Basic Guide to Buying a Lathe

What to look for and what to avoid when purchasing a new or used machine

BY JON SIEGEL

I earn my living by turning wood, and I've been a turner for the last 30 years. I spend most of my time making turnings for furniture and architectural applications, but I also lecture and give demonstrations at woodworking clubs, conferences and classes. One of the questions I am most frequently asked is, "What kind of lathe should I get?" This is akin to asking, "How long is a piece of string?" But to help my students, I have prepared a checklist of things to look for in a lathe.

When buying a lathe, it is the economies that you will regret, not the extravagances. You never will be able to produce fine work on a lathe that is poor in design and light in weight. I generally suggest getting the heaviest lathe that you can manage, fiscally or physically. But beyond this you must evaluate the most important parts of a lathe: the bed, the tool rest, the tailstock, the headstock, the motor and the stand.

Finally, the type of turning you will be doing has a crucial bearing on what to look for in a lathe. If you will be turning mainly bowls, you need the ability to turn at low speeds and a machine able to absorb the vibration of turning large, possibly irregularly shaped objects. If spindle turning is your game, a wider range of easily adjusted speeds is desirable. A longer bed may also be desirable, especially if you plan to turn long pieces, such as bedposts.

The height and structure of the bed are critical

While mass is the most important factor in a lathe's stability, the rigidity of the bed runs a close second. The most important feature is the height of the bed structure: A lathe that will turn a maximum diameter of 12 in. with a length capacity of 40 in. should have a bed-structure height of at least 5 in., excluding its feet.

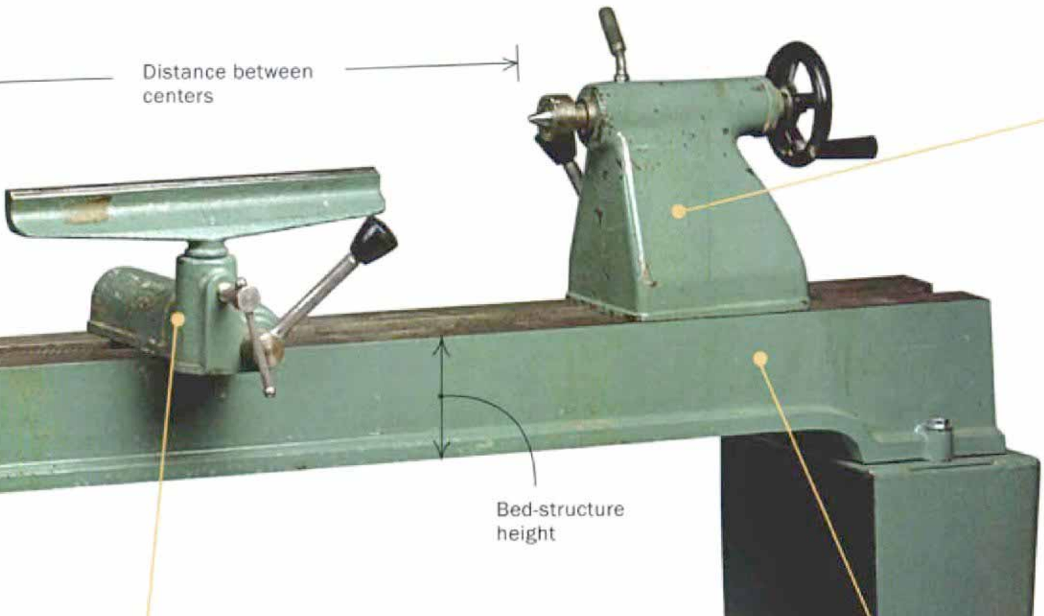
The design of the bed is more important than the material it is made from. In the old days, when you ordered a wood-turning lathe, you made your own bed out of wood. This remains a good idea. You can make the lathe bed as long as you want, and a dense

THE PARTS OF A LATHE

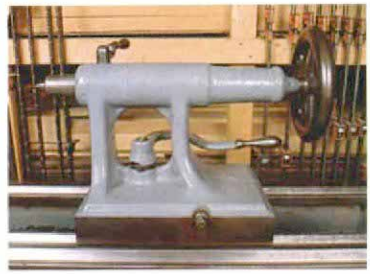
Whether made for turning pens or classical columns, all lathes have the same basic structure: a bed, a headstock, a tailstock, a tool rest and a motor. The distance between centers determines the maximum length of spindle that can be turned, and the swing is the maximum diameter bowl that can be turned.

