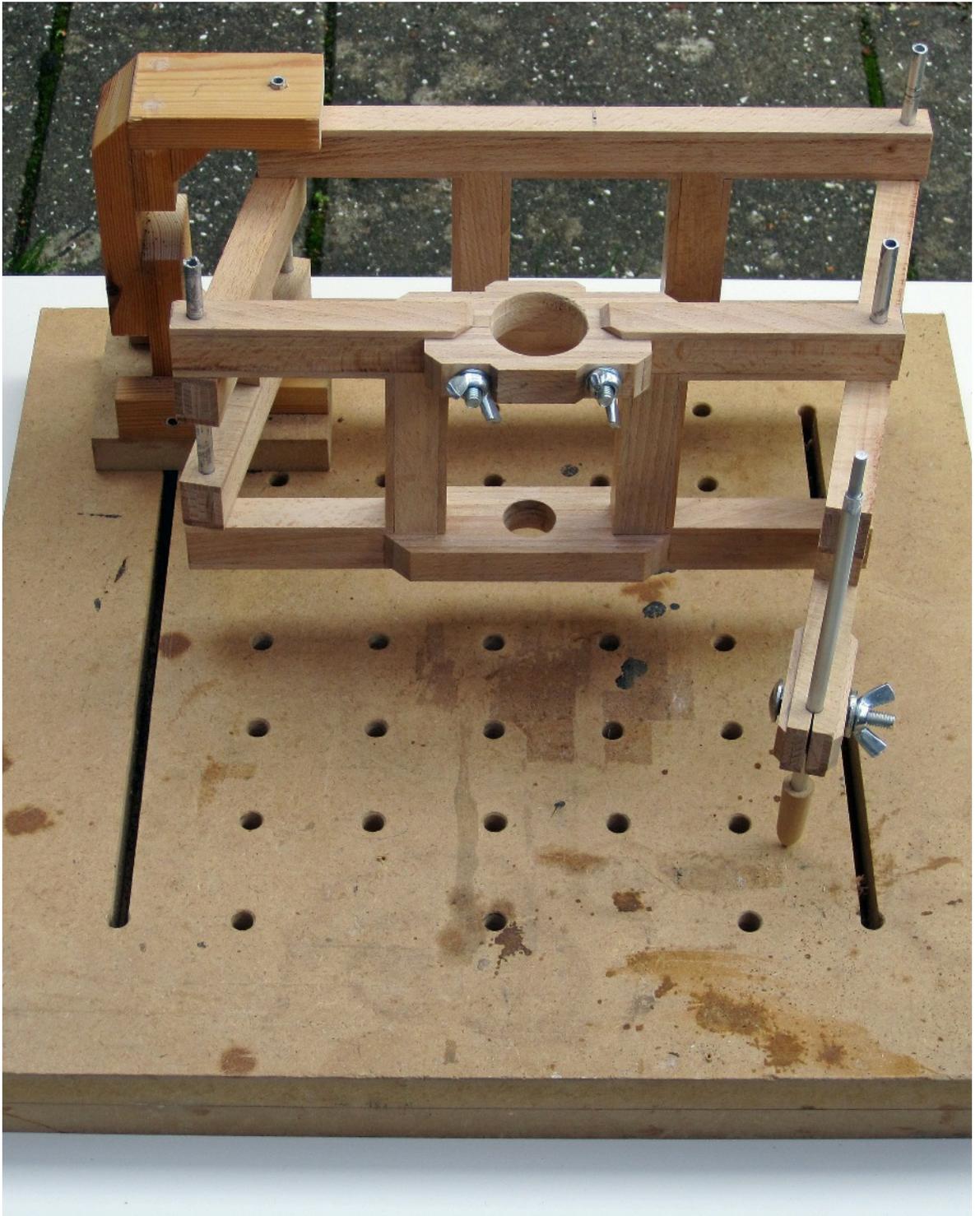


The holder should also be made of "paint sticks" but when I had a landscape that could be used I chose this one. The bars became some 6 mm. aluminum tubes which are also recycled.

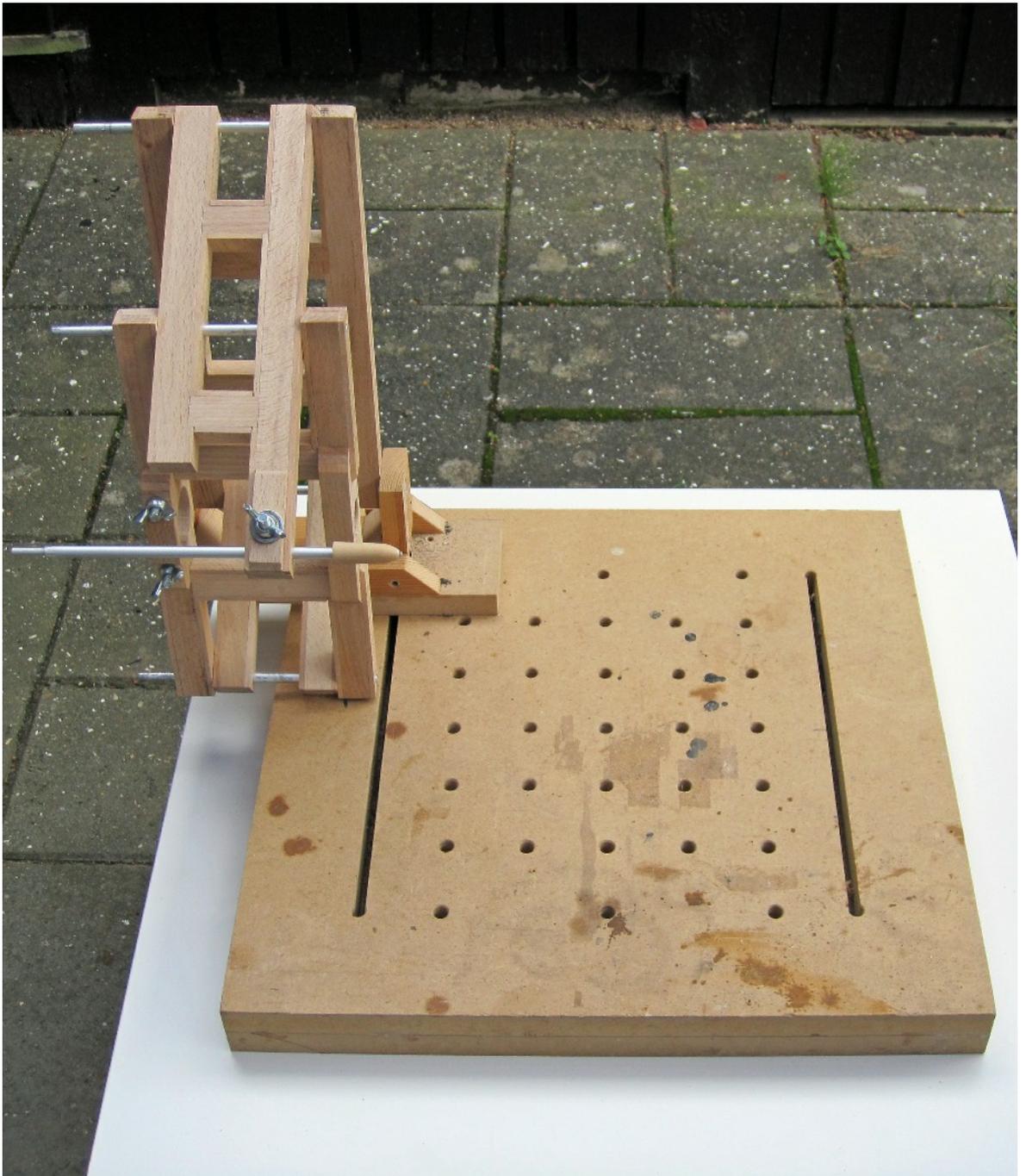




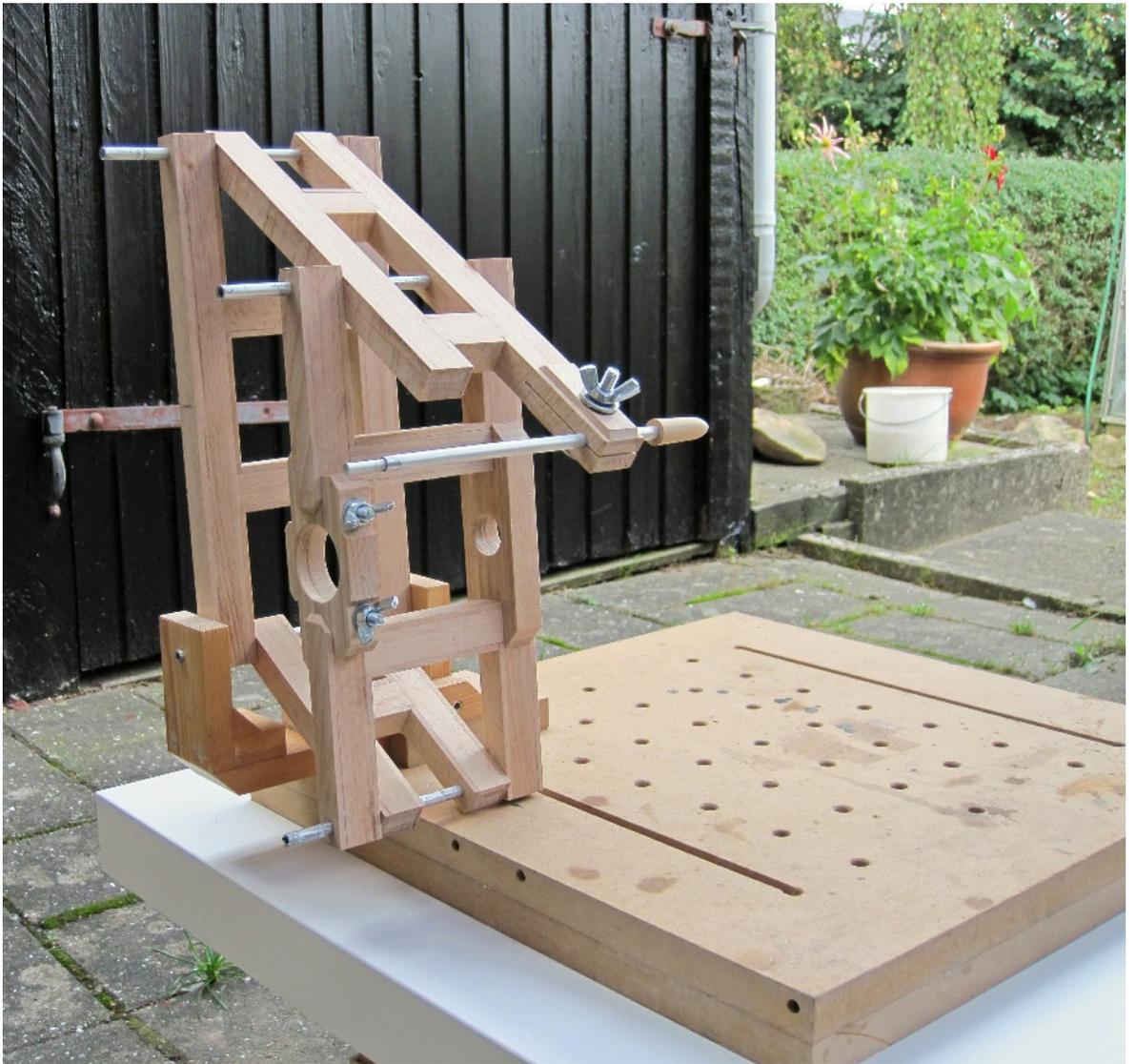
Here it is a 2 mm groove cutter mounted in the machine.  
Note that the pantograph cutter is designed for 4: 1 - the size of what is milled becomes  $\frac{1}{2}$  of the original ( $4 \times 4 = 16$  becomes  $2 \times 2 = 4$ ). This means that the diameter of the guide pin must be twice the diameter of the milling iron, here 4 mm. with vertical sides.



The construction is currently mounted on the workshop's building board but must of course have its own but it will not be until after it has been tested.

