Understanding machinist jargon & what about Sherline's Lathe

Machinist jargon:

- Distance between centers
- Swing over bed/carrier
- Morse spindle
- Turning
- Work
- Dovetail

If you want to purchase a lathe then one needs to read the specs. Therefore, it's important to know at least the most common terms or the guy in the shop may "pull you over the table" – knowledge is always money … Yes, more experienced hobby machinists know all of this, but …

Purchasing stock/raw materials (aluminum, plastic, steel) is one of the first tasks. This raises the question what size stock materials can be worked on with a given lathe?

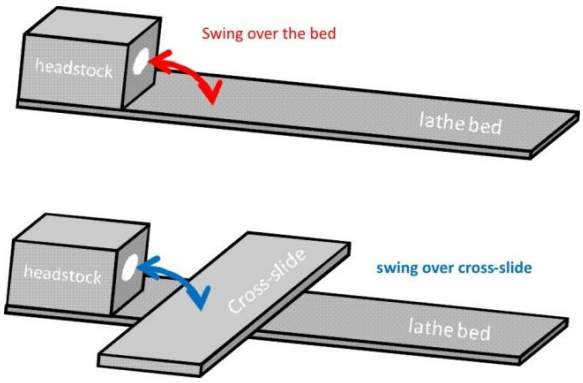

Fig. : For any lathe, the largest stock diameter which can be worked on is defined by the "swing over the cross-slide" (or carrier).

Maximum diameter. I use the Sherline lathe as an example. However, the following concerns hold true for any lathe including the UNIMAT and "China" benchtop type lathes. For the newer Sherline models (as of 2010) the manufacturer provides the following data: the standard version of the lathe can rotate (actually called **turning** in machinists jargon) 3.5" (90 mm) diameter (!, twice the radius) stock. This is called "**the swing over the bed**" (see Fig.). The bed is the long body of the lathe which holds the **cross-slide**, motor with the spindle that rotates, and various attachments. The cross-slide is the small table that moves perpendicularly to the bed (lathe body) and hold most of the cutting tools. Cuts in the front face of stock material (called "the work") may in principle be made on stock of this diameter (3.5"). However, the cross-slide would be in the way for cuts along the bed (or spindle direction). Therefore, for all other types of standard cuts, the stock diameter is limited to 1.875" (48 mm), i.e., the **swing over the cross-slide** (or more generally called **carrier**) equals ~1.8". Note that this is the maximum diameter and not the radius of the raw metal you can shape with the lathe. From that discussion it is evident that the

swing over the bed (most often found in product descriptions) does not tell you much, unless the design details of the lathe are known. Full size lathes can have rather bulky cross-slides. An attachment/accessory kit that raises the spindle and cutting tools is available for the Sherline system. This increases the swing over the cross-slide to 4.3" (109 mm). However, the torque and speed of the motor limits working on big and hard materials of this size. The chucks and some attachments for safely clamping the work are another concern with large size stock materials. Thus, the available attachments and their price matter a lot when deciding what lathe to purchase. In my experience, it becomes quite difficult to chuck (fix) large diameter and long metal parts in a mini lathe. The standard chuck that comes with, for example, Sherline's starter package allows you to fix round stock up to diameters of "only" ~1.5" (38 mm), otherwise the jaws of the chuck would hit the lathe bed. (A face plate could also be used, but ...) However, I have rarely worked with metal rounds larger than 1" (25.4 mm) in diameter on the standard version of Sherline's benchtop lathe. In addition, longer stock (> 4" /or 10 cm or so) need to be supported at both ends using a live center or steady rest, in particular when using large diameter pieces. Thus, there is a theoretical size ("swing over the carrier") and a practical size for simple day-to-day operations. Both parameters may differ significantly, depending also on the skills of the machinist, of course. A mini lathe cannot be used to work on large size metal stock for full-fledged engineering type projects. Don't even try, since this can be dangerous.

