Chapter 2

Laminated Shoulder-Rebate Planes

Making a rebate or shoulder plane by laminating sides to core pieces can be a good introduction to infill plane-making. Traditionally, these planes had sides dovetailed to soles, or cast bodies, but an equally functional plane can be made by joining sides to solid core-pieces with solder or rivets. This is an extension of the method James Krenov made famous with his wooden planes. The metalwork involved is basic & requires very few tools. Riveting is a simple process which can be learnt quickly.

Shoulder planes made by the lamination technique, using each of the readily-available blade sizes, (L to R): 32mm, 25mm, 19mm, 16mm and 13mm

The task is made easier because it is easy to obtain brass bar in increments of Imperial units (even though it may be sold by metric measure). By combining bar stock for sides and core pieces, we can match the widths of available blades, which are also generally made to Imperial sizes.

Joining the brass can also be done by sweat-soldering (see end of chapter), which can also produce a very sound body, but unless you already have experience in soldering, you are more likely to create a sound body with rivets, and they are probably a safer choice for the beginner. A plane can be made quite easily over a weekend or two.

The steel rivets stand out prominently on this small high-angle plane

For a small to medium plane, it will cost you about $40-$60 for brass at 2023 prices, & more (gauge plate) or less (rolled bar) for steel if you choose these as your material. Blades cost between $35 & $80 depending on brand & size. Rivets can be made from brass rod or wire nails of a suitable thickness (nails peen very nicely). If done well, brass rivets on brass sides should be all but invisible on the completed job (ditto steel rivets in a steel body). Some like to use steel rivets with brass for the contrast (see example at left). It's a matter of personal taste which you use.

First obtain your Blade:

I suggest you begin by deciding on what size (width) of plane you would like to have & purchase your blade as the first step. Replacement blades for various makes & models of shoulder planes are available in widths of 1/2" (~13mm), 5/8" (16mm), 3/4" (~19mm), 1" (~25mm), and 1 ¼" (~32mm), each of which can be matched by using 1/8 inch (3.2mm) thick side material and standard bar stock thicknesses for the cores. Be aware that not all 'rebate' plane blades are suitable for use in the low-angle, bevel-up configuration of a shoulder plane. Blades that are meant for bedding bevel-down at angles of 45 degrees or higher (e.g. the HNT Gordon blades) usually have a comparatively short tang. The longer beds of low-angle shoulder planes (typical bed angles are between 15 & 20 degrees) require a longer tang in order to have enough projecting at the back for adjustment. The patterns I've provided for different sizes of planes in chapter 6 may or may not need modification if using other than the brands specified on the drawings. There is variation between brands in both usable blade length, the length of the tang, and position/type of adjuster slots, so for all of those reasons it is wise to obtain your blade before making a serious start on your plane.

¾ inch blades by Lie-Nielsen and Mujingfang. The blade length is almost the same, but the tang of the L-N is longer.

I think 1/8 inch thick brass is adequate for sides regardless of plane size and blade width. It provides adequate stiffness for any of the plane sizes given and is easy to saw & shape. It is also available in a wide range of widths so you can select a size that best fits your plane & minimizes waste. There is plenty of internal room for lateral adjustment for the larger blade sizes, but barely enough for a ½ inch plane because the tang of a 1/2" blade is almost as wide as the 1/4"core piece. Using thinner sides (e.g. 2mm) and a thicker core would increase the range of lateral adjustment a little, but you would need 8.7mm core thick cores to make up an overall thickness of ½" (12.7mm). Reducing thicker brass would be easy enough with a milling machine but a laborious task to do by hand to the required accuracy. As long as you keep your blade edge ground accurately, a ¼" core is satisfactory.

The design of your plane.

The heyday of infill planes of all types was a relatively brief period spanning the latter part of the 19th century & the first decade or so of the 20th. During that time, quite a few British plane makers made infill shoulder planes with both cast & dovetailed bodies. These early shoulder planes tended to be hefty brutes, as befits a plane meant for cutting end-grain. Blade widths of 25-38mm were common, but smaller & narrower planes were made as well.

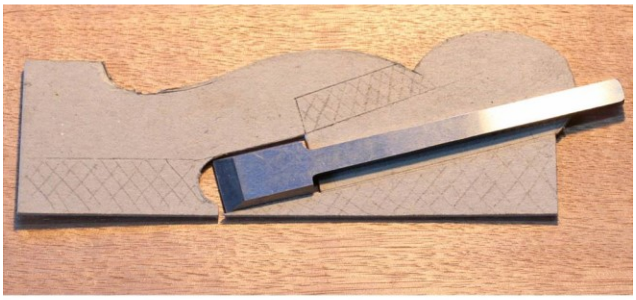
While they evolved a certain similarity of shape, they varied noticeably between makers, each developing a "signature style" which ranged from simple rectangles imitating the old wooden rebate planes, to sides with sweeping curves.