HEADSTOCK

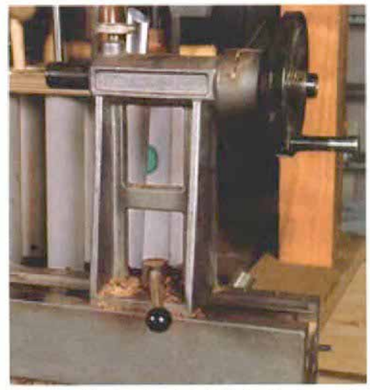
Turning heads. *Many lathes allow the headstock to swivel 90° or 180° to increase the swing and allow turning of larger-diameter bowls.*



TAILSTOCK



Good tailstock. *This tailstock has a wide base with the hold-down bolt forward of the center of the base to minimize vibration.*



Poor tailstock. *A tall tailstock with a narrow base is likely to vibrate.*

TOOL REST

A cam-lock base. *Most modern tool rests have a cam lock to secure the base to the bed. No tool is required to move the tool rest, and the handle is easily accessible.*

A center-bolted base. *Although less convenient than a cam-lock base, the advantage of a center-bolted base is that the casting is lower, allowing a larger-diameter spindle to be turned.*

A longer tool rest with two bases. *Designed for turning long spindles, the two bases diminish vibration significantly but reduce maneuverability.*

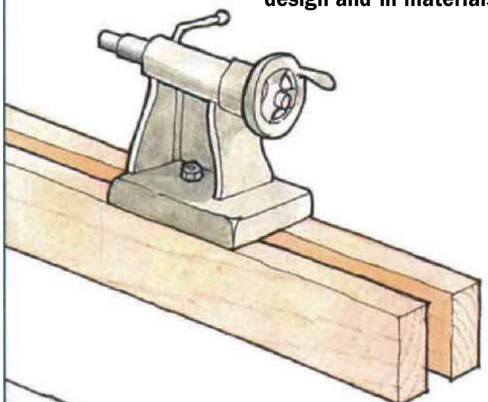
BED

Check under the bed. *The underside of the bed on many low-priced machines is a painted-over rough casting. The tool rest and the tailstock will never slide freely over such a surface.*

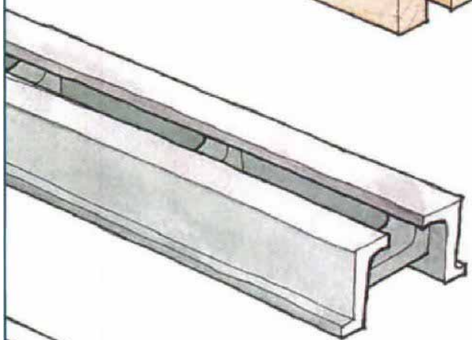
Photos, facing page (lathe) and this page (top left, middle left): Erika Marks

BED STYLES

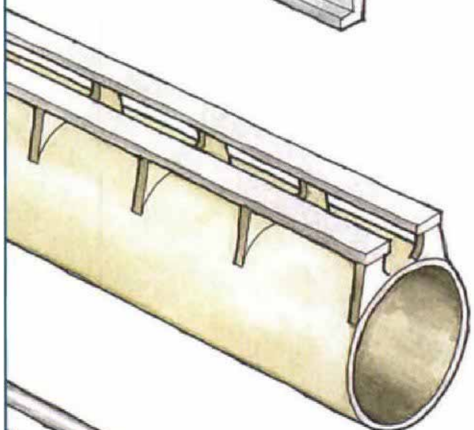
The conflicting goals of making a lathe vibration-free and economical to buy have resulted in a wide range of beds, both in design and in materials.