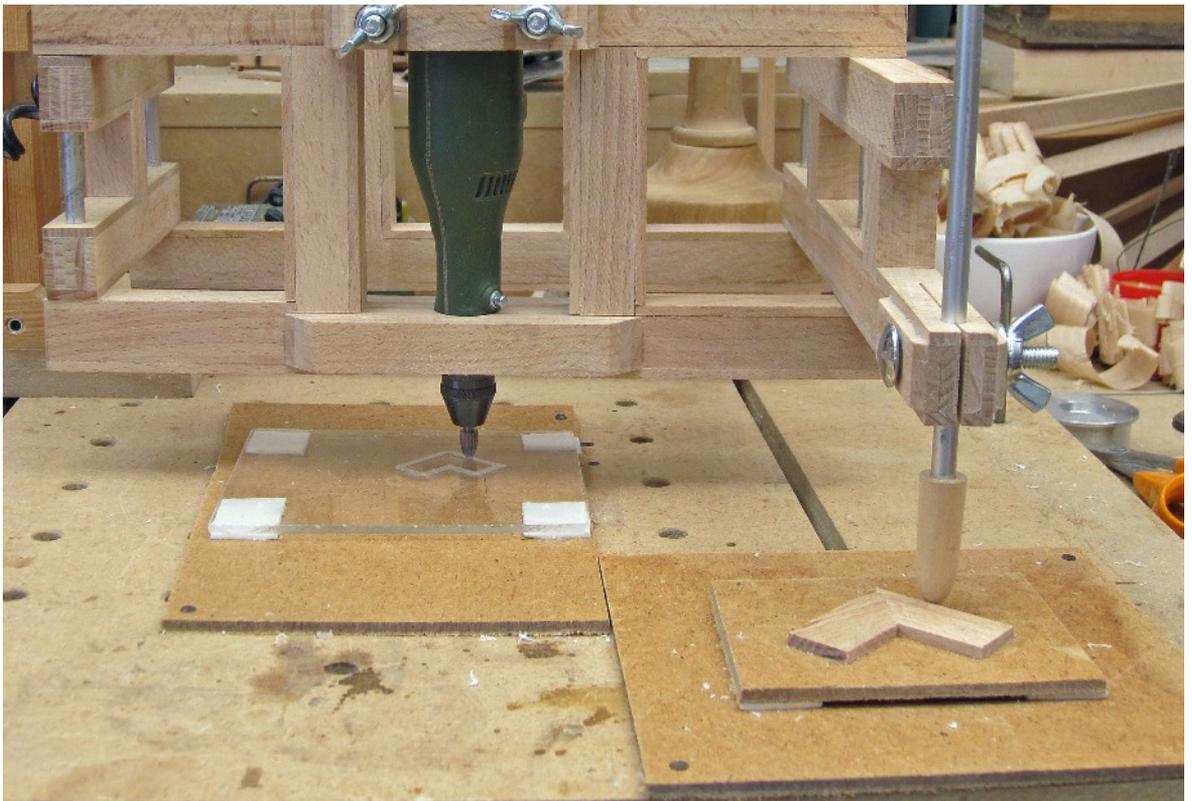
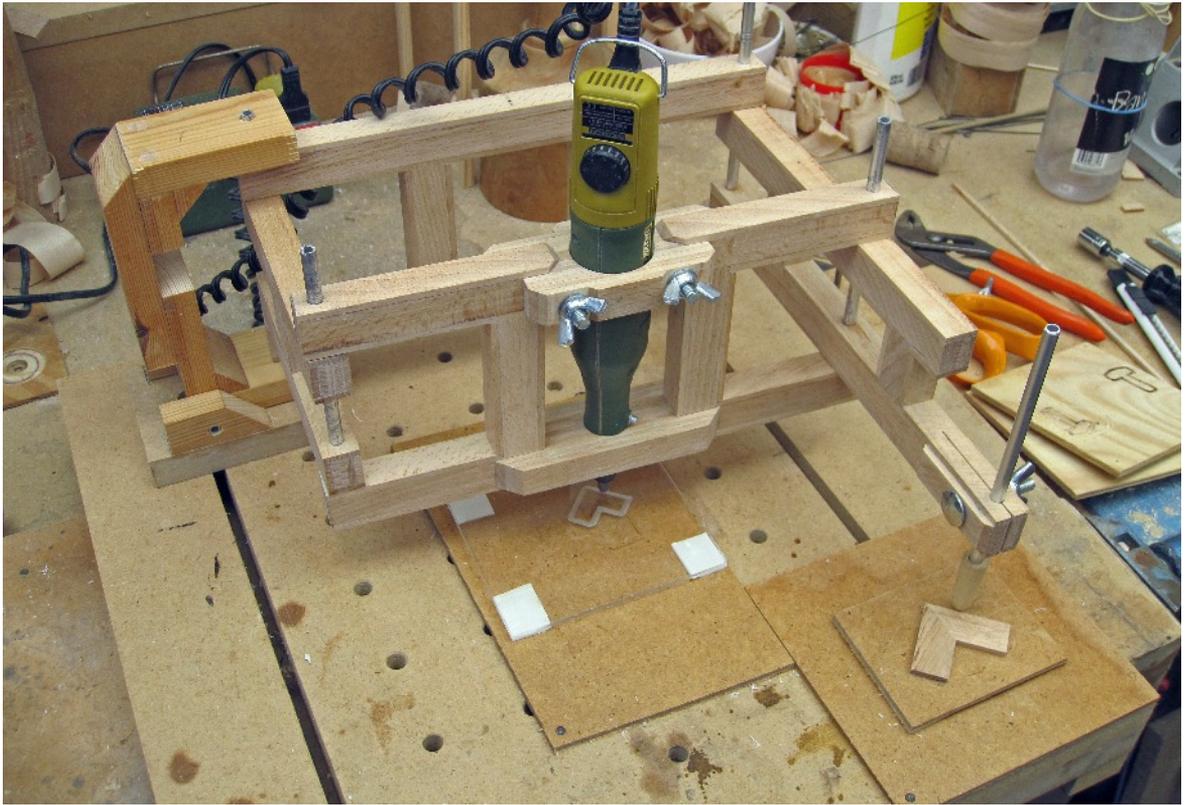


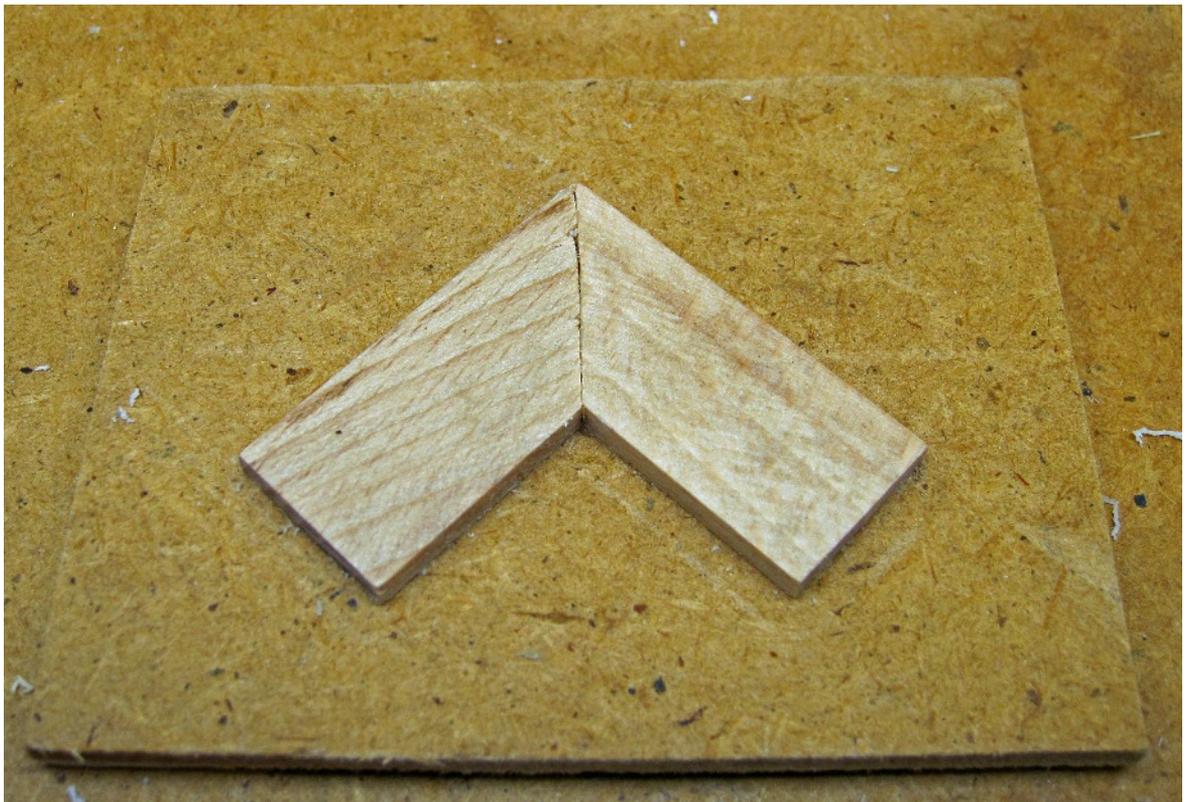
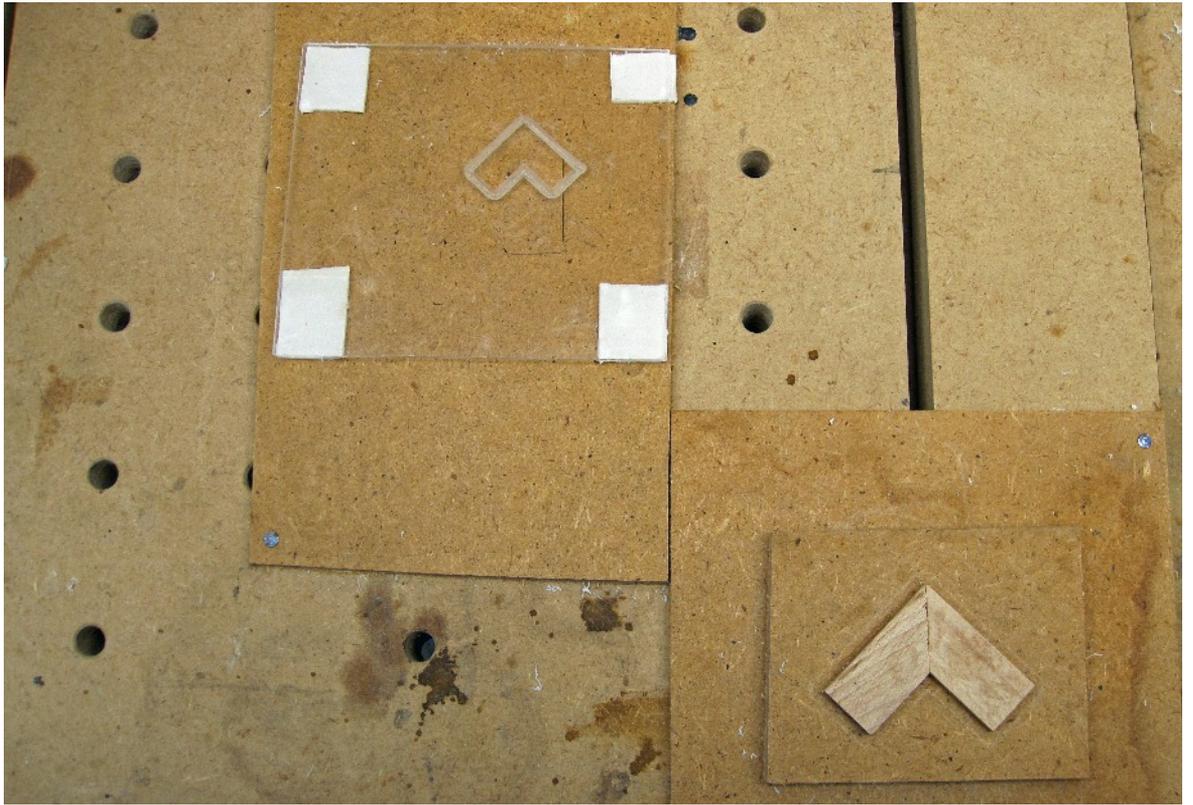
Here, the pantograph part is tilted up so that it stands vertically, a function that is of great importance when changing the milling iron and placing the workpiece on the base plate.

