

Understanding Hand Planes



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2013

Overview

- Hand planes exist in a myriad of styles designed to perform a variety of specific functions. This class will cover the most common type of planes, *bench planes*. Some of what we will be discussing include the following:
- **Body material:** Wood, metal, or both?
- **Components of a Plane:** Parts of a plane and their function.
- **How a plane works:** What properties affect the performance of the tool?
- **Types of planes:** Reviewing different types of benches planes (jack, jointer, smoother, etc) as well as bevel up vs. bevel down planes, infill planes, and specialty planes.
- **Vintage planes:** A brief discussion of what to look for when buying vintage tools and how to go about restoring them.
- **Proper planing technique:** How to use your new best friend.

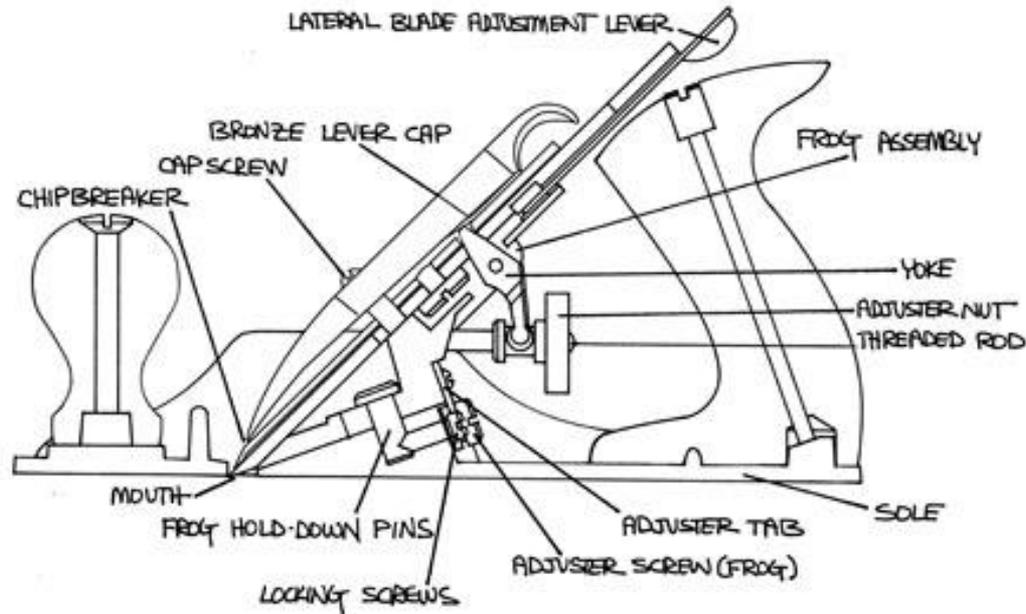
Body Materials for Bench Planes

- **Wood:** Historically, almost all planes had wooden bodies... it was the easiest material that could be obtained and worked into the proper shape based on the manufacturing capabilities at that time (and we're going back thousands of years). Wood is still the material of choice for Japanese planes and many western plane users also prefer wood for its weight, the feel of the wooden sole on the wood being planed, and/or because they like to make their own planes.
- **Metal:** The majority of (non-Japanese) planes made today are metal, typically ductile cast iron or bronze. The bodies are heavy, which is both good and bad, very durable, and stay flat for decades of normal use and with proper care.
- **Transitional:** When Stanley released their Bailey series of metal-bodied planes, some woodworkers wanted the benefit of metal plane's easy blade adjustments, but preferred the wood-on-wood feel and lower cost of wooden bodied planes. These transitional planes were created to *transition* woodworkers from wood to metal, but are no longer manufactured or very desirable among modern woodworkers. One common reason to buy a vintage one today is to replace the sole for creating your own inexpensive, relatively light, extremely long jointer plane.



Components of a Plane

- The major components of a standard metal-bodied bench plane. Picture from Lie-Nielsen.com. (Wooden-bodied planes will simply have a wooden body (duh), a blade/iron, and a wedge.)



- Mouth:** The opening through the plane's sole that allows a shaving to pass through. For smoothing planes, a tight mouth (just larger than the largest shaving to be taken) is ideal for minimizing tear-out. For courser work, the mouth isn't critical as long as it's not too tight.
- Frog Assembly:** Screwed to the body and holds the blade at the desired angle. Moving the frog forward or backward adjusts the opening of the mouth.
- Chipbreaker:** Not used on all planes, but common for bench planes. Mates with the back of the iron to stiffen the blade and help deflect shavings out of the tool. This is why shavings curl.