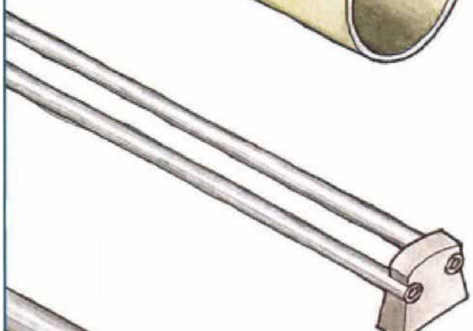
Popular in the past, and still a good choice, a wooden bed provides mass and a length to suit your needs.



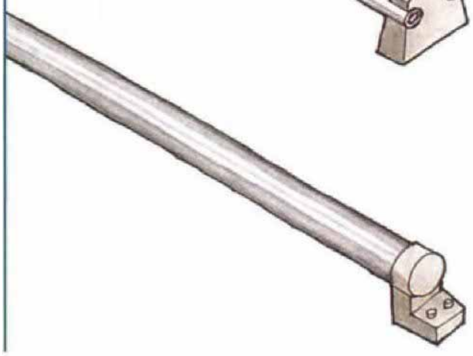
The author's favorite is a solid **cast-iron** *bed because of its vibration-absorbing mass and great rigidity.*



Possibly the way of the future, a steel bed welded to a large-diameter steel tube combines good bed height with low vibration.



Twin steel tubes are an invitation to vibration and flexing.



It is hard to align the headstock and tailstock on a monorail tube and impossible to get top-quality work using a lathe with this type of bed.

hardwood with ample bed height provides plenty of mass. The hold-down bolts on these lathes are somewhat less convenient than those on metal beds, because you mostly reach underneath to adjust them, which is one of the reasons why my first choice is a flat-topped cast-iron bed.

The ribs under a cast-iron bed tie the front to the back, giving torsional rigidity. People have tried to make lathe beds out of steel parts welded together. Most of these attempts were failures. A few years ago a Canadian company, Oneway Manufacturing, rewrote the book on welded lathe beds. Oneway's beds are based not on a pair of rails but on a large tube with flat steel bars welded on top. These beds are highly successful because they have a very large vertical dimension and a flat top. But whether they are better than a cast-iron bed of similar weight and cost is still a subject of debate.

All beds must be accurately machined, and this means more than just the top being flat: The slot must have smooth and parallel sides to guide the tailstock as it moves along the bed; the underside of the slot must be smooth and parallel to the top, because the clamp nuts that hold down both the tailstock and the tool-rest base must slide freely.

Avoid lathe beds fashioned from a pair of steel bars, either round or square, hollow or solid. These beds twist easily, causing vibrations. The longer the lathe, the greater the flexibility of the. bars. With the tailstock in its usual position, it falls near the middle, the most flexible point. With the tailstock at the end, the tool rest is near the middle. These situations lead to vibrations. The monorail type of lathe, which resembles a drill press lying on its back, will make you tear out your hair with its vibration and difficulty aligning the headstock with the tailstock.

The tool rest should be sturdy

During turning, the tool rest is nearest to where the cutting takes place, and that's where vibration usually starts. Many new lathes fail to provide a solid tool rest.

The tool rest consists of two parts: the base, or banjo, and the T-rest (the upper part). Most modern lathes have a cam-lock base that allows the rest to be locked to the bed by means of a front-mounted handle. Ease of adjustment makes this the best system, but a cam-lock base has some disadvantages: The castings rise quite high above the bed, which can interfere with the work; and the handle can get in the way. A simple, center-bolted base is perfectly good but requires a wrench to move the base.