After trying a couple of different profiles, I decided the shape that most appeals to me is the signature shape of G.K. Miller of London. The profile he used has elegant flowing lines without the fussiness of a Spiers, but tastes vary

The two planes in the centre at left follow the Miller pattern. The plane at the extreme left was my first shoulder plane, and of course, there is nothing wrong with a plain 'square' style as exemplified by the HNT Gordon shoulder plane at right.

It is very easy to create your own shape. About the only element of design you need to observe is keeping the arch over the escapement area deep enough to maintain body stiffness.

The low bed angle, or pitch, of shoulder plane blades necessitates a 'bevel-up' configuration of the blade. The toe of the plane is relatively long in proportion to the total length of the sole, which makes it easier to register the plane firmly on the work before commencing the cut, keeping the surface straight. Besides allowing shavings out, the escapement cut-out has to be tall enough for the blade to be turned sideways & withdrawn through the wedge-slot. You cannot remove a bevel-up blade through the mouth of a fixed-mouth plane unless you make the mouth excessively large or fit a removable/adjustable toe-piece. Some later all-metal rebate planes were made with adjustable toes, most notably the Preston design (copies of which are still produced by various makers), but as far as I'm aware all older infill shoulder planes had fixed mouths. As well as leaving sufficient room to remove the blade, the bridge or wedge-stop (the part the top of the wedge bears against), needs to be fixed at an appropriate angle to the blade bed. Around 10^0 included angle generally works well for a wedge, if it's less it will lock very tightly & be difficult to loosen, and if the angle is too steep it won't lock at all.



Drawing sides: Ensure blade can be turned in escapement opening & removed via gap between bed & bridge.

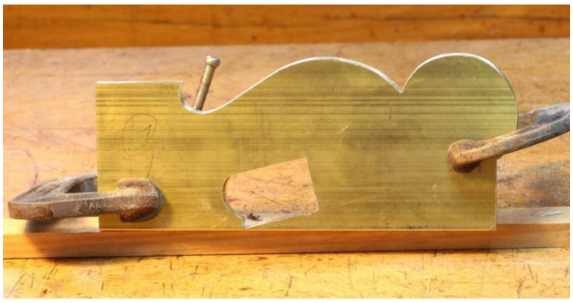
Preparation of parts

Once you've settled on your design, make accurate templates of the side & core-pieces and trace these onto your side material. A 0.5mm mechanical pencil makes fine, but clear marks on brass. For even finer and more robust marks, use layout dye (or paint the surface with a felt-pen), & a sharp metal-scriber.

[*Note: The edges of rolled bar stock are always rounded so don't use the raw edges for the bottoms of the sides or for the sole edge of the core pieces, or you will have a groove between the parts. It takes a fair amount of work to remove the rounding & form sharp corners by filing or sanding, but it will ensure you don't end up with visible gaps between the joined edges.*]

When sawing out the waste along the narrow wedge-shaped extensions that form the outside of the lower blade bed, keep a comfortable distance from the layout lines, & don't file them to the lines until after the body is assembled, then you can bring them flush with the blade bed.

After cutting out both sides, clamp them together and smooth the shapes to the layout lines so that the pieces match exactly. The clamps can be a bit of a nuisance & may need to be shifted once or twice during the process but it's better than having the parts move partway through the job.



Sides clamped together after sawing to smooth to scribe lines

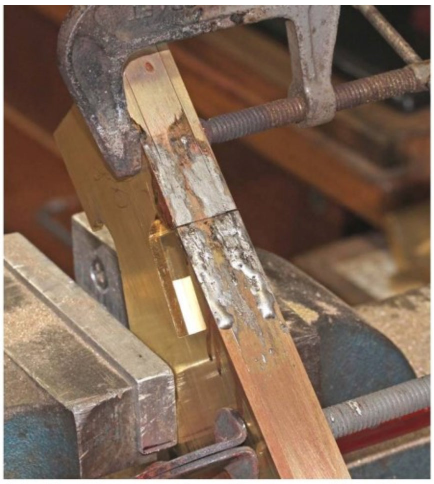
Cut the core pieces so they protrude by 0.5-1mm at front & back to allow the surfaces to be filed flush after assembly. The core pieces can be smoothed & squared by a combination of filing and lapping. Filing a dead flat surface is difficult for the inexperienced and you will probably find it easier to lap them straight & square on some 180 or 120 sandpaper stretched tightly over a flat surface. Flip the piece 180^0 every 20-30 strokes to cancel out any bias and check constantly that you are maintaining the edge square to the sides. Take particular care that both top & bottom surfaces are square to the sides (unless you are making a skewed bed, see later). This is the heart of your plane, and the closer to perfect you get it, the better.

Smoothing & squaring blade bed

Before assembly, lightly sand all mating surfaces to be sure they are clean, then sit the parts on a reliably flat surface such as a tablesaw top and clamp the sides to the blade bed & toe piece. Ensure all of the pieces are correctly aligned and square. I cut about 0.5mm off the tip of the bed wedge so it isn't sharp and & set the toe-piece a little further back so it almost closes the mouth. That ensures there is a little extra metal for trimming & finessing it after assembly.