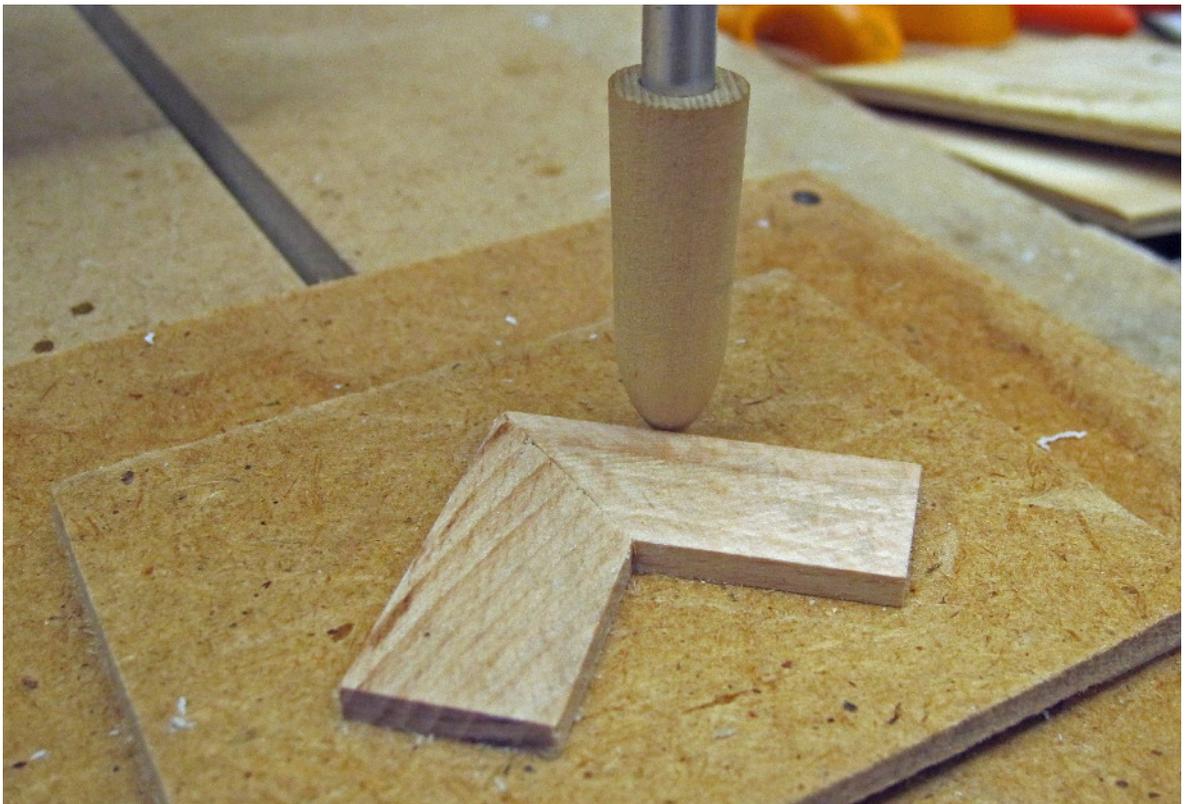
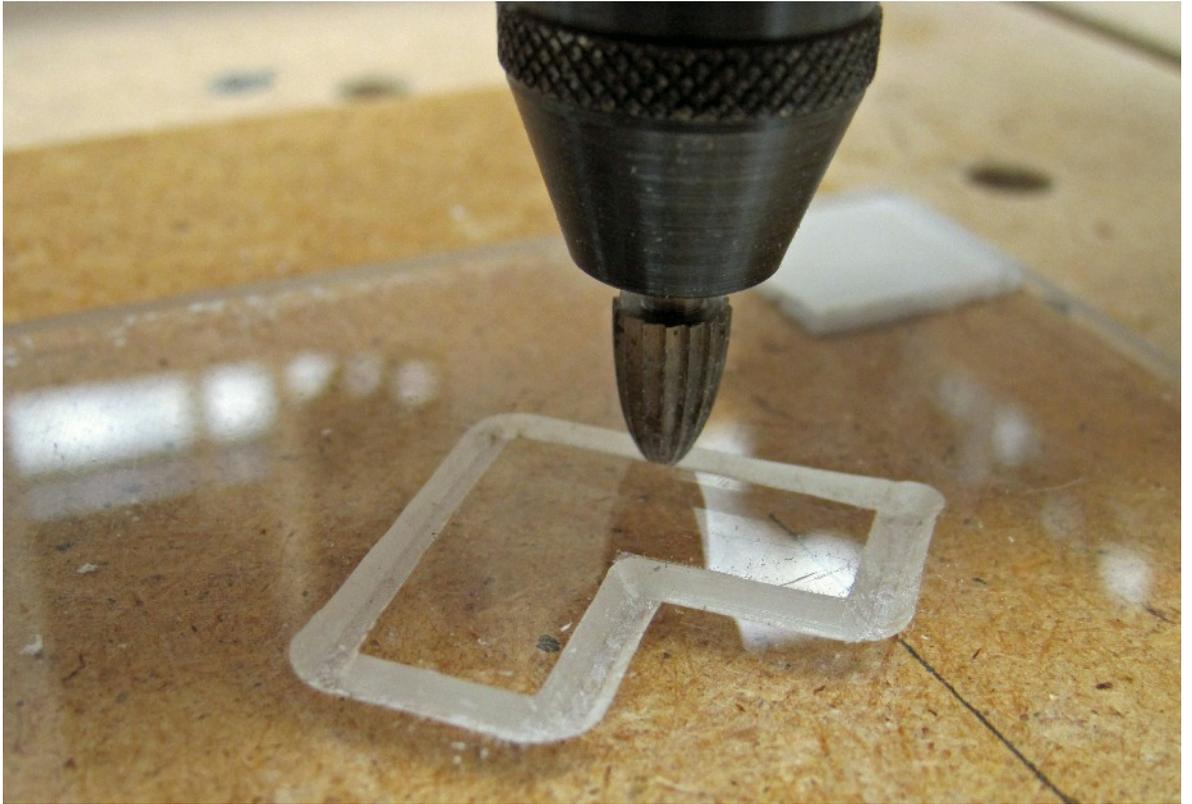




The first attempts at milling by template →





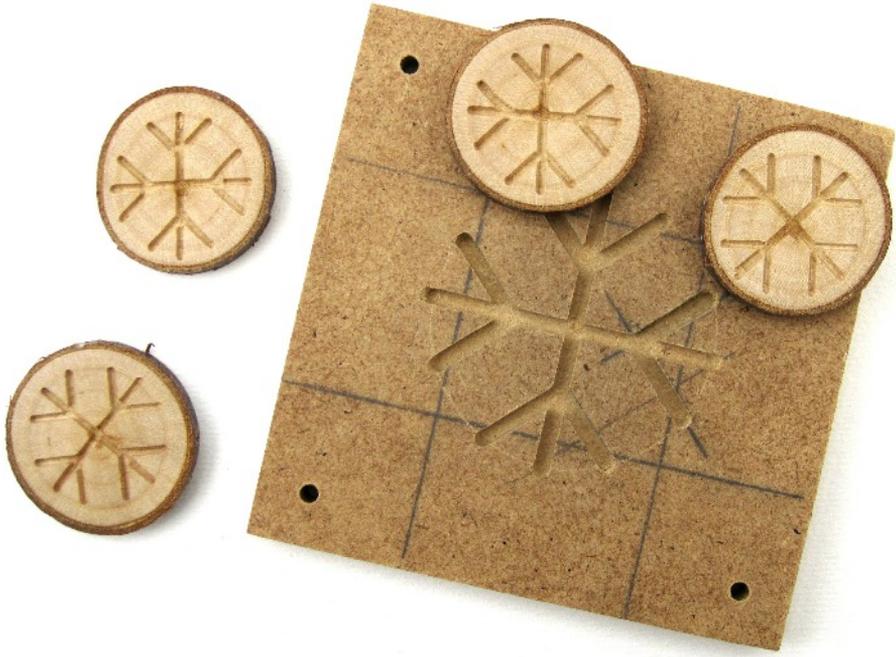


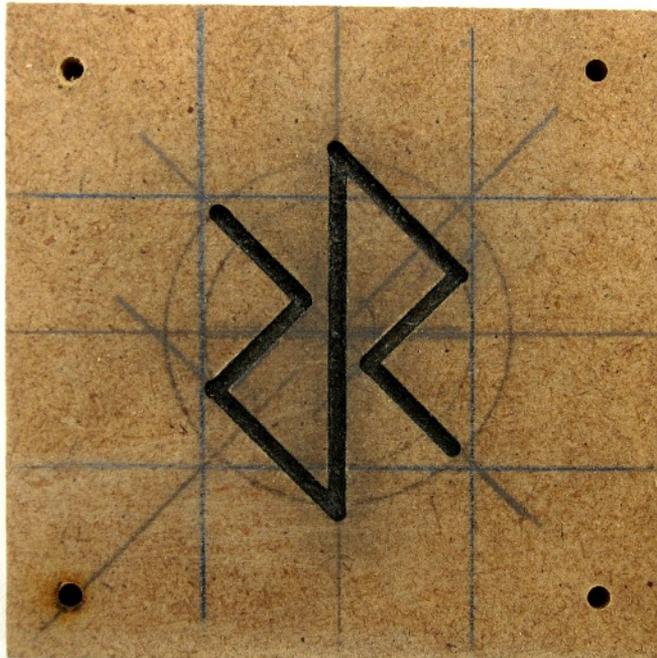
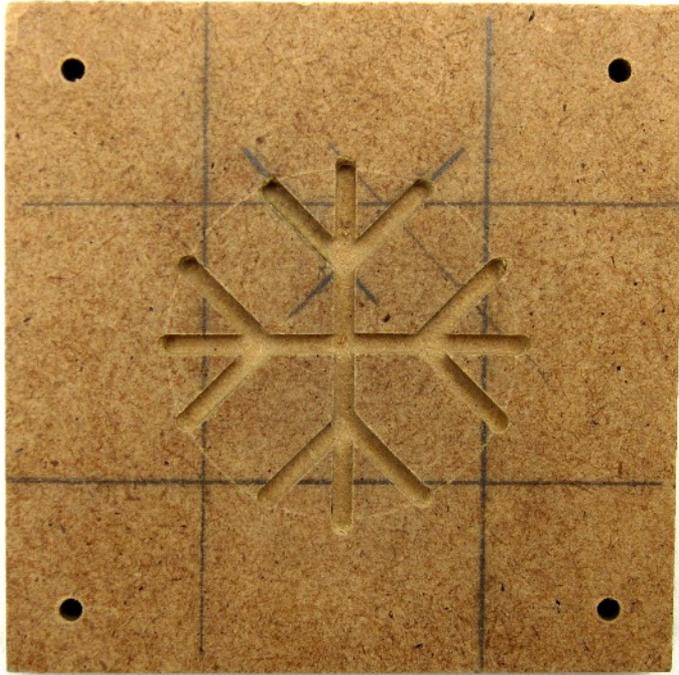


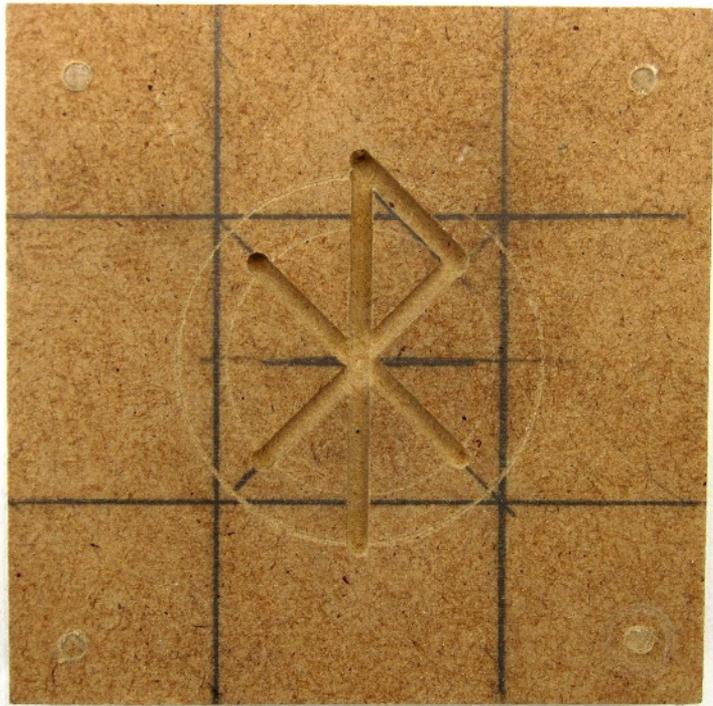
Since I have not yet made any real templates, the machine has been tested with something available and a few attempts to use drawing templates. The test showed that the machine is easier to work with than expected and the result far exceeds what I had expected.

