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Morse Tapers

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This article was prompted by Clive Stacey. He bought an interchangeable centre set in #2 Morse Taper (MT) at our open day on the 9th Aug. He then discovered that it would not fit his Coronet lathe, which has #1 Morse Taper sockets, and he wasn't aware of the difference.

If you look at any of the lathes in the clubhouse, you will see examples of Morse Tapers. A Morse Taper is a narrow angle taper designed for interchangeable tooling. The tool has a conical taper that fits into a matching socket on the machine. The angle of the taper is narrow enough so that it is self holding and will not easily fall out. There are other standard tapers used in other applications, but the Morse Taper is the one you will encounter in wood lathes and drill presses. There is a range of sizes to suit different applications from the #1 which can be found on the Record lathe in the club, right up to massive sizes used only in large machine tools.

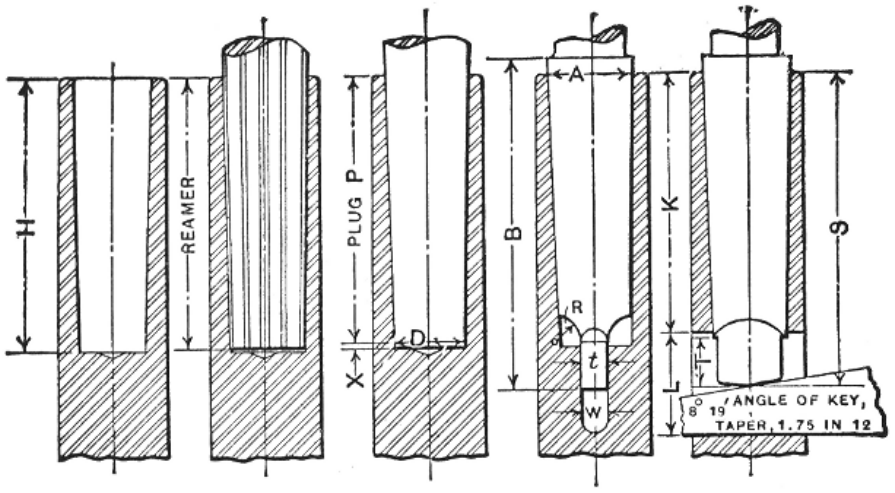
A table of sizes taken from my Machinery's Handbook (16th Ed) is given below. The tapers are designed to accurately hold a tool in the right position, yet be easily removable. Depending on the design of the machine, to remove the tool, a wedge can be knocked in from the side (see the drill press in the club) or a knockout bar from the opposite end of the shaft (see the Jet and Nova lathes in the clubhouse). The Record lathe in the clubhouse has a slightly more awkward arrangement. It doesn't have a hollow headstock shaft – it requires a collar to be screwed off to force out the taper. If you forget to fit the collar before you insert the #1 MT drive centre on the headstock end, and it wedges tight, it can be difficult to remove without tools.
The most common size found on woodturning lathes is the #2 MT. Some people feel that the #1 MT in the Record is too small, but in fact it is quite strong enough for the application of this lathe. The Morse taper sizes are carefully arranged in sequence so that only one size will fit in a socket, to prevent misapplication: The next size up will not fit at all, and the size below is completely loose. You can see this in the table: the small end size "D" for a particular size is larger than the big end size "A" of the size below, so it won't fit in at all.
For severe applications, you will notice a tang on the end of the taper that is designed to engage in a slot to prevent the taper from turning under load. In milling machine applications, a draw bar is used to pull and hold the taper into the socket.
When installing a tool with a taper into a socket, it is important to remove any dust or swarf from the taper and the socket to ensure that the taper locates properly and does not spin in the socket. If it does spin, it is likely to pick up burrs and damage the socket, ruining the accuracy of the machine. Tools such as drive centres are relatively easy and cheap to replace. However the socket usually forms part of the lathe spindle or the tailstock and is expensive to replace, so it is important to avoid damage, such as may be caused by the taper spinning in the socket.

If you wish to fit a different size taper to a machine, such as a #1 MT into a #2 MT socket, there are adapters available.

Extensions are also available, which can be useful when drilling deep holes. Toolquip keep a range of these and some are very reasonably priced. (www.toolquip.co.za)
The adapters and extensions have a slot in the side as shown in the pictures, into which a wedge can be tapped to aid removal.

The story has a happy ending: Clive sold the centre set to me for what he paid for it, as both my wood lathes use #2 MT.

Table 1A. Morse Standard Taper Shanks



No. of Taper	Taper per Foot	Taper per Inch	Small End of Plug *D*	Diameter End of Socket *A*	Shank		Depth of Hole *H*
					Length *B*	Depth *S*	
0	.62460	.05205	0.252	0.3561	2 1/32	2 7/32	2 1/32
1	.59858	.04988	0.369	0.475	2 9/16	2 7/16	2 3/16
2	.59941	.04995	0.572	0.700	3 1/8	2 15/16	2 5/8
3	.60235	.05019	0.778	0.938	3 7/8	3 11/16	3 1/4
4	.62326	.05193	1.020	1.231	4 7/8	4 5/8	4 1/8
5	.63151	.05262	1.475	1.748	6 1/8	5 7/8	5 1/4
6	.62565	.05213	2.116	2.494	8 9/16	8 1/4	7 3/8
7	.62400	.05200	2.750	3.270	11 5/8	11 1/4	10 1/8