Directions for use and tips on

Juuma Bench Planes #4, 5, 6 and 7

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1 Introduction

The Juuma- bench planes numbered 4,5,6 and 7 are the right tools to smooth, thickness, flatten and square up solid wood. The shorter a plane is, the better adapted it is for finishing the faces of a board as a smoothing plane even on relatively irregular surfaces. The longer a plane is, the better it is for trying and jointing wood, that is, fine work to flatten the faces and make the edges straight and square, which is the basis for all fine joinery. So, from short to long:

#4: Smoothing plane for finish work

#5: Jack plane for general work

#6: Try plane, for fine surfacing and squaring up

#7: Jointer plane, for surfacing and jointing long workpieces

The designs of these planes are based on the best models made by the top quality American manufacturers during the apogee of hand tools during the first half of the 20th Century. They combine the highly evolved design of those “golden age” planes with the high precision that modern manufacturing can provide.

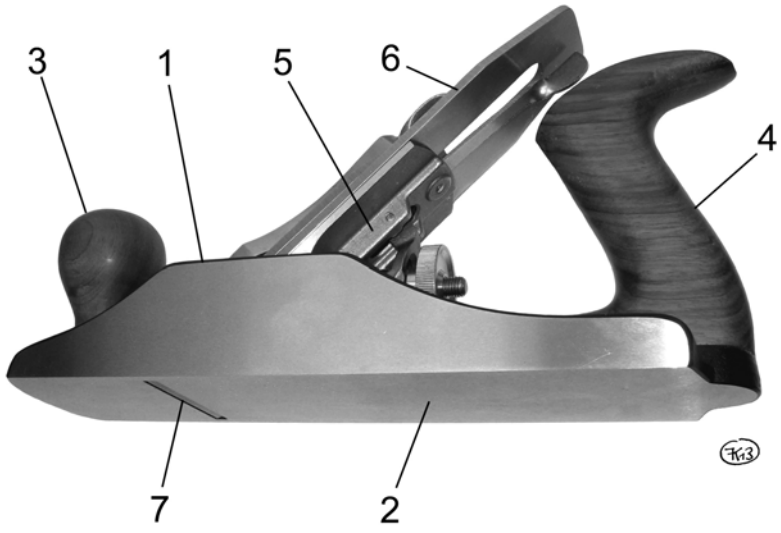
The cast iron bodies of the Juuma bench planes make them enormously durable and long-lived. In comparison with wooden-bodied planes, the extra mass allows them to glide unfazed through knots and other irregularities in the wood grain. The low center of gravity of the grips allows very good and precise control of the plane.

Planes should be able to cut different thicknesses of shavings. But the geometry of user-sharpened irons is often relatively inexact, and the iron gets a tiny bit shorter with each sharpening. So for every plane, no matter what style, construction material or manufacturer, the position of the iron needs to be properly set for the plane to function well.

Setting a plane iron is not all that simple, because it is a question of mere hundredths of a millimeter. Iron planes of this type have the great advantage that all of the important adjustments and settings can be precisely controlled by knurled knobs, screws and levers. The traditional way, on wooden planes, of tapping with a hammer on the plane body, wedge or iron, is no longer necessary.

2 Parts and function of the Juuma Bench Planes

All Juuma Bench Planes are identical in their basic construction. So all the directions and images will use the smallest, #4 plane, and these can be applied simply and directly to the larger planes.



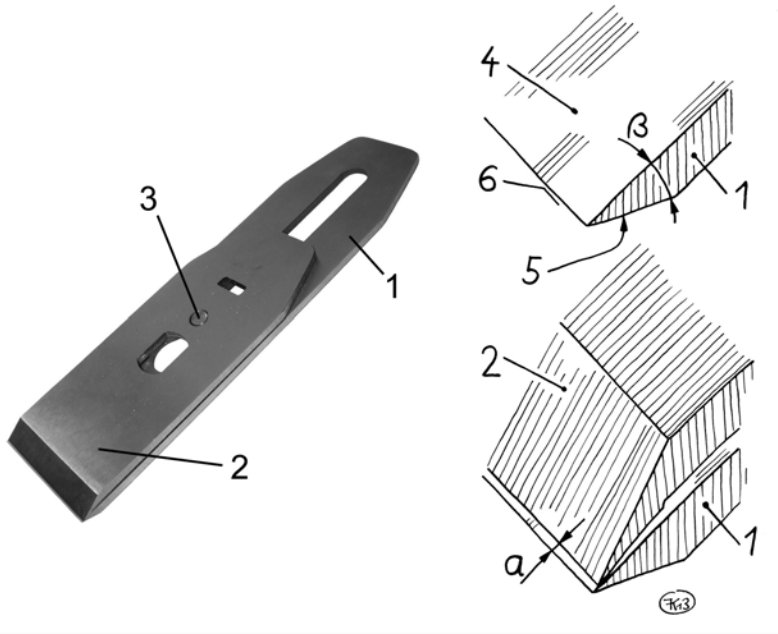
1 Plane body
2 Sole
3 Knob
4 Handle
5 Frog
6 Plane iron
7 Mouth