The T-rest has a round shank that fits into the base. The longest T-rest that can be used with a 1-in. shank is about 15 in. (shorter on wooden beds). A longer rest has two shanks, requiring two bases, which are a must for large spindle turning and are a joy to use because of their extreme rigidity. Perhaps the only reason why turners don't use two bases all the time is the maneuverability that one base allows, especially during bowl turning, when the angle of the T-rest is frequently changed.

The tailstock needs a large base

Because it is the function of the tailstock to push the workpiece against the headstock, it must have a wide base. The most common problem with a tailstock is a too-small base. On the best lathes, the size of the tailstock base, as measured along the bed length, is greater than the center height of the lathe. The hold-down bolt or cam should be forward (left) of the center. The part of the tail-

Drawings: Jim Richey

The way of the future. Electronic speed control is the easiest to adjust because the motor can be either running or still. It is the most expensive form of speed control.

Shifting on the fly. Manual control via variable-speed pulleys can be changed only with the motor running. Many turners swear by this robust method of speed control.

Not high tech. Adjusting speed via belts and pulleys isn't convenient because the machine must be stopped before the belt can be shifted. However, it is inexpensive and reliable.

stock that holds the center is called the ram. This should extend (feed forward) by turning the handwheel clockwise.

The ram on a tailstock can be internally or externally threaded. I prefer they be threaded on the inside and driven by a screw connected to the handwheel. This time-tested design allows the tailstock center to self-eject when the ram is fully retracted. A hollow tailstock ram is threaded on the outside and operated by a threaded wheel rather than a central screw. An externally threaded ram is cheaper to make, but the presence of the threads compromises the fit between the ram and the tailstock casting.

Headstock should provide solid support

The fundamental job of the headstock is to support the spindle, which transfers power from the motor to the piece being turned. When faceplate turning (i.e., without the use of a tailstock) the entire weight of the object being turned and the resulting vibration bear on the headstock. For this reason it is critical that the headstock be very solid and well-machined.

The bearings that hold the spindle should be large and well-supported. A strong spindle lock is necessary for removing faceplates and chucks, and an indexing device is useful if you want to set up a fluting jig with your router. Pay close attention to the spindle-nose design, and be sure the measurements of the spindle threads and Morse-taper socket match one of the common sizes (see the story on p. 70).

Pivoting headstocks allow larger bowls to be turned, but care must be taken not to stress the bearings and spindle by turning too large a blank. And most factory-supplied tool rests no longer provide good support when the headstock is turned 90° to the bed.

SPEED AND HORSEPOWER REQUIREMENTS

High-speed spindles. *For spindle turning (1 in. to 4 in. dia.), a ½-hp motor with a speed range of 400 to 2,000 rpm produces fine results. For larger spindles, more horsepower and lower speeds are needed.*

High-powered bowls. *Turning 12-in.-dia. bowls requires 1 to 2 hp and a speed range of 200 to 1,500 rpm. For 24-in.-dia. bowls, starting speeds of 100 rpm or slower are needed, powered by motors of 2 to 5 hp.*

Speed control and horsepower are important

The greatest recent breakthrough in turning has been the introduction of electronic speed control. This system is available across the entire range of lathes with a.c. and d.c. motors, although sometimes it's an option that will add to the cost.

For a large lathe, you may want to look at a three-phase motor. These motors were generally confined to industrial sites with a three-phase power supply. Today, however, frequency controllers, also called inverters, can convert a domestic single-phase input to a three-phase output while controlling the speed of the three-phase motor.

An older form of speed control is through the mechanical adjustment of belts and pulleys connecting the motor to the spindle. Fewer new lathes still use belts as a form of speed control, but the vast majority employ them for transmission. Belts can be a source of frustration, especially at the low speed and high torque demanded by bowl turners. However, most slipping and vibration problems caused by belts can be eliminated by using the right belts at the right tension.

With regard to what speed and what horsepower you will need, here are some guidelines: For spindle turning (1 in. to 4 in.