Components of a Plane

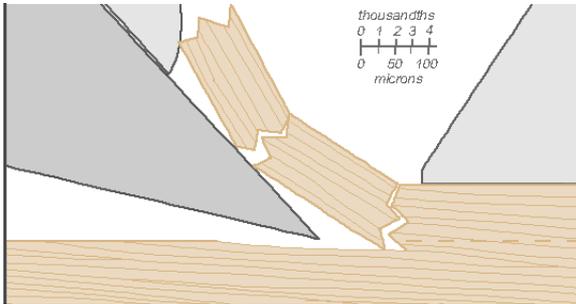
- **Lever cap:** Clamps the blade-chipbreaker assembly to the frog.
- **Cap screw:** Adjusts the amount of pressure the lever cap applies to the blade. Pressure should be high enough that the blade doesn't wander during use, but light enough that it is easy to spin the depth adjustment wheel. When in doubt, use less pressure than you think is necessary and only increase it if you see the blade shifting position during use.
- **Depth adjustment wheel/nut :** Controls how far the blade penetrates the sole and consequently, how thick of a shaving the tool will take. *Beware of Backlash.* In wooden planes, more penetration is done with a hammer, less penetration requires tapping the heel and setting the wedge or backing the blade out and starting again... it's not as bad as it sounds.
- **Lateral adjustment lever:** Skews the blade left/right to square the blade to the sole. Also done with hammer taps in a wooden plane or block plane. Move the lever *towards the heavy side of the cut to reduce it.*
- **Knob:** Handle at the front/toe of the tool.
- **Tote:** Handle at the back/heel of the tool.

How a Plane Works

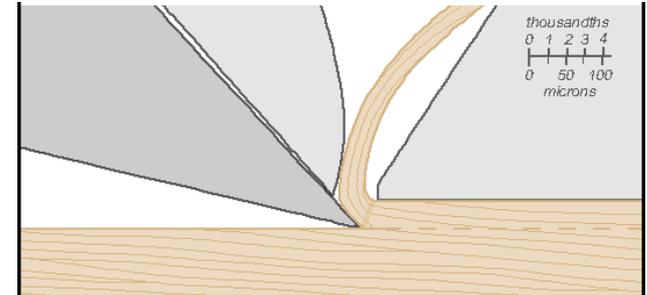
- A plane is simply a glorified jig for holding a chisel and a specific angle. The important aspects of a plane are the length and flatness of the sole, weight, blade angle and shape, clearance at the mouth, and (for comfort's sake) the tote and knob.
- **Length of sole:** The length determines the type of work the plane will most often be used for. Longer planes ride over the high spots on a board, flattening the surface. The longer the plane, the flatter/straighter it will make a surface/edge. Shorter planes are preferred when working localized areas of a board or if the board being planed isn't very long to begin with (you don't need a 24" plane on a 10" board... ever). This will be discussed more in the Types of Planes section.
- **Flatness of sole:** All bench planes are designed to flatten wood, but that cannot happen if the sole isn't flat, at least in the critical areas. This will be discussed more in the Vintage Planes section.
- **Weight:** Many view heavy bench planes as a good thing, especially for taking thick shavings or cutting end grain as the momentum of the tool carries it through the cut easier. Others prefer lighter (wooden) planes because they tire less quickly when in use, particularly if the shaving being taken is thin.
- **Blade Angle:** Standard bench planes cut at 45° where as low angle planes cut at 37°. End grain and softwood tend to cut better at low angles, hardwoods tend to prefer higher angles. For tricky wood (figured boards, interlocked grain, etc) 55°-65° can be used to reduce tear out. And if all that fails, a scraper or sandpaper can handle anything.

How a Plane Works

- **Clearance at the mouth:** A plane is designed to slice a shaving off a board. This happens when the force to slice wood fibers is less than the force to simply tear it away from the board. A sharp cutting edge is the best way to ensure slicing the fibers rather than tearing them, but for critical cuts as when using a smoothing plane for a perfect final surface, a tight mouth will also help. The fibers cannot tear up while the sole of the plan is holding them flat. The sole will do this until the edge of the mouth is reached, freeing the fibers of pressure and allowing them to pull up. A tight mouth minimizes the length of this no-pressure zone. Too tight, however, and the shaving cannot fit through and will jam. For non-critical cuts, the mouth can be left relative wide open.



Thick shavings, a wide mouth, a chipbreaker set far from the cutting edge and, worst of all, a dull blade all increase the chance of tearout.