Picture 1: Juuma Smoothing Plane # 4

The flat sole, the bottom part of the cast iron body, glides over the surface of the wood workpiece. The wooden knob and handle are held in the hands and used to push the plane in use. Which hand used on which part does not matter -- these planes are in principle equally useable by either right- or left- handed people.
The iron is fixed to the “frog”, the wedge-shaped brass part, which holds it firmly at a 45° angle to the sole with the edge projecting slightly through a wide slot in the sole, the mouth, which allows the shavings to pass out of the plane.

2.1 The Plane Iron

The plane iron has the chip-breaker screwed to it (the function of which is explained in section 2.2). This combination is known as a “double iron”.



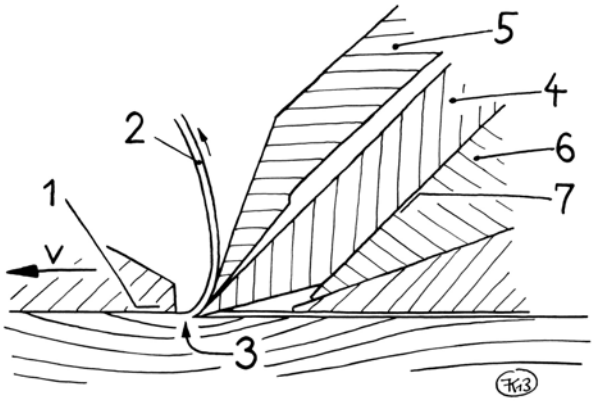
1 Iron
2 Chipbreaker
3 Chipbreaker screw
4 Back of iron
5 Bevel
6 Cutting edge
β Bevel angle
a Space between edge and chipbreaker

Picture 2, left: Double iron of the Juuma Planes, top right: Cutting edge of the iron, greatly magnified. Right bottom: cutting edge with chipbreaker.

The iron is ground only on one side -- in other words only one side has an angled bevel. The iron will be fixed in the plane so that this bevel will face down, and the back of the iron up. The opposite side, also shown above, is called the flat or the back of the iron. The back and the bevel meet to form the cutting edge. The bevel angle, β (beta), is the angle between the two surfaces. The Juuma planes are sold with their irons ground, as is very common, to a bevel angle of 25%. In sharpening, only the bevel should be sharpened! During this process, it is possible, and can be advantageous, that the bevel angle at the very edge will increase slightly. (More on this: chapter 6).

The chipbreaker is set onto the back of the iron so that its leading edge is between about 0.5 and 1 mm back from the edge - the finer the shaving, the closer to the edge the chipbreaker should be set. Then the chipbreaker screw should be tightened enough that the chipbreaker does not move around in use.

2.2 Using a Juuma plane with double iron



1 Sole
2 Shaving
3 Mouth
4 Iron
5 Chipbreaker
6 Frog
7 Bed
v Direction of movement

Picture 3: Planing with the Juuma. Cross-section drawing with a thick shaving curving up through the mouth.