Photos, except where noted: Mark Schofield dia.), 400 rpm to 2,000 rpm and ½ hp; for 12-in-dia, bowls, 200 rpm to 1,500 rpm and 1 hp to 2 hp; for 24-in.-dia. bowls, 100 rpm (or even less for uneven blanks) to 800 rpm and 2 hp to 5 hp.

The stand must be stout enough to resist vibration

A massive stand is not a substitute for a massive lathe and can only slightly mitigate the shortcomings of a poor machine. The stand can help control small vibrations caused by an unbalanced workpiece, but the stand needs to be heavy. A cast-iron stand is excellent but expensive. Some steel stands made from angle iron are simply the cheapest way to get the lathe off the floor, and no more.

Which lathe is right for you?

In the last few years mini- and midi-lathes have become very popular. These benchtop lathes have a swing of around 10 in. and a distance between centers of around 14 in. Whereas most mini-lathes require dedicated accessories, a midi-lathe with a l-in.-dia. spindle with eight threads per inch and a #2 Morse-taper socket allows accessories to be shared with larger lathes. For this reason, and because I have been impressed by the solidity of some of these midi-lathes, I suggest those readers with a lathe budget of under $500 get one. Then learn the basics, decide later what kind of turning most interests you, and trade up from there.

Few of the larger lathes (12-in. swing and around 36 in. between centers) in the $500 to $1,500 price range have overly impressed me. If you plan to turn workpieces near the capacities of these machines, at least look at a used heavy-duty lathe. Once you reach the $1,500 to $3,000 price range, the quality improves, and if money is not a consideration, the new top-of-the-line lathes with cast-iron or welded steel beds will set you back $3,000 to $5,000.

Before you buy, whether new or used, ask yourself the following questions: Is this the most robust lathe I can get for my money? Can I get all of the accessories I need? Does the speed control offer the range of speeds I need, and are they easy to change? Do the parts appear to be constructed with accuracy and care? If the answers are all yes, the money you will spend will be rewarded by many years of happy and successful turning. □

Jon Siegel has been turning wood and metal for more than three decades. At his shop in New Hampshire, he uses lathes of nearly every size and age.

Entry-level lathe. *Small but well-proportioned, a midi-lathe offers an economical way to begin turning on a solid machine.*

Shopping for a used lathe

More value for your money. *By scanning the classifieds, you may find a lathe like this, with a timeless design, well-machined parts and a solid structure, for a fraction of the price of a new lathe with the same features.*

If you are looking to purchase a heavy lathe, you may get more mass for your money in an old machine. Do not buy a lathe if the tailstock is missing. Not only will that prevent you from turning spindles, but even a bowl turner will need the tailstock to rough out large chunks between centers, for drilling and for other purposes. It is nearly impossible to find a replacement tailstock that will fit properly. Do not reject a lathe because the tool-rest base (banjo) is missing. A tool-rest base can be fitted from another machine.

The most common spindle-nose threads for wood lathes in North America are: ¾ in. 16 tpi; 1 in. 8 tpi; 1 in. 12 tpi; 1¼ in. 8 tpi; 1½ in. 8 tpi; and 33mm-3.3mm. A very old machine may not have standard spindle threads and tapers. This may mean re-machining threads on modern accessories or having adapters made. You should also machine the lathe spindle of any machine that does not have the standard tapered centers. A precision inspection of a lathe is beyond the scope of this article, but you should look for play in the bearings, play in the tailstock and runout of the spindle. If you have a dial indicator, you can check the spindle runout; it should be under 0.002 in. total. If you do not have an indicator, you should check the runout by feel.

Many old lathes are for metalworking and, although there are fundamental differences between metal and woodworking lathes, the former can be used in woodworking, especially for large work such as bowls, turned at low speeds. The presence of a carriage and the prismatic ways on the bed (not a flat top) make it harder to fit a wood-turning type tool rest base and T-rests to the bed.