Assembling the body

To hold the pieces together while drilling the rivet holes, I tack them with solder. This also minimises any "squirming" of the parts as the rivets are peened, which can cause slight misalignment. For the first shoulder plane I made, I sweated the parts together with old-style lead solder. This makes a neat & solid body, but it's a bit risky if you are not familiar with soldering. Lead-free solder has a higher melting temperature than lead solder and does not 'wet' the surface of the brass as readily so it won't flow between the surfaces as freely. While I have managed to sweat a small plane together with lead-free solder and it seemed sound, I still added a few rivets because I didn't totally trust the solder alone for the long haul. If you are experienced with soldering and confident you can make sound



Tacking the core pieces in place with solder joints, it offers a neat & durable way to join the pieces, but if not, I suggest using solder only for attaching the thin pieces either side of the mouth (where it's easier to get a sound joint), and rely on rivets to supply the main structural strength.

Allow the body to cool slowly then clean off the excess solder with a coarse file. Files made specifically for soft metals are best for this job, but if you don't have one, use the coarsest file you have & clean the teeth regularly as you work. If any solder does get into the internal part of the blade-bed, it can be cut & pared away (carefully!) using an old chisel.

Now set out, centre-punch, & drill the rivet holes. The more rivets you use, the stronger the body & the less likely the parts will ever work loose, but of course the more you use, the more peening is required, increasing the chance of mis-hits & dings. I usually space rivets at 12-15mm (depending on plane size), which provides ample strength. If you place the rivets too close you'll find it awkward to peen them.

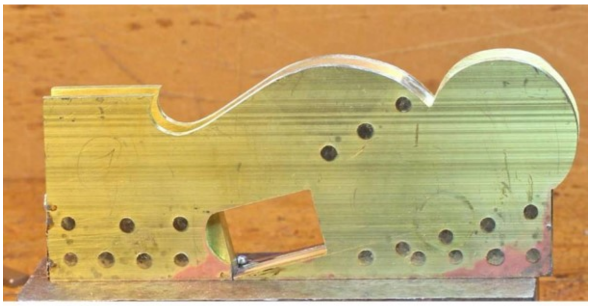
[*Note: I don't tack the bridge with solder because it would be hard to do without getting solder dribbling into the wrong places where it would be difficult to remove. I leave it until the other two pieces have been riveted, which usually pulls the sides together tightly enough to make the bridge a firm fit. It can then be eased into position & pressed against a temporary wedge before drilling the first hole. Put a rivet in this hole, check that the bridge is still in place, and drill the second hole. With a rivet in each hole you can now drill any remaining holes confident that it remains aligned.*]

Holes for rivets drilled & countersunk using the home-made tool in foreground

Make *shallow* counter-sinks on the rivet holes on both sides as illustrated at left. For this I use an old triangular file ground to a sharp-edged triangular point. Pressed firmly into the hole & rotated about 5 or 6 turns, it makes an adequate bevel (in brass, but you'll need 2-3 times as many turns in steel to form the same bevel). You could use a normal rose-bit (for metal), but these make a wide hole in proportion to the depth and the rivet heads feather to fine edges when they are filed flush. These thin edges can lift or flake a little, which makes the rivets obvious. Steeper bevels minimise that effect.

I generally use 3.0mm diameter rivets unless it is a very small plane, for which 2.5mm is adequate. I've used 2mm on occasion but that size is difficult to peen because they tend to bend when struck, making it hard to form a head. A rule of thumb for rivets is to have them protrude by half their diameter each side to give enough for clenching. This is usually ample, but I suggest you experiment with some scrap to decide what works best for you, but aim for the minimum amount you need to fill the countersinks thoroughly. This not only means the least amount to file & sand off when finished, it actually makes it easier to control the flow of the metal as you peen them (it's hard to explain this adequately, but something you'll quickly discover for yourself).

Use a good, solid anvil of some sort (I have a solid piece of smooth steel about 75mm square by 250mm long which I sit on my bench). Get yourself comfortable and have good lighting. You'll find you have better accuracy if you hold the hammer closer to the head than you would if driving nails. Begin by striking each rivet in the centre (with the ball side of the hammer), and gradually move in a tight spiral towards the edge, spreading the metal over and slowly filling the countersink. The rivet will want to slide back & forth in the hole at first, so flip the plane over frequently and work the "heads" a little at a time on each side to keep them even. Watch how the brass moves under the hammer & you will get a fair idea when it has fully filled the countersink. When I think I've got the countersink filled, I strike the tops hard with the flat side of the hammer to seat them solidly. Check



All rivets peened down firmly into the counter-sinks

that the rivets have pulled the sides together tightly - there should be just the barest of visible lines between the pieces, and no obvious gaps.

At first, you may find your arm tires quickly, and your accuracy declines & if that happens try setting just a few rivets at a time. An occasional mishap where the hammer slides off the rivet & hits the surrounding metal is almost inevitable, but if you are careful, that shouldn't happen often and the ding from a glancing blow on hard 385 brass is usually very shallow & should sand out during clean up. Some people advise applying duct tape or similar to protect the surrounding metal, but I have not found this to be very effective & in fact the tape was more nuisance than help.

