

# Ultrasonic drilling machine

ideal setting

Frequency 19600 HZ +-

Amp meter 0.5

**Do not go over 0.5 on the amp meter**

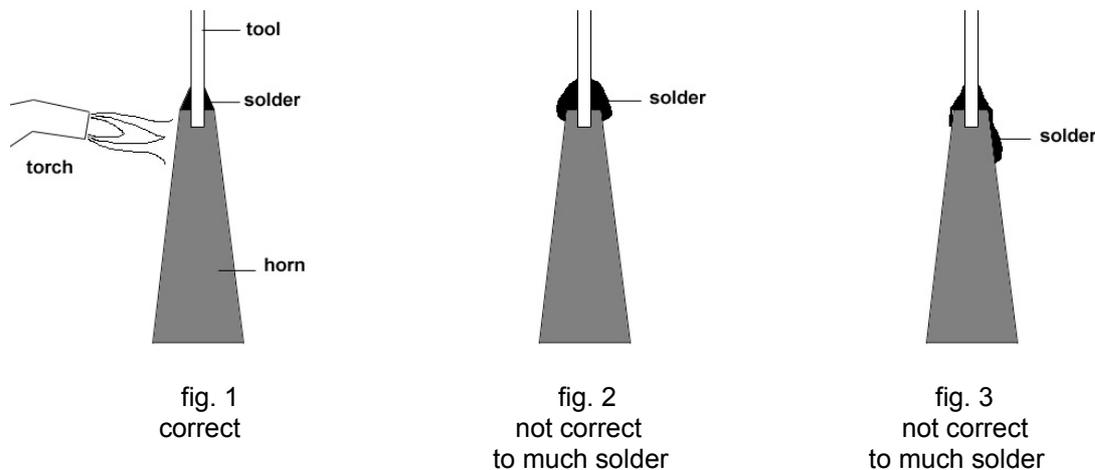
## Assembly instructions

### Solder a drilling tool onto the horn.

- Apply a little flux and silver solder onto the end of the drilling tool.
- Put the drilling tool into position on the horn, and add flux to the joint.
- Heat the horn with the gas torch, until the silver solder fuses and connects both pieces.
- Do not heat exactly at the joint of tool and horn, but below on the horn.
- When the drilling tool is consumed during the drilling operation, the old tool should be removed by heating, and then replaced with a new tool.

Making one or two 1.5 mm holes near the upper end of the drilling tool, near the horn, is very effective for core drilling of large holes over 8 mm in diameter. The grit will also enter the inside of the drill tube.

It is important to solder the tool onto the horn correctly, please refer to the following figures.



Small tools up to 1.2 mm are made of high carbon steel wire. As the diameter of the tool increases, machining efficiency will decrease. Therefore stainless steel tubes are used to drill holes larger than 2 mm. Wall thickness of the tube is between 0.1 to 0.5 mm

The horn needs special care.

- Do not overheat the horn.
- Do not quench the horn in water after soldering. No rapid cooling, as the silver solder will become brittle.
- Do not hammer, file, drop or deform the end of the horn.
- Excessive solder may run down along the horn, it must be removed.
- If you file away excessive solder great care must be taken not to damage the horn. Even a small flaw will prevent the horn from correct ultrasonic vibration and eventually breaks the horn.

## Mounting the horn

Tighten the set-screw in the cone.

Clean the contact surface on both sides, transducer-cone and horn. Apply a drop of machine oil on both sides. Screw the horn onto the transducer-cone and tighten it with the provided tools.