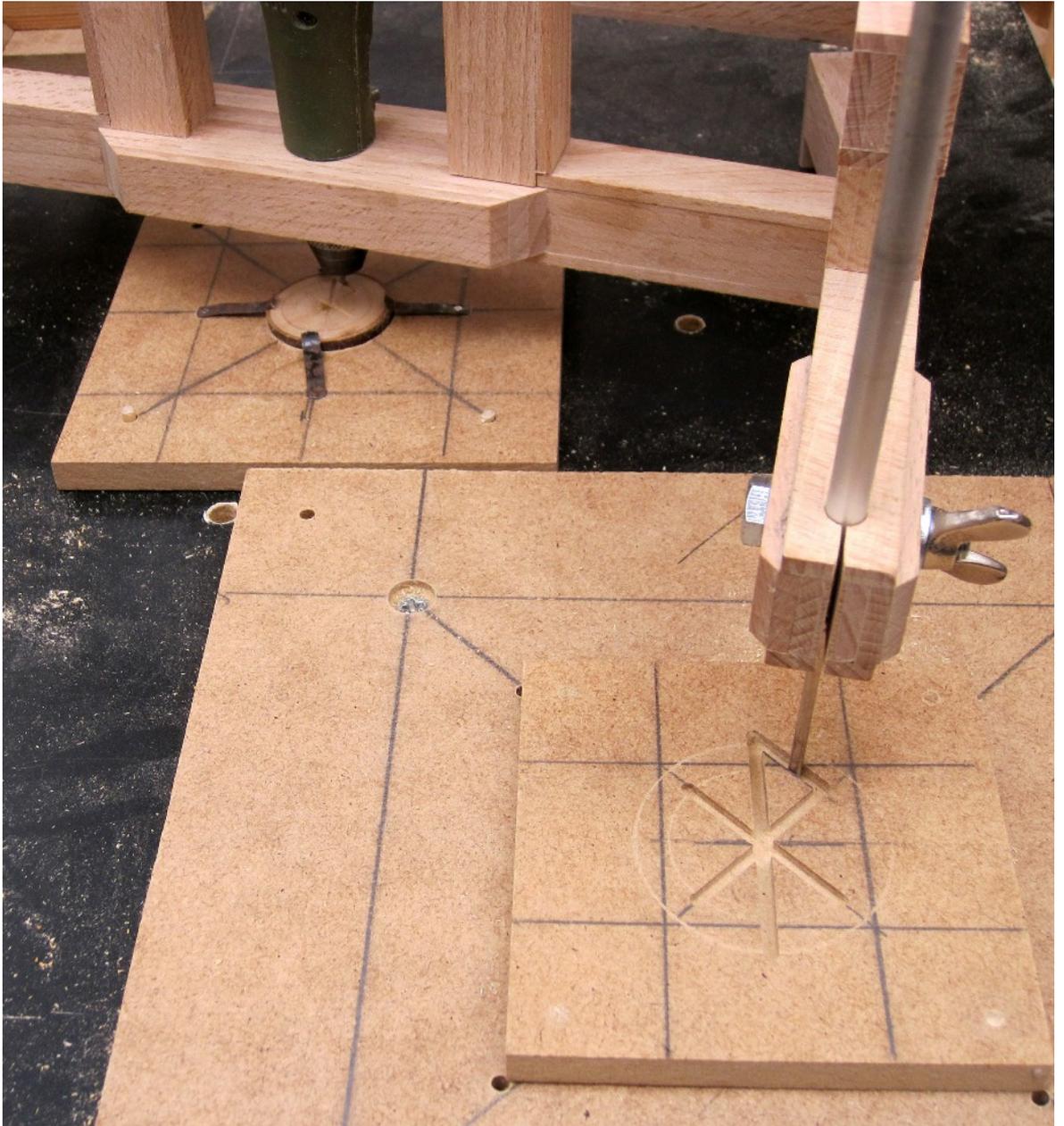
## Update

I have now used the machine for a while and it has proven to work far better than expected so I have started building one that is twice the size and there are plans to make a new version of it but with some changes .

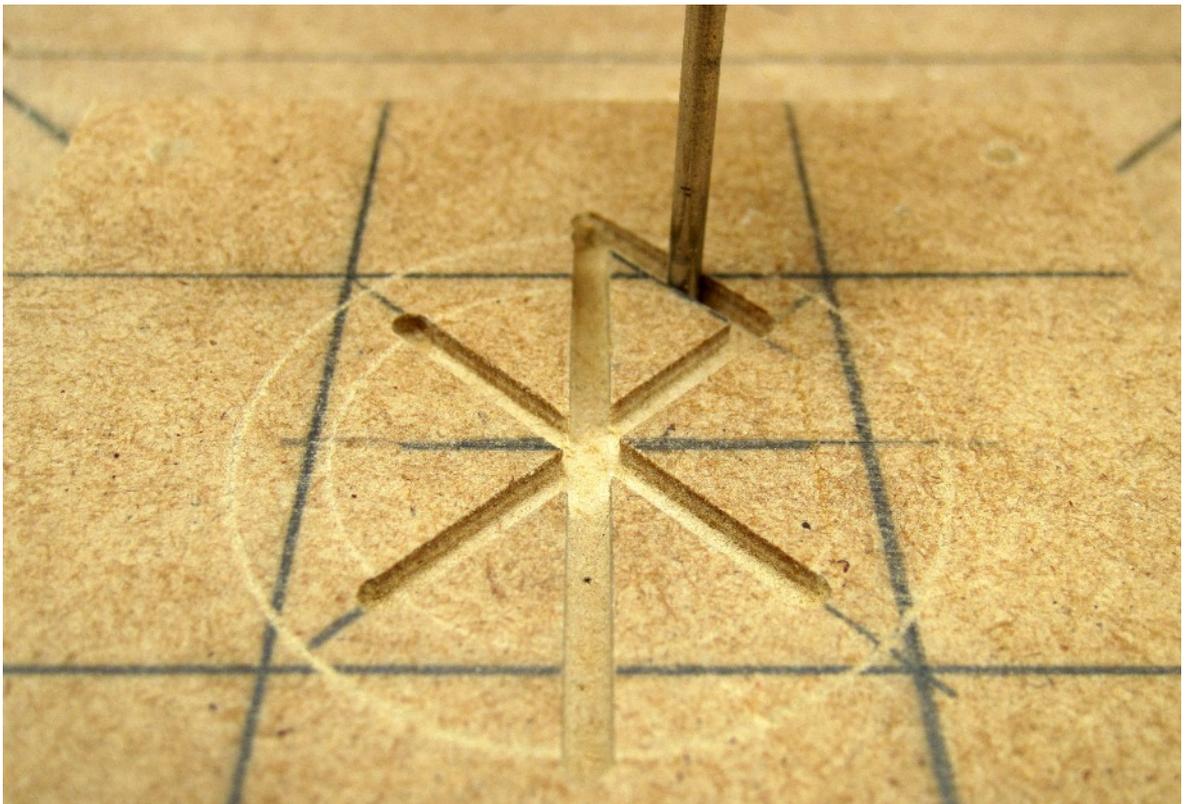








The workpiece is held on a workpiece plate and the template is placed on the template board where it is held by four small sticks in the corners. With a good milling iron it does not take time to mill an item and the only finishing step is to remove the chips with a brush and a pointed wooden stick.





It is quite time consuming to make more complicated templates but many of the same items need to be milled and if you are firm with a decoupage saw templates are the right thing, super easy to work with and the result is the same from time to time. If you have access to a laser cutter or cnc machine, really good templates can be made in 3 mm. acrylic sheet. Fortunately, machines are also suitable for freehand use so that's what the next pages are about.

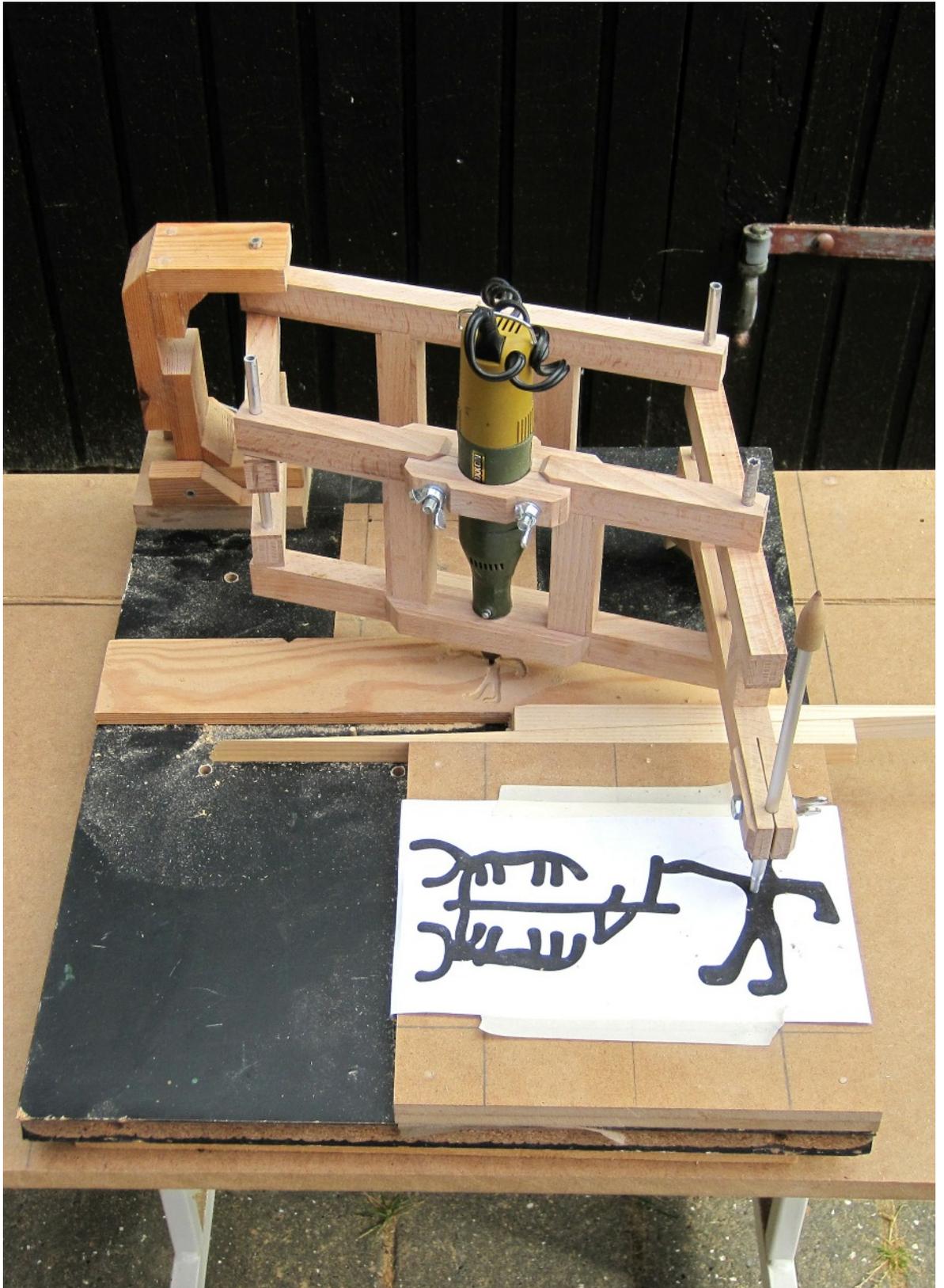
Freehand milling after photo / drawing



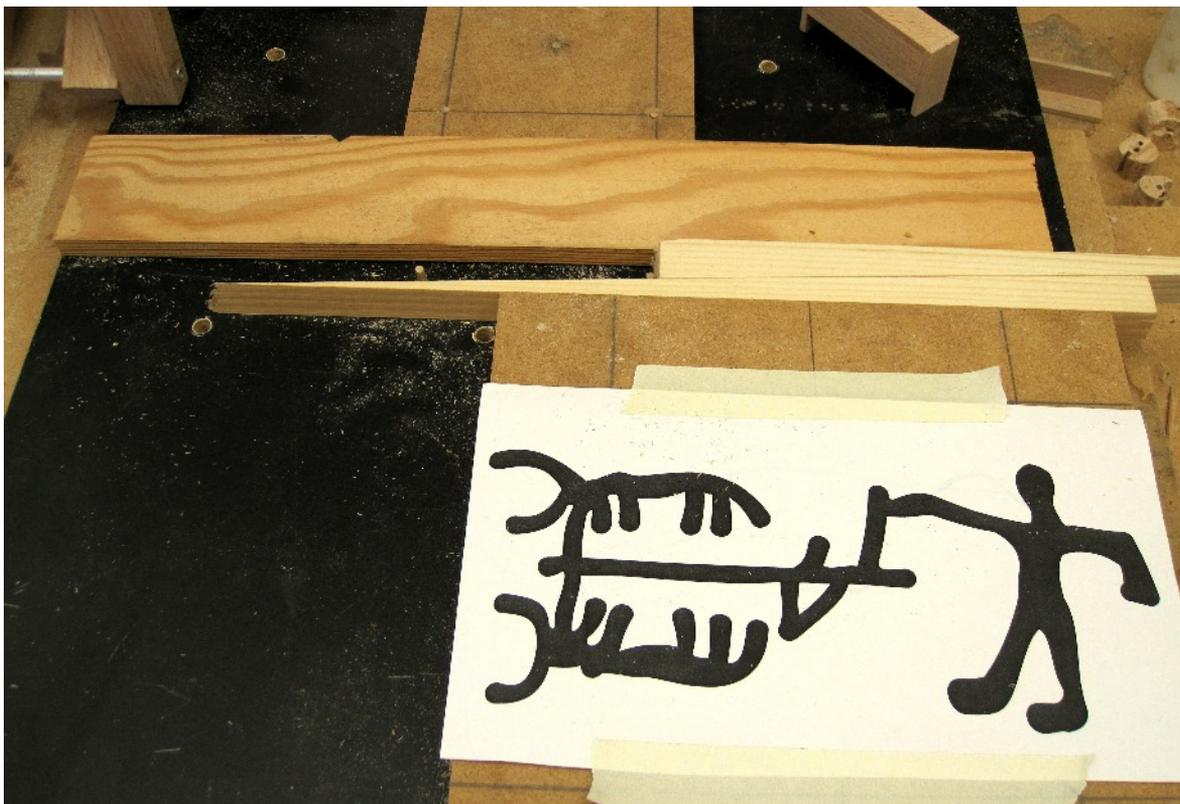
For simple drawings like rock carvings it is not necessary to create templates with very little practice it is easy to mill directly after a drawing or photo.