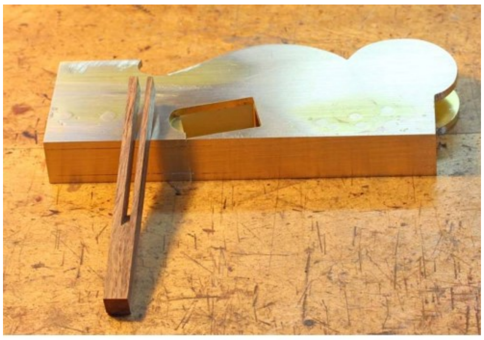
When you think you have clenched all the rivets, part-file the 'heads' and check them all carefully. Filing about half of the "head" off removes any work-hardened metal and you can then peen the rivets a little more, if necessary, with less danger of cracking. Once satisfied all rivets are seated thoroughly, I file the remnants as close to flush as I can without damaging the sides, then rub the body over 120 grit paper stretched over a flat surface. This flushes the rivets quickly & safely & if you've done a good job, they will begin to disappear after a dozen strokes or so.

Rivet heads filed flush with sides

I don't bother going further than rough-sanding the sides at this point, there is more work to be done, & holding the brass in a vise, even with aluminium-jaws, can leave marks, so save the final sprucing-up 'til the end.

Fitting the infill

To fit the front infill, I start by making a cardboard template of the inside shape. You could make the template before joining the pieces, but I prefer to make then from the assembled body to be sure of



Peg used when making a pattern for the infill

Tracing top of core on side

getting a precise fit. You will need to cut the part of the template that fits over the bridge out first so you can slide it into position for tracing the top profile. To get the necessary shape & dimensions, I use a long, narrow square 'peg' which slides neatly over the sides so it sits against internal edges & allows me to trace them on the outside where I can get accurate measurements or set a bevel square to match angles. I like to have the front infill projecting a little over the top and rounded over like a cushion in the G.K. Miller style, but some makers made the wood flush with the sides, so follow your own preference here. If you prefer it flush, leave a little wood protruding in any case, so you can make it flush with the metal after installation.

When setting out for the wedge, don't forget to allow for the thickness of the blade.

Front infill & wedge cut from templates

The front infill should be a very firm fit between the sides whilst the wedge should be a nice sliding fit.

If you have the top edge of the wood sitting proud, shape, sand & polish it before installation as it is much easier to do it now.

You can add a couple of rivets through the infill if you wish, but I don't think it's necessary unless you don't fit a metal bridge & have the wedge bearing directly against the wood, in which case I would certainly add a few rivets. I use epoxy glue, which is pretty reliable and also has the advantage of being (slightly) gap-filling, if your fit isn't perfect. Once the glue has cured sufficiently, file & sand off any excess wood & metal projecting into the escapement area and file & sand the wood flush at the nose & rear of the bridge.

Front infill glued in place

Now it's time for the final clean-up. One task that needs extra care is filing the sides on each side of the blade-bed. Work very cautiously so you don't damage the bed surface. Once the sides are flush with the blade bed, insert a blade with the cutting edge well out of danger (it probably won't protrude at this stage anyway), wedge it firmly, and lap the sole flat & square to the sides. Reverse the plane every 20 or 30 strokes & check frequently that you are maintaining the sole square to the sides. I take soles to 240 grit, which gives an adequate working surface, you can give them a higher polish if you like, but there is little point because soles will become finely scratched in use.

With the sole lapped you can now refine the mouth. Note that the gap between the toe & the end of the blade bed is *not* the *functional* mouth, which is the gap between the cutting edge of the blade & the toe section. Removing the sharp tip of the blade bed (it gives negligible support to the blade & is too easily damaged) widens the gap, but does not alter the 'true' mouth. If you have positioned the core pieces carefully, you should only need to remove a small amount of metal to straighten the front edge and create the desired gap. Even with a small amount removed from the end of the blade bed, it is not a very wide gap and there will be little room to get anything but a very thin flat needle file in. Take your time, work carefully, & check by trying the blade constantly, the last thing you want is to spoil the job at this stage. What you are aiming for is a passage about 0.2mm wide when the blade is protruding enough to cut i.e., a gap you can barely see.

With the mouth ready, hone your blade & take your new plane for a test drive.