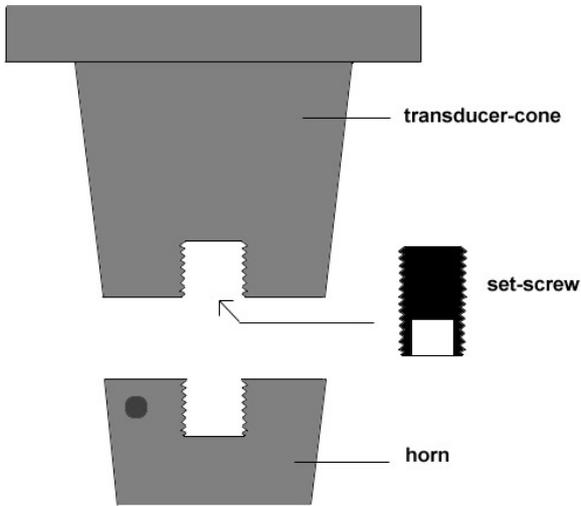


Fig. 4

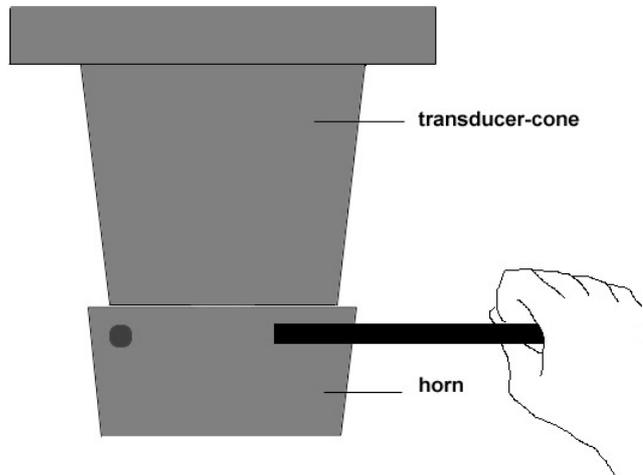


Fig. 5

## Set-up and adjusting of the feed-tray (The water tank is not supplied)

Position the feed-tray with a proper inclination. Adjust the water-dripping device to feed a mixture of abrasive and water to the tool. A piece of vinyl hose, attached to the end of the feed-tray, is used to feed the grit and water uniformly to the work piece along the horn and drilling tool. The abrasive grit is composed of carborundum (SiC) and can be re-used.

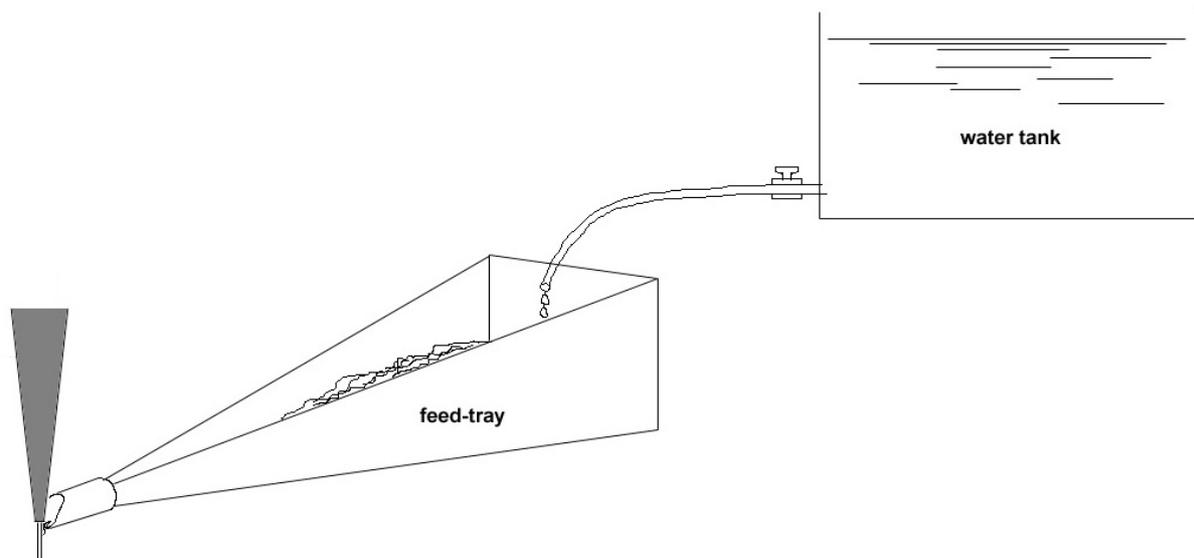


Fig. 6

## Operating instructions



### Fine tuning the frequency

- Turn on the machine and check the frequency and amp meter settings, by pushing down the foot control pedal.
- You need to “harmonize” the frequency for your machine at 19600 HZ.
- To do this, turn the “power dial” to full clockwise position.
- Adjust the frequency until the “amp meter” reaches about 0.5
- The frequency should be about 19600 +/- HZ.
- Adjust the power dial counter clockwise to see if the meter goes lower. If so, fine tune the frequency to maximize the power, but **do not go over 0.6 on the amp meter**. Or an emergency shut of will be activated. Is this happens, Shut of the machine and start again.
- When you change horns or tube sizes you may need to fine tune the settings again, but adjust it very slowly and with a light touch.