The pantograph is mounted on a plate measuring 45.5 x 37 cm. and has a working area of 21 x 21 cm. for drawing / photo / template and a milling area of 10.5 x 10.5 cm. The workpiece height can, as a standard, be from 1 to 18 mm. but can easily be increased by a further 16 mm. to 36 mm.

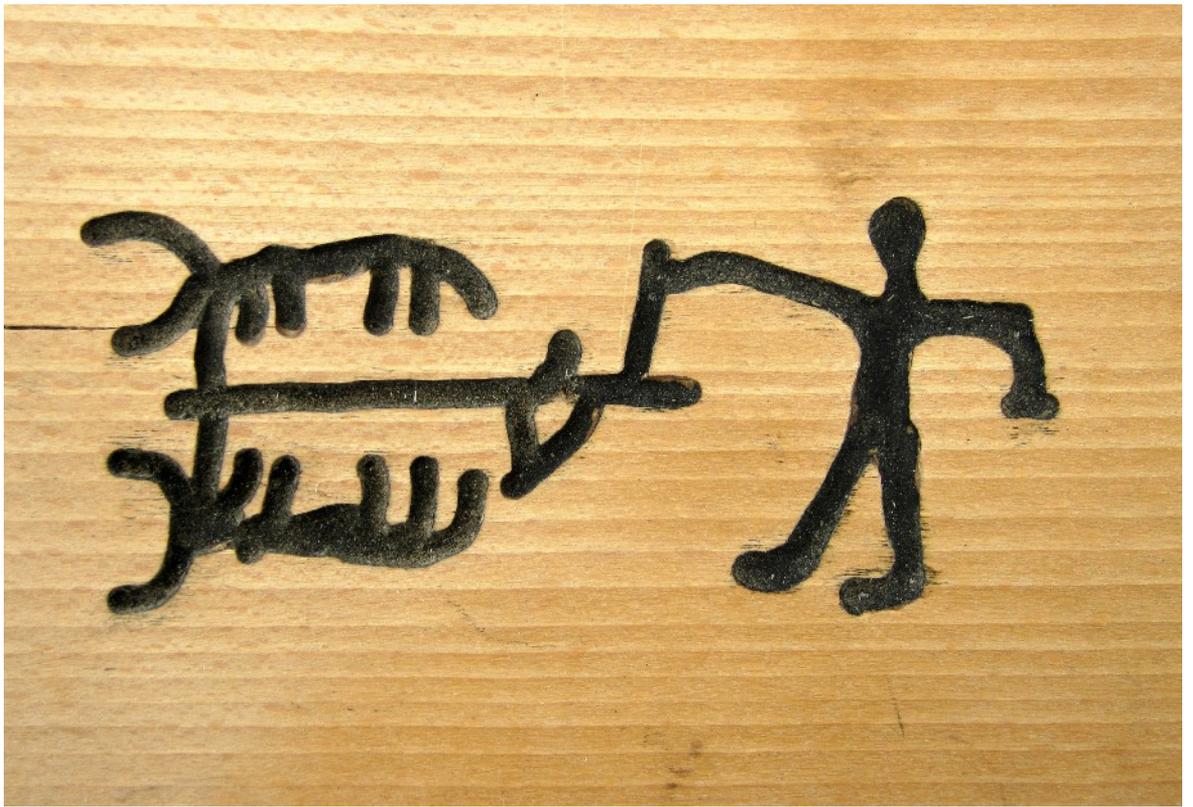
Workpieces with a width of 24 cm and as long as desired can be milled. One can, for example, well cut a very long name with letters that are 10.5 cm. tall.