First shavings

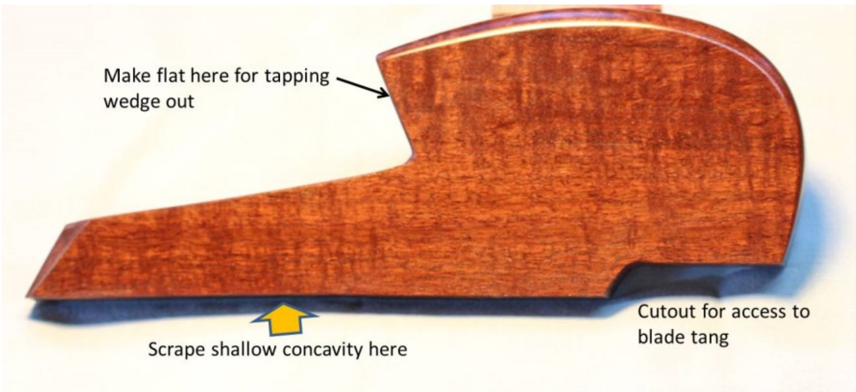
There is a knack to setting the blade quickly, which you'll soon acquire. My method is to slide the blade in & hold it flush to the sides at the mouth with thumb & index finger of my left hand, with edge not quite far enough advanced to cut. Slide the wedge in & tap it gently with your hand to hold the blade in place. Tap & test until it begins to cut. If one side starts cutting before the other, tap the tang sideways in the appropriate direction to straighten the cut. Once you have a light, even cut, give the wedge a firm tap to lock the setting. This will sometimes advance the blade a bit more to the point it is taking a coarser shaving than desired, which can be a bit frustrating at first, but with practice you will find it becomes quite intuitive. When properly set, and with a sharp blade the larger planes should take a continuous, thin shaving across end-grain under their own weight but the smaller sizes may require a little bit of hand pressure to keep them cutting evenly.

The blade width may need adjusting to match your plane. Blades may be slightly wider than nominal size, and/or lapping the sides may reduce your plane width so you will most likely need to reduce the blade width a little for a precise fit. A shoulder plane (or any rebate plane) works best for me if the blade is not dead flush with the shoulder side, but projects by a very tiny amount, just enough so you can barely feel it with a fingernail. This makes it easier to cut flush into corners & keep them square. We tend to use one side of a rebate plane most often, depending on whether we are left or right-handed, so you can simply set the blade for the side you use and not worry about the other side. If you only need to change sides occasionally, that's a minor hassle, but if your work requires frequent switching of sides it is obviously worth taking the time & trouble to grind the edges and fit the blade precisely for both sides at once.

If your blade bed is canted relative to the sole, you may not have enough lateral adjustment to get an even, full-width cut with the edge sharpened square - it's amazing how much effect the slightest cant of the bed has at low bed angles. If you find you have insufficient lateral adjustment the only way to compensate may be to sharpen your blade with a matching skew. The plane will work equally well & you can always claim the skew was intentional.

Polish & decorate your new plane to your taste. At a minimum, gently ease all edges that your hands contact. If you are confident with your file-work, stopped side chamfers or Vnotches or other decorative flourishes like a ‘lamb’s tongue’ will add a nice touch.

A Note on Wedges



The wedge angle obviously needs to match the angle of the bridge or it will leave deep indents in the wood so try to match these closely. The shape & extent of the rear part of the wedge is totally up to you but it’s a good idea to have enough wood projecting at the back of the plane to provide a comfortable hand-hold. There was much variation in the shape of wedges between makers, & if you do a search on antique planes you’ll find plenty to copy or inspire your own design. I cut away a short section under the back of the wedge to give clear access to the tang when setting. And finally, scrape or lightly rasp a shallow concavity between toe and heel to ensure there is pressure on the blade at the toe where it is most needed.

The traditional method of loosening wedges is to tap the back of the plane with a mallet. A well-riveted body should easily tolerate being struck with sensible force, but tapping the wedge itself is both very effective & safe. If you put an accessible flat on the wedge behind the bridge, it makes a very convenient place to tap it out. Wedges are far more easily replaced than the body.

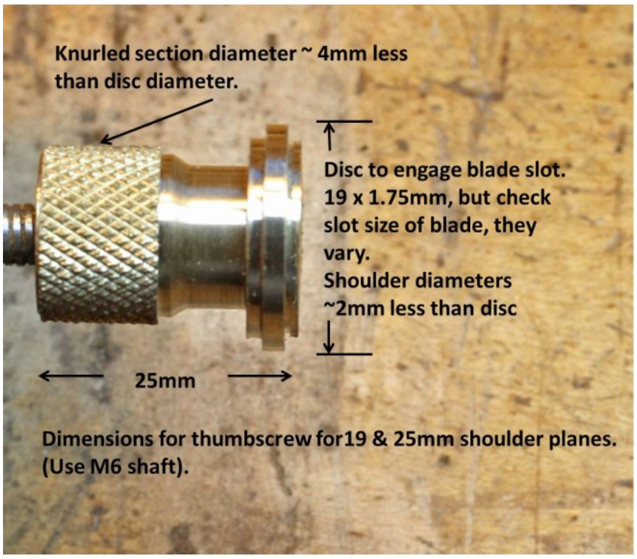
Screw adjusters

If you want to add some refinements, and have access to a metal lathe, it is not difficult to fit a screw adjuster to these planes. Exactly how you do it will depend on the blade you chose, but the basic principle is to have a thin disc on a thumbwheel which engages a slot in the blade. Some blades have multiple slots, others a single large slot at the end of the blade.