### The amplitude curve

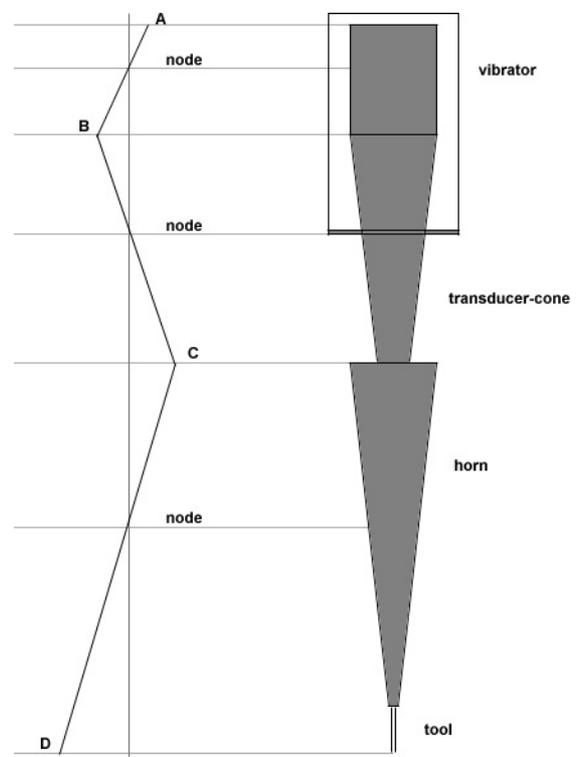
The vibration amplitude curve is shown in the following figure. There is no vibration at node, but the largest stress appears at these points.

The machining efficiency is determined by the following factors,

- 1) Vibrational amplitude of the tool
- 2) Working pressure to the work piece
- 3) Condition of abrasive fed to the work piece

Too large working pressure as well as too small pressure results in poor machining efficiency.

The abrasive is absolutely necessary. Too little or too much will result in poor efficiency. If no abrasive is present at the end of the tool, machining is almost impossible and the work piece may be broken. Especially in case of deep drilling, it is necessary to move the work piece up and down along the tool, once in a while, to allow the abrasive to reach the drilling tool end.



Amplitude curve Fig. 7  
A, B, C, D are the maximum amplitude points of vibration.

## Operation of the machine

Place the 220 grit in the feed tray and set up a water drip system so you have a steady but very small stream of water and grit, coming down over the horn and tube. Hold the material against the tube lightly and you will feel the cutting actions. Using a light pressure, hold the stone against the tube. With holes over 5 to 6 mm of depth, the drilling action slows down, as the drill tube vibrations are dampened by the walls of the hole which confine it. You may need to clear the cut material from the hole with an up and down motion.

## Drilling through holes

For best results, drill the hole from both sides. This will prevent break out, which sometimes happens when you drill all the way through the stone. To align the holes on both sides use a centre pin. For drilling round beads the following ideas may be useful.

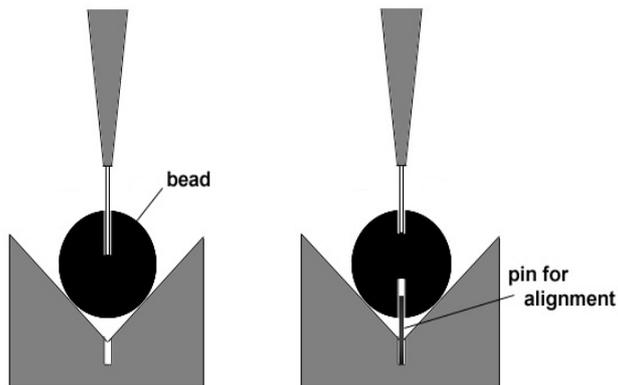


Fig. 8  
first step

Fig. 9  
second step

## Drilling cameos, intaglios, textures or other shapes

As this tool operates, not with a rotary, but vibratory action it is possible to drill square, triangular or heart shaped holes. Iron or steel nails shaped to the desired form will do the job. Surface textures, small cameos or intaglios up to 10mm in diameter are also possible. Serial casts of bronze tools are used for this and mounted on the large horn.

*Helder Hubert  
Montreux September 2016*