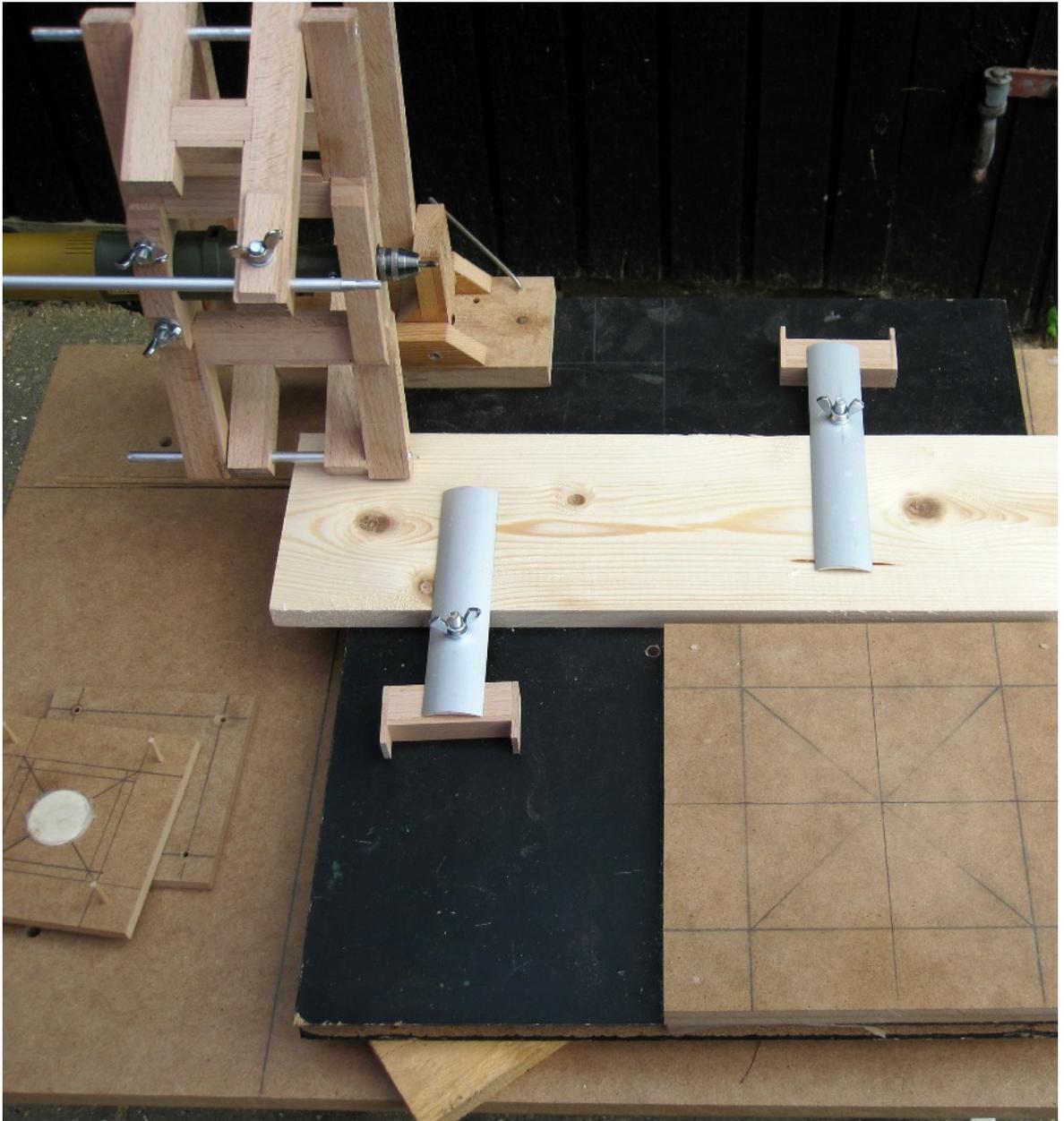






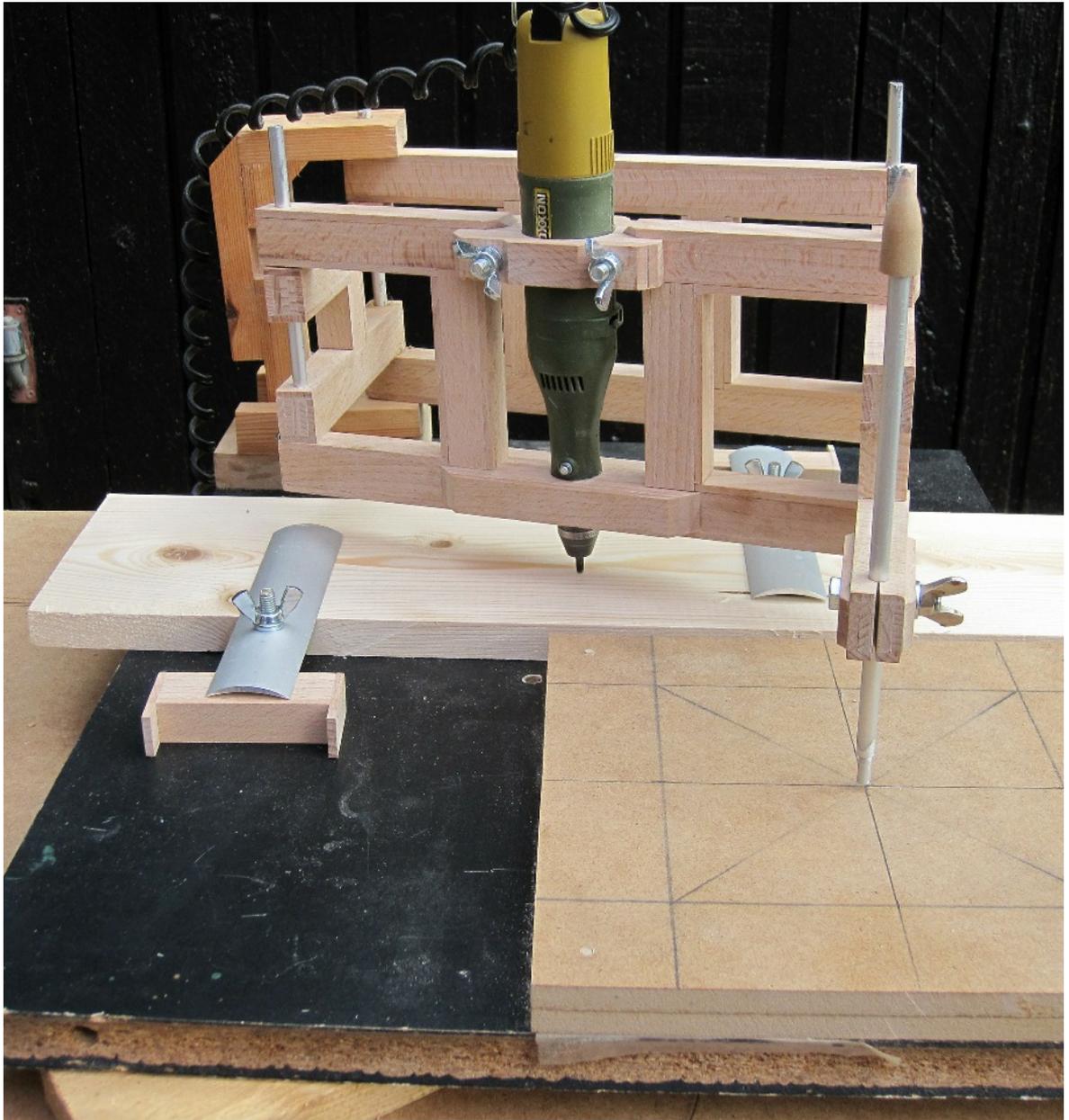






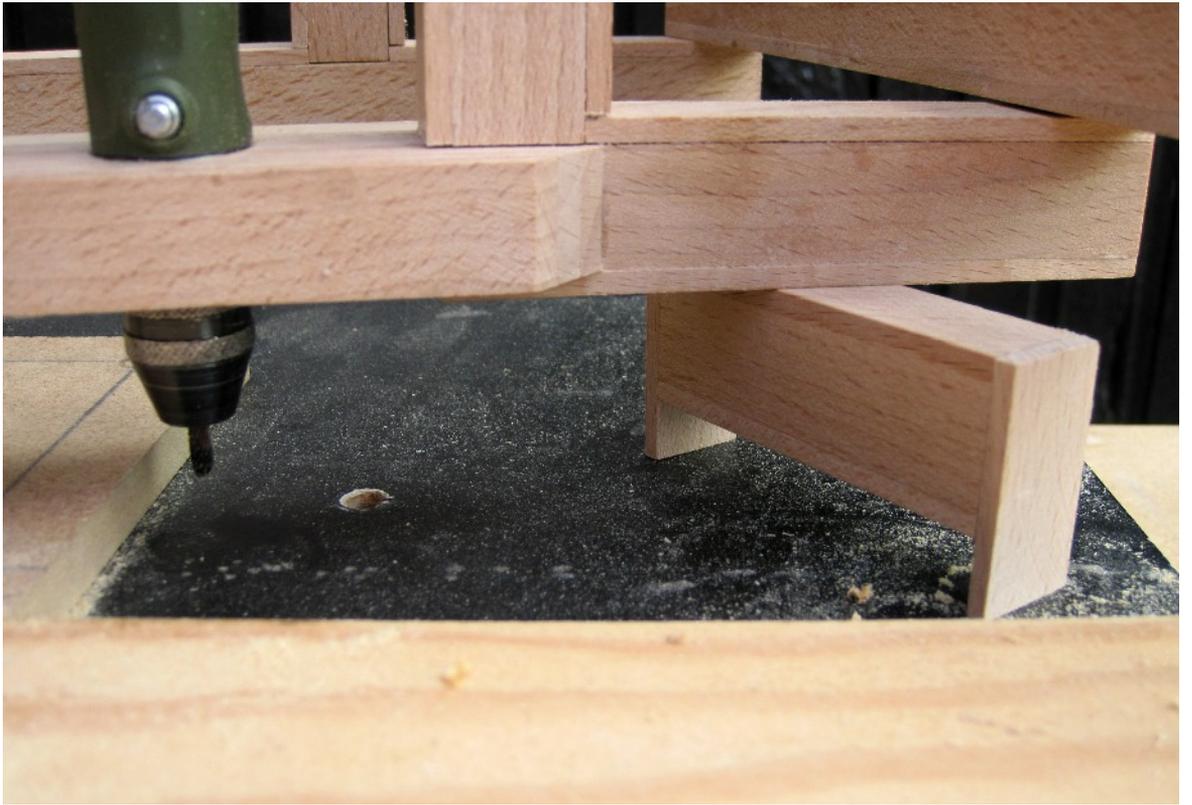
There are several ways to maintain the items to be milled. Here it is a few pieces of aluminum that are tightened with screws and wing nuts. In the previous, wedges were used. Both are equally suitable and it is first and foremost a matter of size and shape of the item that is decisive for what to choose, but fortunately there is enough space on the base plate for you to choose between several methods.

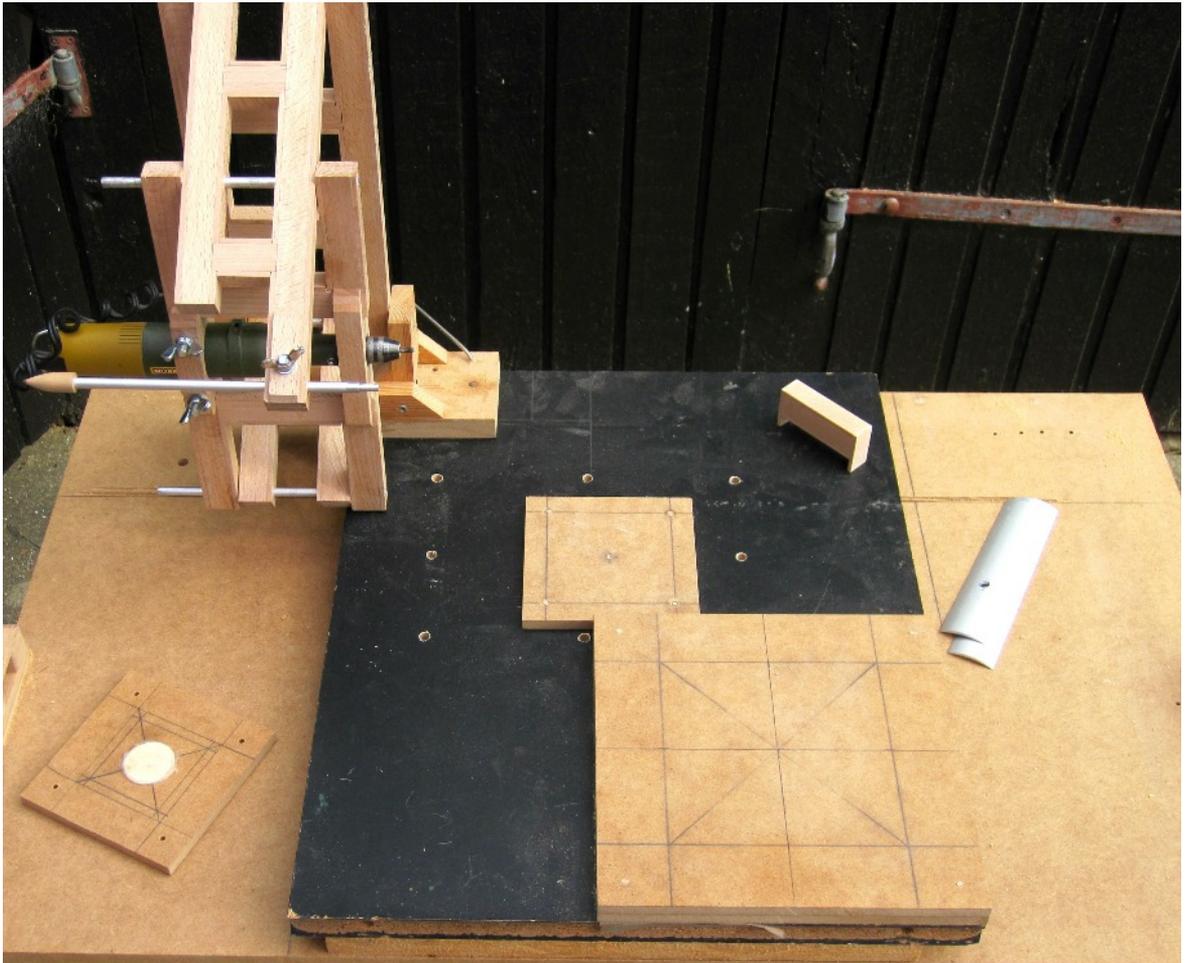
If working with very small workpieces I use to mount these on some standard workpieces as it is then easier to attach to the baseplate.



The subject to be milled and the drawing / photo serving as a publisher must be positioned so that the center of the subject should be just below the tip of the milling iron and the tip of the guide pin.

It is also important that the pantograph works horizontally, to check this use a small block (see top of next page). The pantograph holder is fitted with a single screw which means a risk that it will rotate during use and thus displace the center, the problem is solved with a piece of 3 mm. round iron that locks the holder (see next page at bottom).