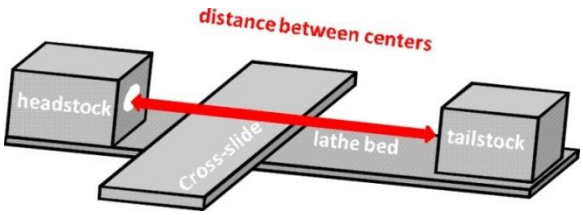

Fig.: For any lathe, the maximum length of stock which can be worked with is given by the "distance between centers".

Maximum length. For the larger version of the Sherline lathe, the maximum length (see Fig.) of the raw materials that can be worked on amounts to 17" (43 cm). However, clamping a long piece of metal that it turns without jiggling too much is again rather difficult. The term used in machining is "**distance between centers**". I typically did run into problems due to the limitations of the maximum diameter of the metal piece, rather than due to length restrictions. However, if you are interested in making mostly fancy metal table legs for furniture, then 17" as the maximum length may be an issue. The length of the lathe bed is longer that the distance between centers – don't mix it up.

Stock materials with a diameter smaller than 0.405" (10 mm) fit through a hole in the spindle on the Sherline lathe. For example, cutting threads in the ends of a longer metal rod would be limited to diameters smaller than 10 mm (0.39"). However, again clamping a long metal rod that sticks through the spindle is tricky (and dangerous). This is not advisable.

On the other side of the extreme, it becomes also difficult to mount very small parts in a lathe. Collets may be the best way to do so.

Now, any system has size limitations. In fact, it is easier to work on small parts with a small lathe. Sherline offers a microscopy for the lathe, for example. The strength of a mini lathe is certainly

making small parts. Anyway, professional machine shops have typically several lathes of different size. A small lathe may be considered as a training tool.

Spindle type. If you read descriptions (specs) of lathes then you may come across the term Morse taper #2 (MT2 or MT0) .. Äh – Morse … what? No, that's not about SOS - beep beep … It refers to the type/shape of the lathe spindle. Morse taper (name of a guy) are

Fig.: Left) MT0, MT1, MT2 taper (reduced length), **Middle)** MT0 and MT1 arbors, **right)** full length MT2. LatheCity sells these type of accessories.

standardized slopes either cut in the outside of a round (Morse taper) or a funnel like sloped boring (Morse arbor); see Fig. If the angle cut is small (1-2°), then the taper/arbor combination is self-holding. That pair fits quite tight together without bolts or glue. Therefore, a Morse arbor is use in the headstock and tailstock spindle of a lathe. (Your drill press may also have one – here it is typically a Jacobs (another guy) taper.) Morse taper are numbered from zero to seven depending on the diameter of the large end. Sherlines lathe has a Morse #1 in the headstock and Morse #0 in the tailstock. On more shop size lathes, typically at least a Morse #3 is used in the headstock. Some other benchtop systems just have a straight through hole as an arbor, such as the UNIMAT lathes. The advantage of a Morse arbor is that it can be used as a fast tool change system. In addition, many accessories are available and the system is self-centered, i.e., it is more precise than just a boring type arbor.

Dovetail vs. rods. Better lathes and mills, in my opinion, have a dovetail (lathe) bed. A dovetail is perhaps known from wood working since drawer slides, for example, have dovetail joints. That kind of joint is very sturdy and allows for a very precise alignment. Some older lathe such as the first UNIMAT models just had rods as the lathe bed similar to a drill press or a simple drill press vise. That's not a too great design. Most China style lathes have a V-bed for the lathe bed and dovetails only for the carrier.

Swing lathe. That term does not exist, but once a customer contacted me "I have a swing lathe do you have …". Actually, it describes the concept correctly. On the Sherline lathe and also on the UNIMAT the headstock is rotatable. Taper (slopes) are cut by using that features which is quite uncommon. All other lathes I have seen have a fixed headstock and use a rotatable cross-slide (compound slide) for taper turning. A rotatable headstock has advantages and disadvantages, but it is quite uncommon for a lathe. On larger systems the tailstock can be off-set but the headstock is fixed. Bothe versions allow for similar machining operations.

Many more machinist terms are in use, all of these are explained in our books. Go to www.lathecity.com