Adjuster fitted to a Mujingfang blade with multiple grooves on tang.

The thumbscrew stud must be positioned parallel to the blade bed so the adjuster disc does not jam or become disengaged when the thumbwheel is screwed in or out. The tolerances are pretty tight, so careful set-out is required. When drilling the pilot hole for the stud, make sure the plane body is <u>firmly secured on the drill press</u>. To start the pilot hole for the tap, use a centre bit (#2 is recommended), which can cope with an angled entry, whereas an ordinary bit is likely to flex & go severely off-course. Once the centre bit has made a secure entry the drill bit should proceed without deviation. The tap also needs to start accurately in the pilot hole, & this can be achieved by clamping it in the DP chuck, without moving the plane after drilling. Turn the chuck by hand for several revolutions before releasing it from the chuck & using a tap wrench to take the thread to full depth (10-12mm is adequate for a 5 or 6mm stud).

Dimensions of the knob & disc that engages the blade will depend on the chosen blade. Lie-Nielsen & Record use a single, wide through-slot to engage the adjuster on their larger blades and accept a disc 2.5-3mm thick. The individual slots are narrower on the multi-slotted blades, around 1.5-2mm wide so the disc needs to be thinner. Veritas use round holes which are engaged by a spigot, and require a different, less simple mechanism.



I assume anyone with lathe skills will be capable of working out the dimensions for themselves so the dimensions provided here are meant only as a guide. My experience suggests that if the disc is between 1.25-1.5mm thick it will be sufficiently stiff & provided it has a reasonable area engaging the blade it won't wear too quickly. If the thumbwheel fits under the blade as shown for the Mujingfang blade above, the knurled section needs to be reduced in diameter so it doesn't foul the blade.

A thumbwheel for the single slot on Lie-Nielsen & Record blades sits mostly clear of the tang so the knurled section does not need to be reduced (right).

"Upgrading" the wedge

If adding an adjuster, a modification to the wedge is desirable. A simple wedge would be very inconvenient because you need to ease pressure on the blade before trying to advance or retract it with the thumbscrew. So to make the process much easier I use a thumbscrew-tightened wedge. To protect the wedge from the end of the thumbscrew, a small brass cylinder with a shallow divot in the top is pressed into the wood at the appropriate position. The divot in the insert engages a rounded point on the end of the thumbscrew so the wedge doesn't fall out when the thumbscrew is slackened a little for blade adjustment. When drilling the hole in the bridge for the thumbscrew, be careful to avoid the retaining rivets.

An almost identical system was used for Norris shoulder & chariot planes fitted with screw adjusters, so it has a good pedigree.

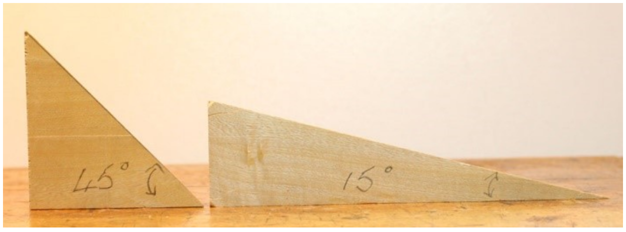
With these added features, you can have the good looks of an infill shoulder plane with all the convenience of the modern screw-adjuster types, & if you've taken care in its construction, its performance should be equal to the best.

Norris A7 shoulder plane with wedge retained by a thumbscrew

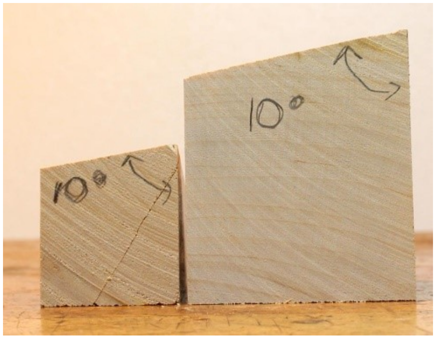
Skewed blades

Back in their heyday most shoulder-plane makers offered skewed blade models "to order" but the number of surviving shoulder planes with skewed blades is miniscule, suggesting they were not ordered very often. The advantage of a skewed blade in a shoulder plane may be debated, but making a plane with a skewed blade is an interesting challenge. It's a little more demanding than making a 'square' blade-bed (remember, small errors are magnified by low bed angles), but the process is essentially the same.

[Note: *It requires very little cant to the blade bed to produce a skew at low bed angles. To illustrate the point, compare these wooden models representing a 45^0 bed and a 15^0 bed. From the side, the different pitches are very obvious:*



If both blade beds are canted at 10 degrees, they look the same from the rear:

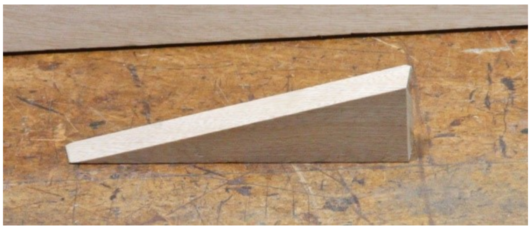


But the angle formed at the mouth edge is very different: A 10^0 bed cant creates a ~12^0 skew on a 45^0 bed, but with a bed pitched at 15^0 it results in a 40^0 skew angle of the mouth. This is far too extreme, the very acute point on the leading edge of the blade is really too fragile & liable to damage as well as dangerous to errant fingers. Furthermore, the greater the skew, the more precisely the blade angle must be matched or you will not have enough lateral adjustment to get an even cut.]