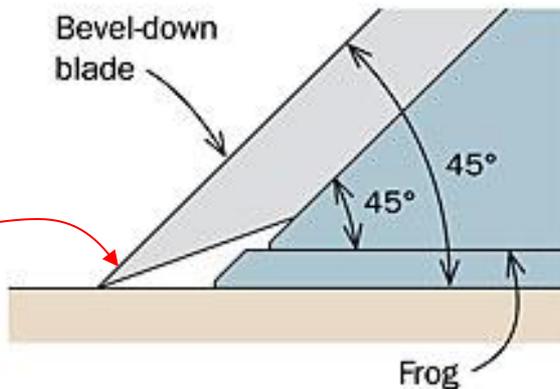


- **Tote & knob:** Comfortable grips make a big difference. Planes are often used for several minutes or even hours at a time. If the tote or knob is poorly shaped the plane is essentially useless no matter how good all the other aspects of the tool may be.

Types of Planes

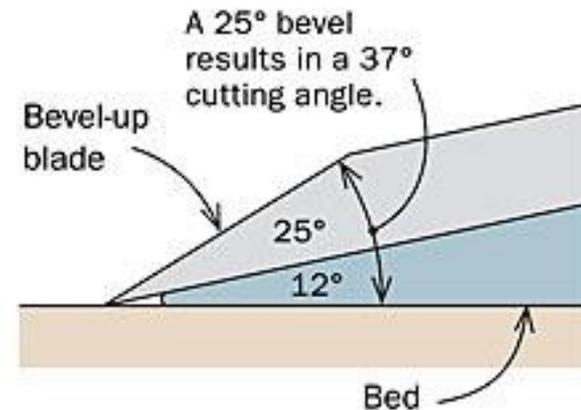
- **Bevel-Up vs Bevel-Down:** Direction the bevel faces when a tool is cutting wood. Bench planes are bevel-down, block planes are up.

BEVEL-DOWN PLANE



The cutting angle is determined by the frog angle.

BEVEL-UP PLANE



The cutting angle is determined by the bed angle and the bevel angle.

This is where a back-bevel can increase the effective cutting angle on a bevel-down tool, helping to reduce tear out. The other option is to install a high angle frog assembly.

Types of Planes

- **Bench Planes:** Bevel down tools, typically use chipbreakers, and offer depth and lateral adjustment. Three categories exist: jack planes, jointer (or try) planes, and smoothing planes.
 - Jack planes (14"-18" long) are used first to remove a lot of material quickly (0.007"-0.010") and begin the flattening process. The blade doesn't have to be shaped or sharpened to perfection, the mouth can be relatively wide open, and the sole's flatness isn't critical. Vintage jack planes are a good option here.
 - Jointer planes (22" or longer) are used to flatten a face or straighten an edge. The length of these planes enables their flattening capabilities. The longer the plane, the flatter the surface. Shavings are usually moderate (0.005"), mouth opening isn't critical, but sole flatness is vital. If buying vintage, be careful of a warped sole.
 - Smoothing planes (10.5" or shorter) are for leaving a perfect surface for finishing. They take thin shavings (0.001"), need to be extremely sharp, have a tight mouth, and dead-flat soles. These are the most sensitive planes to set up.



- **Block Planes:** Bevel up tools with no chip breaker and often only offer depth adjustment. Typically smaller tools used for detailed work such as chamfering corners or working small parts. Technically, even a low angle jointer or smoothing plane is still a block plane, though it functions like a bench plane.

Types of Planes

- **Infill planes:** Technically, an infill plane is simply a bench plane but generally with no frog assembly and the sole of the plane is “filled” with wood. This forms both the tote and a majority of the bed for the iron to rest against. Many do not use a chipbreaker, but have extremely thick irons. Today, vintage infill planes are pricey collectors items (search for Norris planes) and a few modern makers also turn out some gorgeous tools. If you’re interested, look for Hotley, Ron Brese, Daed, Marcou, and Sauer & Steiner planes, but be warned, they range from \$1,000-\$3,000 each depending on the maker and model.



- **Specialty Planes:** Numerous other planes exist for performing specific functions besides simply flattening boards, but they are out of scope for this class. Some of these include moulding planes, rabbet planes, plow (or plough) planes, router planes, shoulder planes, chisel planes, shooting planes, and more. As your skill increases, the need for these tools will become apparent based on the work you are doing. Regardless, a good jack, jointer, smoother, and block plane will always be the backbone of any hand tool shop.