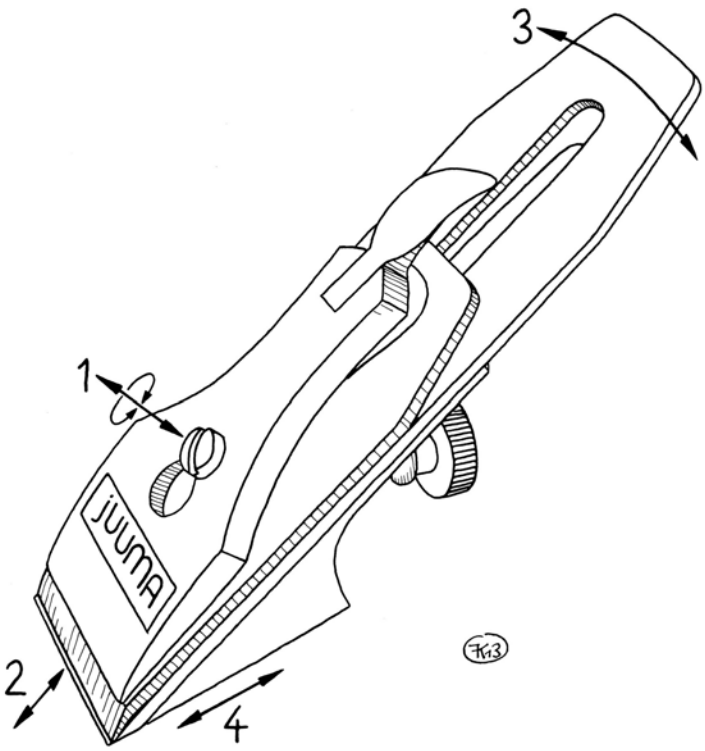
The plane glides on its sole in direction v over the wood. The iron’s edge, bedded on the frog, sticks out a tiny bit below the sole and cuts a shaving which is as wide as the iron. This shaving slides up through the

plane's mouth (the slot between the edge and the front surface of the sole) and slides up over the small bit of the iron back and the chip breaker.

The "chipbreaker" doesn't actually break the shaving, it just bends it sharply up, kinking the wood fibers and hindering the formation of leverage that could cause tearout in irregular grain in front of the bevel edge (where the wood splits out below the depth of the cut). The chipbreaker's second function is to stabilize the iron at the thin edge and prevent "chatter" -- that is unwanted vibrations.

The most effective measure to prevent tearout is a very narrow mouth - as narrow as possible while still allowing space for the shavings to pass through the slot. In this way the sole presses down on the wood directly before the iron's edge and makes it much more difficult for the edge's bevel to lever up the grain and split out wood under the depth of cut.

3 Setting up a Juuma Bench Plane



1 Adjusting the clamping pressure

2 Adjusting the shaving thickness

3 Adjusting the iron to take a uniform shaving over the width of cut

4 Adjusting the width of the plane's mouth

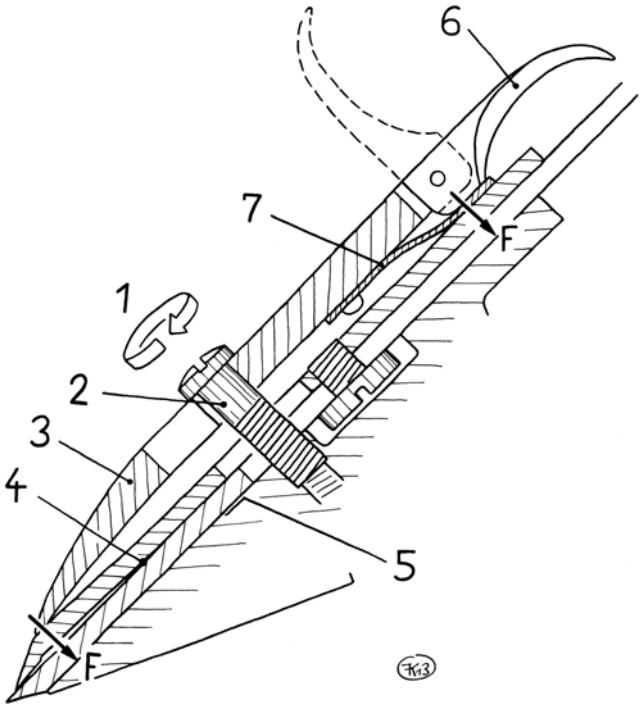
Picture 4: Adjustment movement (drawn on the frog with the double iron and the lever cap.)

For the plane to function properly, four things must be set: first the force with which the iron is clamped against the frog, then the shaving thickness and its uniformity across the cut, and finally the relatively difficult ratios involved in the width of the plane mouth.

3.1 Adjustment of Clamping Pressure

The depth of cut knob and the lateral adjustment lever should be able to move the iron around without using too much effort so the iron must not be clamped down too tightly to its bed (the surface of the 45°-angled wedge called the frog). But it cannot be too loose either, because then the iron can move or be knocked out of alignment on the bed and cause problems on the workpiece. So when both of these requirements are fulfilled, the correct clamping pressure has been found.