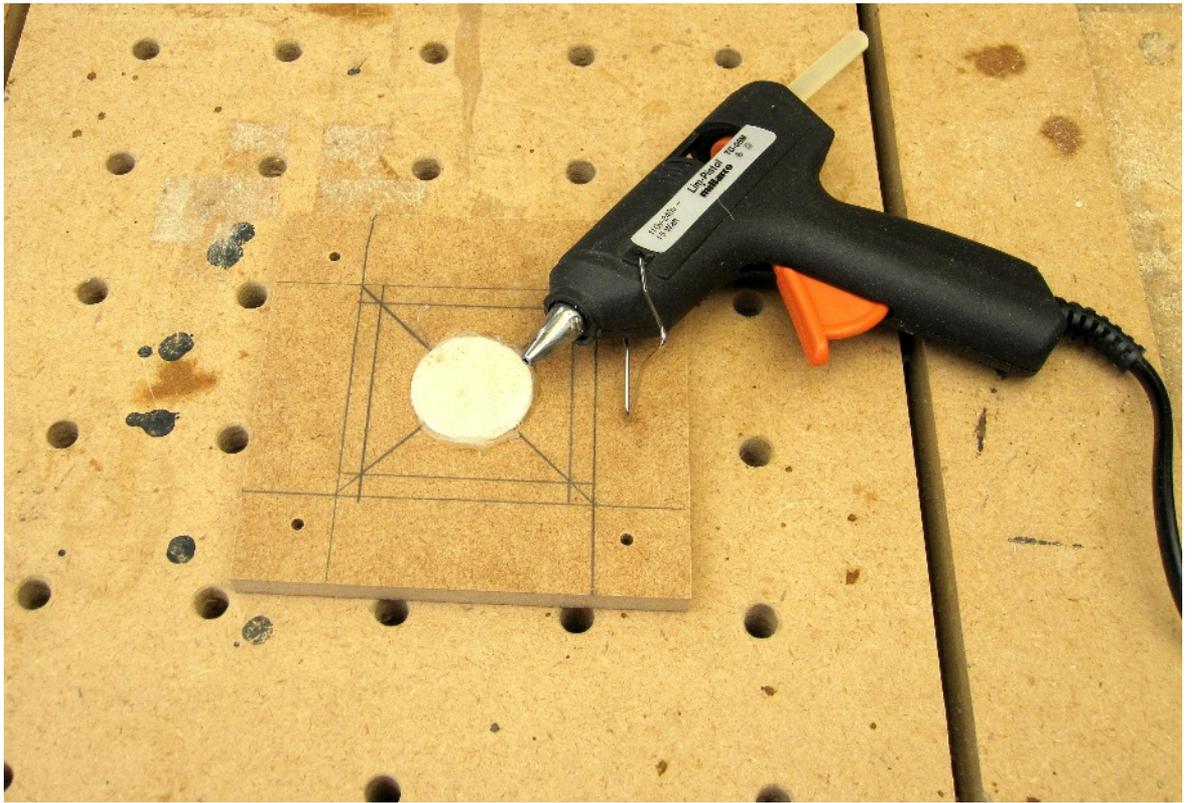


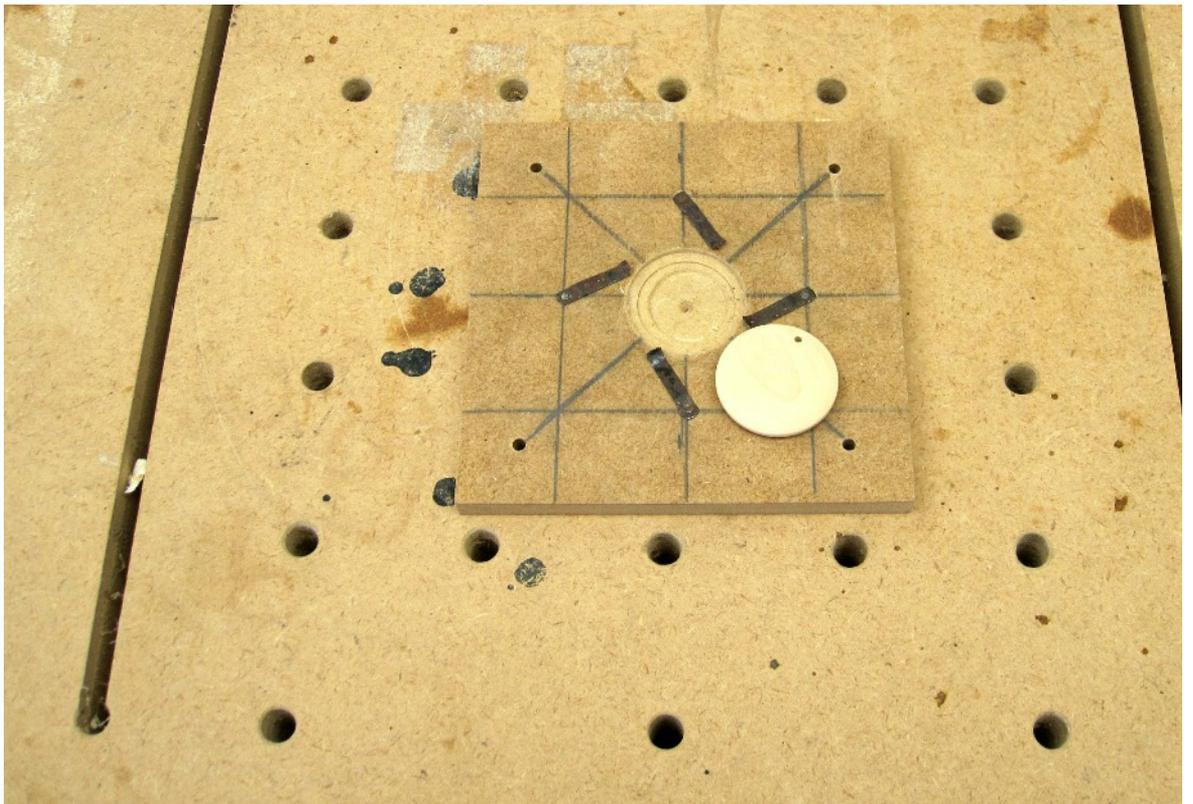
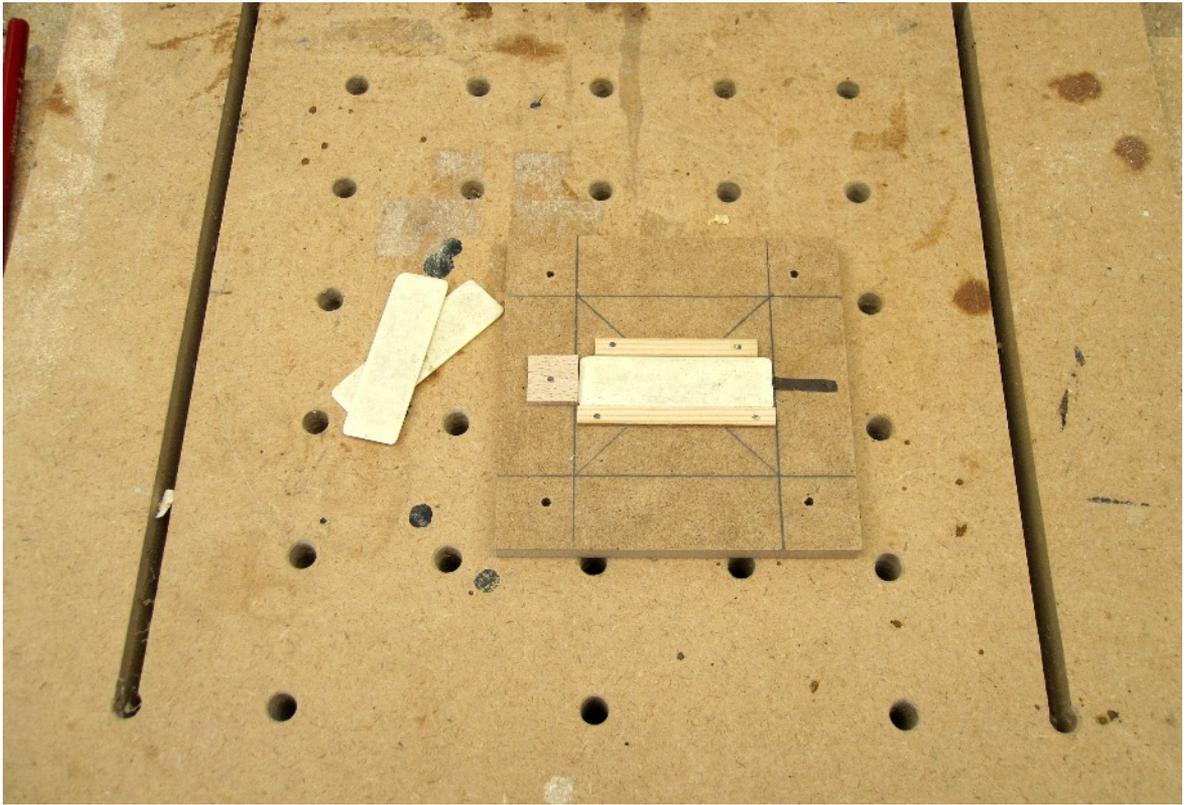


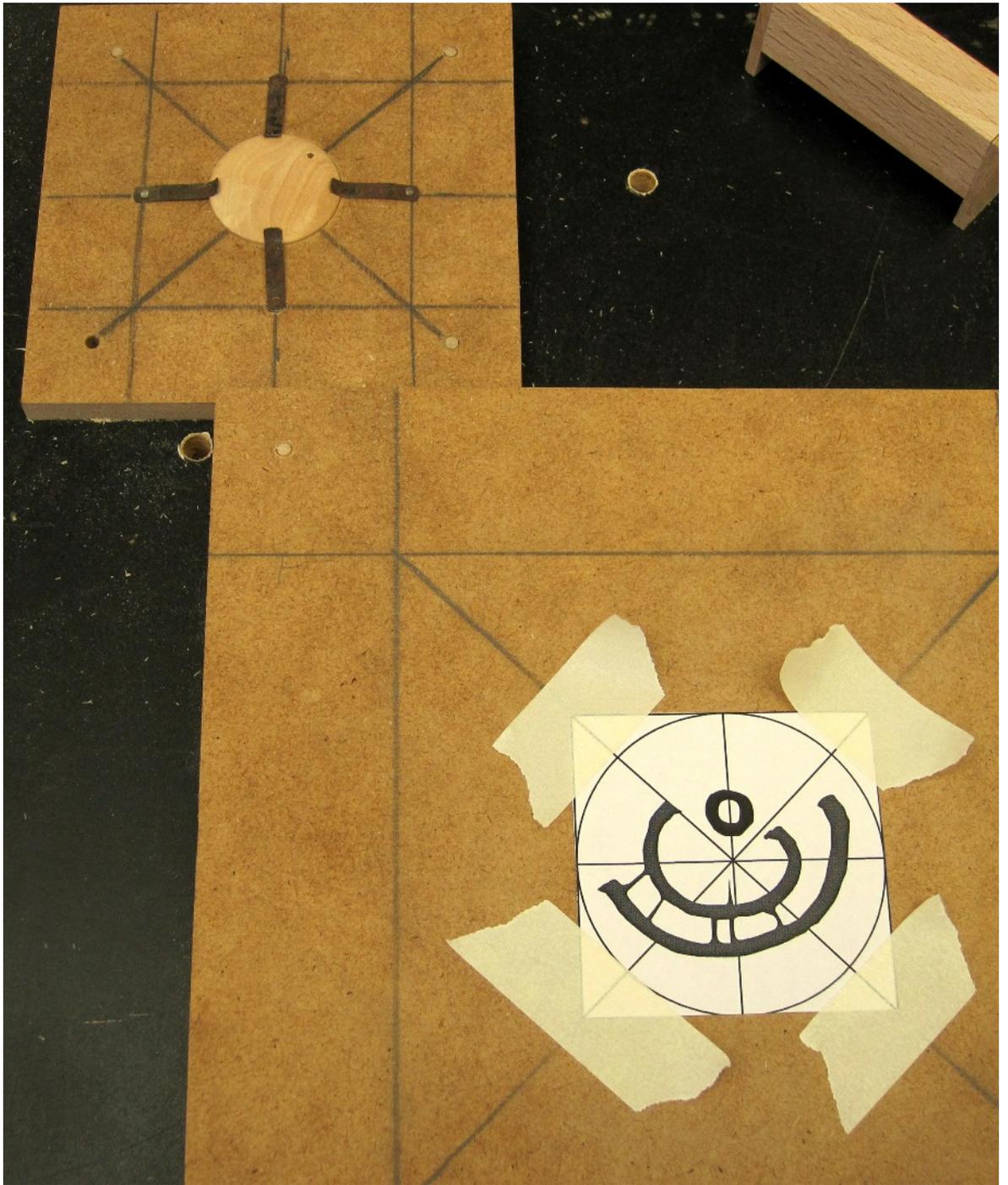
For small items I use an arrangement where the item is placed on an interchangeable standard plate corresponding to the milling area 10.5 x 10.5 cm. The plate is held by small 3 mm. sticks so that it can be easily replaced with another.

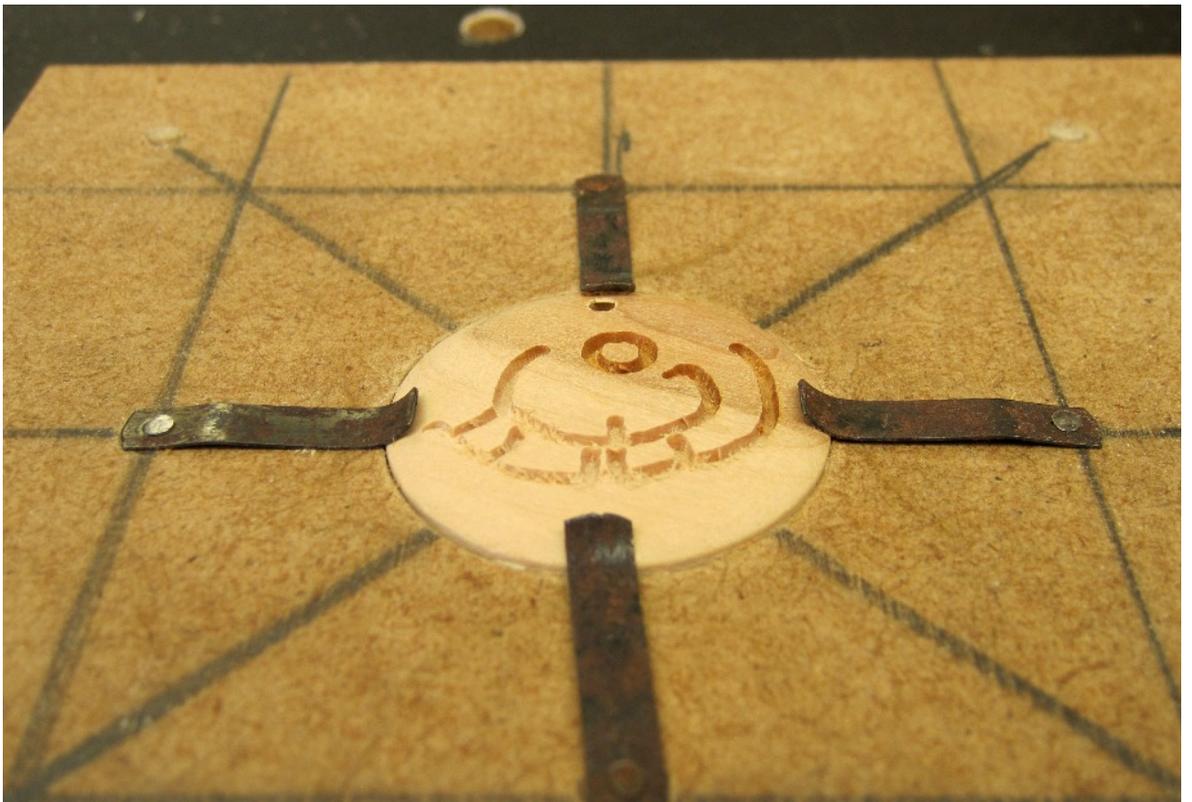
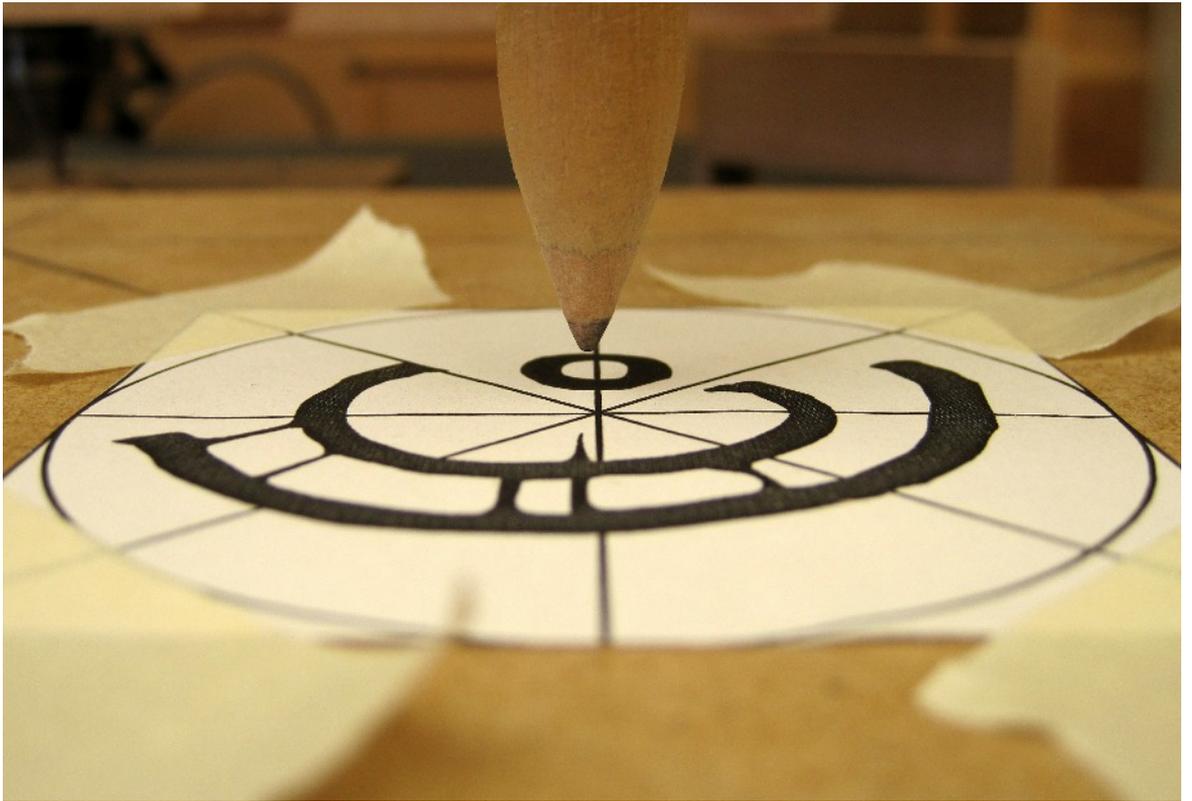
The blanks can be fixed to the plates in a variety of ways. If only a single copy is to be made, I use a glue gun or double-sided tape. If I have several similar items I make a set where the subject is held by eg. small pieces of wood or the like - so that the item is retained but easily replaced with the next one. In cases where what is to be milled does not have a flat back, it can be advantageous to make an actual cut in the plate itself.