The mouth skews on rebate planes I've measured were between 12 & 15^0. For a blade with a 15^0 pitch, a skew angle of about 12^0 will be plenty and make a noticeable difference to the way the plane cuts across the grain.

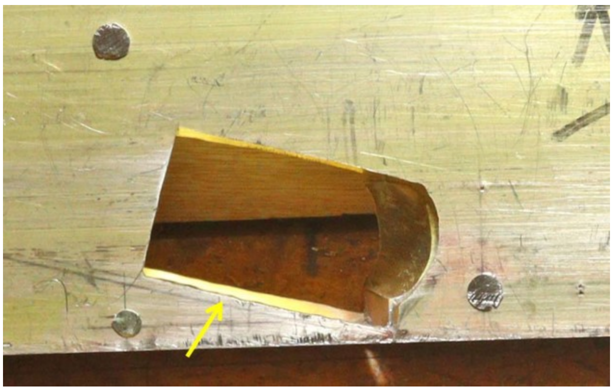
Setting out

Begin with the skew angle itself, everything else follows from that. My low-tech method is to make a wooden bed piece cut to the skew & pitch angles of your proposed plane. (You could use the actual piece of brass you intend making the bed from, but wood scraps cost nothing & you can try different angles easily if you wish). Take a block of wood the same thickness as the core of your proposed plane. Mark the mouth skew angle across the 'toe' end, then using a cardboard template cut to the pitch angle, extend a line along each side from the 'skew' line. Saw off the waste & smooth to the lines by planing or sanding. You now have a canted, skewed core which can be used to set out the sides.



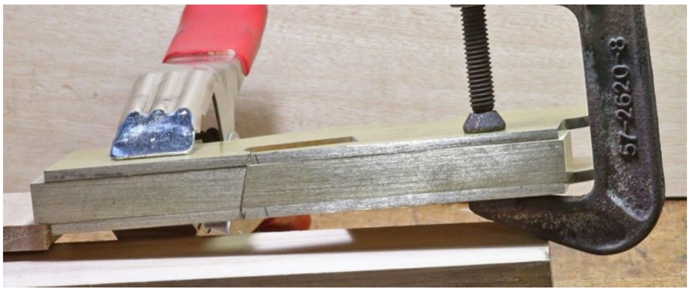
The side pieces are the same except the escapement has to be moved back on the trailing side to match the end of the blade bed. The method I use is to take a side template for a 'square' plane & make a blank copy with no escapement cut-out. Align the end of the blade bed on the first template with the leading edge of the bed core, then place the blank template against the other side so their fronts are square at the toe end. A small spring-clamp will hold them in position while you mark the point of the blade bed on the blank template. Now place the original template on the blank one, aligning the point of the blade bed on the template with the mark on the blank. Trace the second cut-out and cut out the waste. You now have two side templates with cut-outs that match each side of the skewed blade bed.

The edges along the blade bed should be sawn at an angled to match the cant of the blade bed, but I find it exceedingly difficult to saw out the waste whilst maintaining the necessary matching angles. So I cut well clear of the lines leaving plenty of extra metal to file down to the angled bed after assembly. This is a bit clumsy & means some extra filing but it's safer than trying to match the angle of the bed while sawing. If you feel confident of your sawing, by all means make the cuts closer to what they should be.



Here are the sides & core pieces ready to assemble. Note how the escapement cut-out for one side sits behind the other.

Clamping the 4 pieces together ready to tack-solder them requires a bit more juggling than with a straight mouth to get all the parts aligned and square. I get the blade bed positioned first and then set the toe core so it almost touches it. This sets the front of the mouth a little bit too close, but it gives spare metal to trim & straighten the front edge of the mouth after assembly.



After tacking, the body can be drilled & riveted as previously described.

Fitting the infill presents no special problems. The front infill is the same as for a ‘square’ blade, but make sure it extends into the escapement area sufficiently to trim it at an angle to match the staggered sides. The wedge needs to be angled on its bottom side to match the cant of the blade bed, and the toe cut to match the skew angle.

To set out the angle on the blade, use a thib cardboard template or a bevel square set to the skew angle. It took me several attempts to get the exact angle on the blade for this plane, mostly due to a crooked mouth (see next section).