Vintage Planes

When it comes to vintage planes, there are a few things to consider:

- Jack planes are a great option here as they're readily available from Stanley (bailey or bedrock), Millers Falls, Record, etc. and the set up isn't critical.
- Jointers are tricky (especially if buying off eBay) because a long, flat sole is critical. If you can't inspect the sole before buying you may end up with a useless tool or one that takes hours of grinding and lapping to make the sole flat (there's a lot of material to remove on a tool that long). If the sole is flat, however, not much else matters.
- Smoothers require the most precision to set up correctly. The sole must be dead flat (but at least there isn't much material to remove during flattening, so that's nice), the mouth must be tight (some vintage planes don't have enough travel in the frog assembly to actually close the mouth the desired amount), and the blade must be razor sharp and thick to avoid chatter and the chipbreaker must meet seamlessly to avoid clogging (expect to replace the blade with a modern version for decent edge life and thickness).
- If possible, corrugated soles are nice for vintage planes because there is less material to remove during the flattening process.
- Don't be too turned off by a little rust or pitting on the tool. Evapo-Rust or other products will remove the rust and pitting won't stop the tool from functioning (unless it's right at the mouth or near the cutting edge of the blade, but the blade can be replaced).
- Cracked or welded bodies should be passed over, a cracked handle can be replaced however.

Proper Technique

- **Pressure:** Start with downward pressure over the front knob, your dominant hand on the tote simply pushes forward. Once the entire tool is over the wood, even pressure can be applied front to back. As the tool starts to exit the cut, only apply downward pressure to the rear of the tool.
- **Skewing:** It is common (and advisable) to skew a plane in use. It is more comfortable to hold and cuts in a slicing fashion leaving a cleaner surface.
- **Hollow or humped?:** Hollows are always better than humps. A plane can follow a hump forever, but can only create a tiny hollow. Strive to create a hollow and the plane will do the rest. A spring-joint is also easy to make using hand planes when edge jointing boards.
- **Body position:** Keep the plane relatively close for most work, let your body drive the bulk of the motion, not your arms. Some operations, like planing across the grain, require more arm motion, but too much pushing with your arms will wear you out in a hurry.
- **Work holding:** Several vices and devices exist for immobilizing your work. Sometimes all you need is a hard stop to push against. Just be aware that even moderate clamping pressure can bow the board, making it very difficult to flatten. The less clamping and downward pressure you need, the simpler things will get.
- **Order of operations:** Assuming the board is large enough, start with a jack plane to remove the rough surface and begin the flattening process. Plane tracks and tear-out are not a big deal at this point. Next switch to the jointer. When the surface is flat, tear-out is minimal to non-existent, and plane tracks are erased, switch to the smoother. A few light passes is all that should be required to leave a flawless surface. If you are spending a long time using the jointer or smoother, you probably didn't spend enough time with the previous tool. You will develop a feel for when to switch fairly quickly.

Creating a 6-Sided Board

- Start by jack planing straight across the grain. This enables thicker shavings with less force, but beware of spelching (blow-out on the back edge).
- Next, plane diagonally in both directions. Pencil marks on the board will help reveal low areas that have not yet been reached.
- When the entire surface has been hit, plane with the grain (and reduce your shaving thickness) to get a relatively flat surface with reasonable finish.
- Switch to the jointer. Planing across is probably unnecessary, but diagonal and with the grain will still be required. Shavings are relatively thin, the surface should be flat (FYI- not all surfaces need to be dead flat), and the finish should be very good (at least for show-surfaces).
- Finally, light shavings taken with a smoothing plane should leave a flawless surface. Use minimal pressure and only push with the grain.
- After a surface is flat, plane an edge perpendicular to this face. This reference face and edge will be what all other dimensions are measured against.
- Repeat for the opposite face and edge.
- For end grain, block planes or shooting boards are commonly used as bench planes are too large to use by themselves on most boards.
- You can wax the sole of your plane during use to reduce drag. After use, oil your tools to prevent rust. Use Camelia or Jojoba oil as machine oils (WD-40, 3-in-1, etc) can rub onto the wood and affect the appearance of the finish when applied.

Resources

Books / DVDs:

dvd | **Coarse, Medium & Fine: Fundamental Woodworking Techniques** *by: Christopher Schwarz*
Hand Tool Techniques Part 2: Hand Planing *by: David Charlesworth*
books | **The Handplane Book** *by: Garrett Hack*
The New Traditional Woodworker *by Jim Tolpin*
Foundations of Better Woodworking *by Jeff Miller*

Popular Brands:

new	<i>Clifton</i>	vintage	<i>Millers Falls</i>
	<i>Lie-Nielsen</i>		<i>Record</i>
	<i>Veritas</i>		<i>Stanley (bailey or bedrock)</i>

Websites:

www.lie-nielsen.com

www.leevalley.com (veritas)

www.supertool.com (just about every plane Stanley ever made)

My Info:

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