In some cases I have used small metal clamps to hold the workpiece, it is easy and works well but as they go over the edge of the workpiece just be aware that they are not in the way of the milling iron, it may be necessary to rotate the drawing so the parts of the subject that come close to the edge of the workpiece lie between the metal clamps.

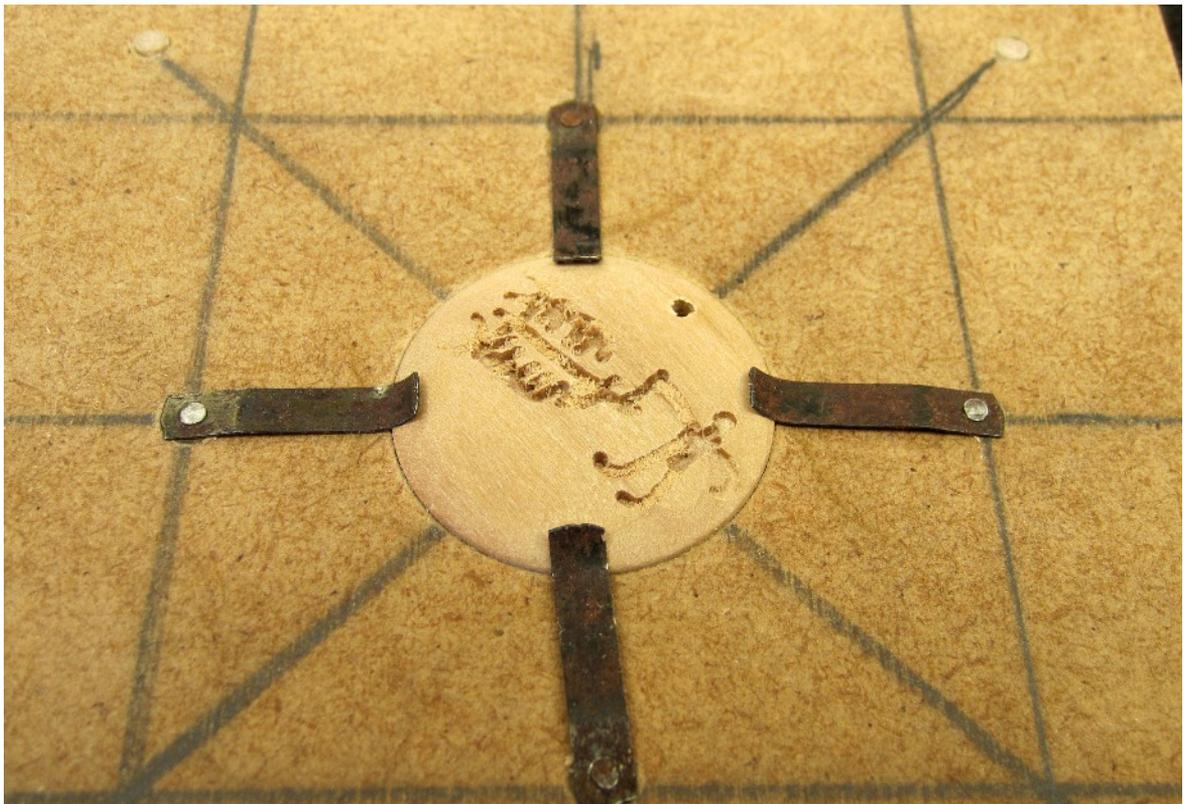
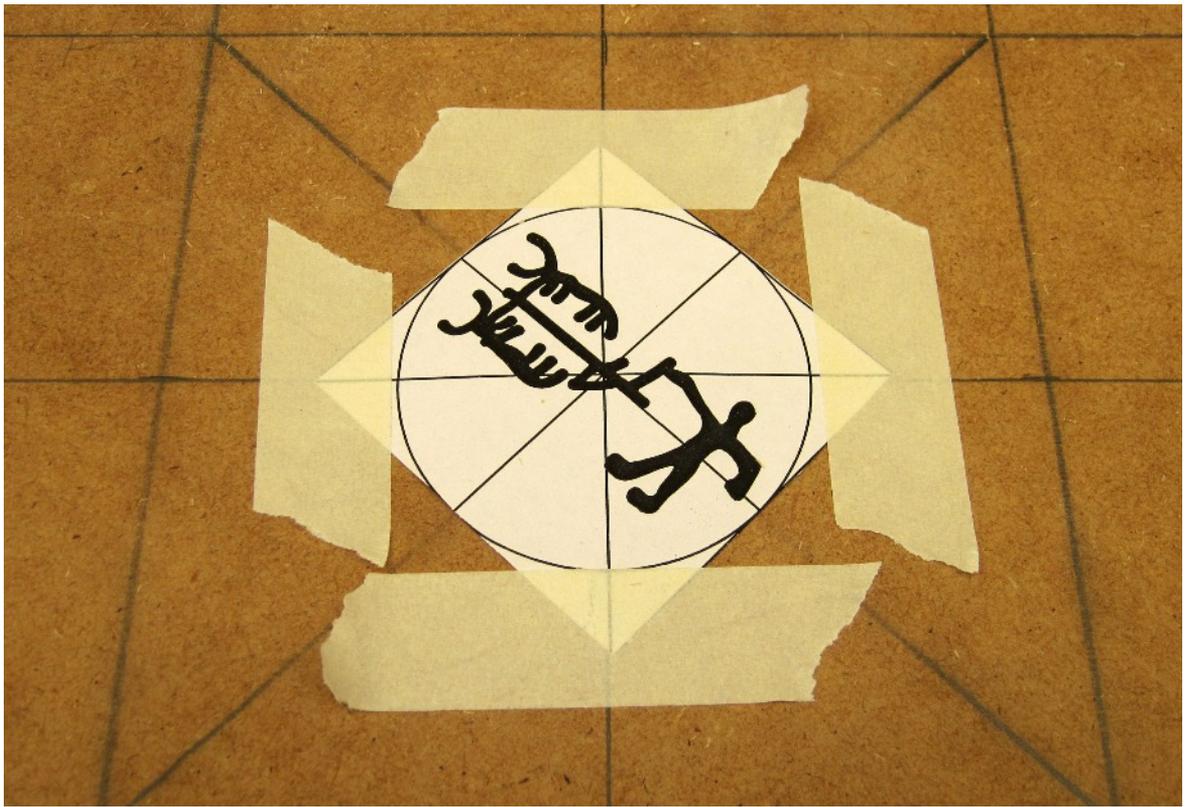


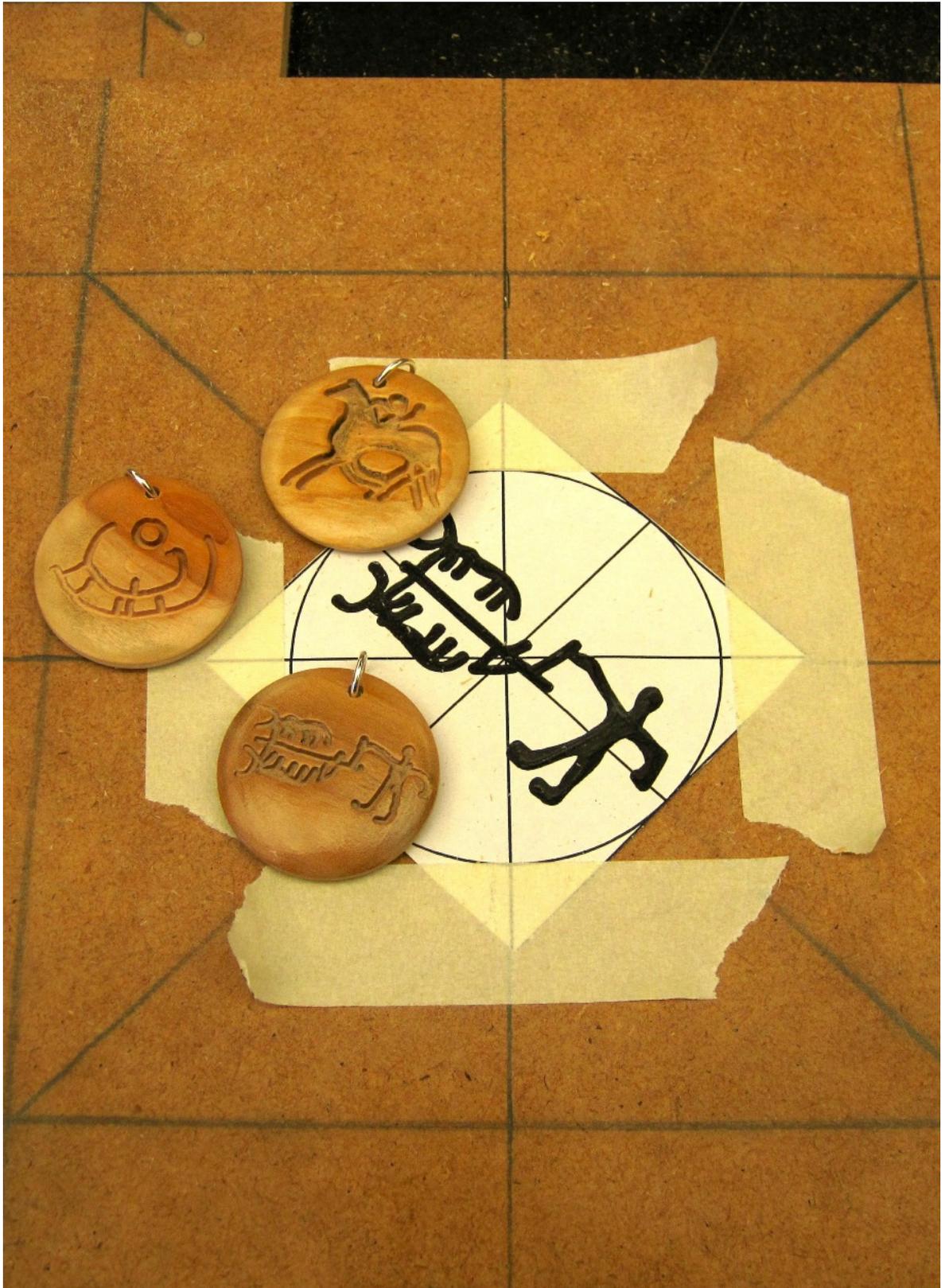














Milling iron suitable for free\_hand milling