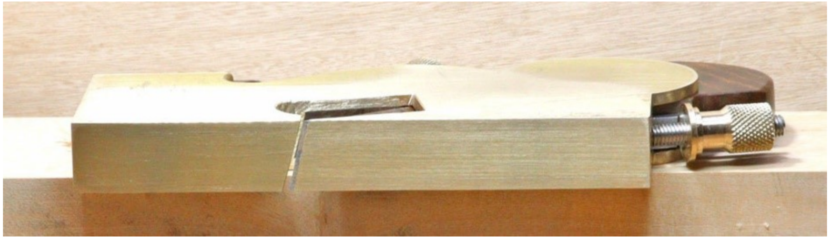
But if all goes well, you should have a sweet-cutting tool that slices across end grain very cleanly and as a bonus, shavings spiral out the trailing side and don’t pack in the escapement as they often do with ‘square’ blades.

Adding a steel sole

Many old cast bronze planes had thin steel soles soldered or "sweated" on the bronze. I have read different suggestions of why that was done, such as to reduce friction, or to protect the soft bronze or prevent smear marks on the wood from the bronze. It also provides a way to close mouth on a casting of a low-pitched plane after filing the mouth bevel.

As previously mentioned, the hard C385 brass is pretty tough, and wears very well, but if, for whatever reason, you do wish to add a steel sole to your plane, it is a fairly simple process. I would recommend you use lead solder (still readily available) rather than lead-free because as already mentioned, you'll find lead solder *much* easier to work with. The strength of the joint is more than adequate if made properly (as demonstrated by the number of old planes with their sweated soles still intact).

Due to some carelessness on my part, the skewed plane above ended up with a slightly over-large mouth, but even worse, it was uneven, with a larger gap on the leading side making the blade tip prone to catching edges (& fingers!).



I decided this was a very good candidate for a steel sole, which would extend the blade bed forward a little & allow me to re-cut the mouth. But by the time I decided on this remedy, the infill was already glued in place. I debated trying to remove the wood before attempting to solder a new sole on, but wasn't sure I could get it out in one piece and it is a very nice (& expensive) bit of ringed gidgee, so I decided I had little to lose by attempting to solder it with the wood in place.

I used a worn-out circular saw blade as donor material. The steel was a touch under 2mm thick (anything from 1.6-2.5 mm should be satisfactory) and ground to an even thickness. A single piece was cut about 0.5mm oversize all round, one surface sanded clean, then Ilaid it on a perforated brick and tinned the cleaned side.

The plane was held upside down in a vise, gripped across the infill area in the hope the jaws would absorb enough heat to protect the wood & glue. The brass was cleaned, wiped with Baker's soldering flux and the new sole placed on top. I played the torch on about 50mm at a time until the solder flowed freely, then pressed the steel down with a screwdriver tip. When the solder solidified, I moved to the next section.

Once the brass had warmed sufficiently, I was able to proceed quite quickly along the sole, melting the solder 50-60mm at a time. I didn't need to add any more solder to the thin layer that was on the steel after tinning it, I could see that a small amount oozed out when the steel was pressed down, forming an even meniscus along the edge. Thankfully, the wood showed no hint of damage, and remained firmly glued in place.

And what was particularly pleasing, a quick rub of the new sole over some stretched sandpaper after it had cooled showed it was remarkably flat & would need little lapping.

The excess steel around the edges was carefully filed flush to the sides and a new mouth laid out. This was (very!) carefully done by aligning a ruler against the edges of the old blade bed & scribing lines to the sole, which were connected across the bottom. The extra depth of sole moved the tip of the blade bed forward by almost 3mm, giving me plenty of material at the front to straighten it.

I sawed through the end of the blade bed with a jewellers' saw to define that (a #6 blade worked nicely), then cut away a small wedge of brass from what had been the original front of the mouth.

This removed most of the waste cleanly & it could now be attacked with files, first to bring the steel into line with the old bed and form a continuous bevel matching the brass. It took me quite a while to achieve this, filing the hard steel whilst avoiding the brass required a delicate touch. After much filing and testing, the blade eventually sat nicely on the new part of the bed with no gaps. A couple of minor slips with the file left some small marks on the brass, but nothing more than shallow scratches.

Finally, the front of the mouth was worked on to open it enough for the blade to come though (very cautiously this time!). It was a slow & tedious job, but I did not want a repeat of the first debacle. Eventually, I was rewarded with a mouth that is as close to perfect as any I've managed, & this time, the gap is *even*!

If you wish to add a steel sole to a plane, it is obviously better to do so before installing the infill, but as demonstrated, it's possible to do it later. This was only the second plane that I have fitted a steel sole on, but both have gone smoothly & I think I can safely say that it is a pretty straightforward process. The most difficult part is re-forming the mouth, and using files with "safe" edges is a big help with that. I did consider forming the bevel on the sole piece before soldering it in place, but thought it would be too difficult to align it accurately. Adding the new sole as a single piece, then forming the bevel seemed like the safest alternative, but either way could work, so follow your own intuition if you think forming the bevel or even part-forming it would make the task easier. Fortunately, it's not a do-or die process, if it goes awry, you can easily remove a failed attempt & start over.

I'm very pleased with the result in this case, the new sole is very neat & I was able to eliminate an eyesore of a mouth and turn it into a neat & much better one. The plane is now an excellent user.

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