This setting should be carefully checked on new planes (it is best to reduce the strength to almost nothing and gradually increase it as described below) and then correct the pressure as needed.



1 Rotates to adjust
2 Cap iron tensioning screw
3 Cap iron
4 Double iron
5 Bed (on frog)
6 ension lever with cam
7 Flat spring
F Pressure

Picture 5: Double iron clamped on to the frog - diagram of cross-section

The cap iron, which is slid under the head of the tensioning screw, presses on the chipbreaker in two places: at the bottom, with its wide end, near the iron's cutting edge, and at the top with the four-sided cam on the tension lever. The cap itself works as a thick, flat spring. Turning the tensioning screw clockwise bends the spring up toward the cam on the tension lever - the more you turn the screw, the more tension the cam will exert on the screw, and the more pressure the bottom of the cap iron will place where it bears on the chipbreaker, and so on the iron, both at the cutting edge and at the top as it is clamped onto the bed (these pressure points are the F arrows in the drawing).

By rotating up the tension lever (shown as a dotted line), the cam will turn to its second, raised position, and with the tension off the assembly, allowing the cap iron and then the double iron assembly can now be easily removed. When the double iron and the cap iron are replaced under the tensioning screw and the lever pressed down, the tension and compression are restored. The flat spring riveted to the cap iron holds everything in place during these operations.

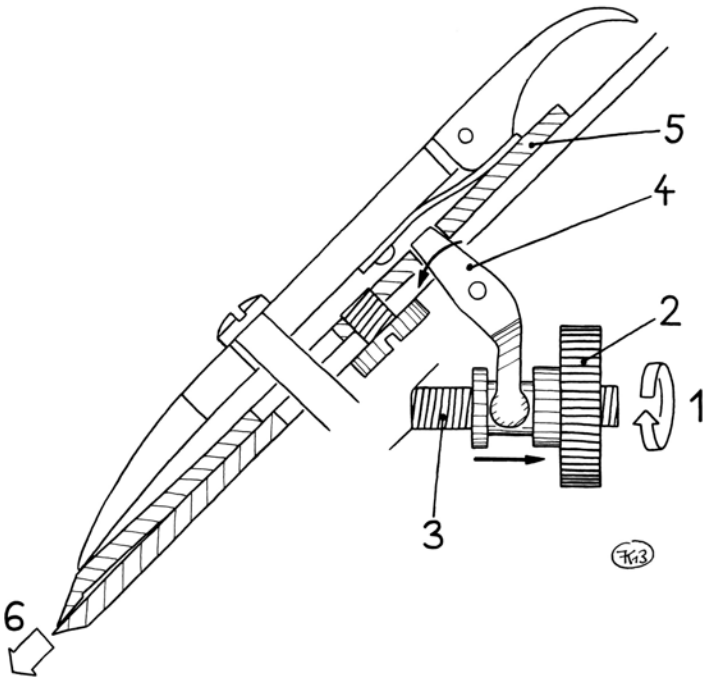
► The tension increases as you turn the the tensioning screw clockwise (into the frog), and is reduced as you turn it counter clockwise. This tension is released and restored by raising and lowering the tension lever on the cap iron.

If the tension is too high, and one tries to adjust the position of the iron, then something can easily break. So be careful! In almost all cases, if the adjustments are hard to make with the knobs, screws and levers, then the tension needs to be reduced.

3.2 **Adjusting the shaving thickness** (“depth of cut”)

This is the most commonly used adjustment. It slides the iron up and down lengthwise over its bed so that the amount the blade projects below the sole, and so the shaving thickness, increases or decreases.

On Juuma - Bench Planes the adjustments are very sensitive and comfortable to the touch. When planing wood, even the slightest adjustments are transmitted directly from the wood through the iron and the plane to one’s hands.



1 Rotates to adjust
2 Knurled nut
3 Lead screw
4 Y, or Angle lever
5 Chipbreaker
6 Adjustment of the double iron

Picture 6: Adjusting the shaving thickness, drawing in cross section

By turning the large, knurled nut (for example, clockwise, as illustration 6 shows) it threads itself along the left hand thread of the lead screw into the frog and moves the angle lever around its fulcrum in the mid section. The end of the lever fits closely into a slot in the chip breaker and if you turn the nut clockwise it moves the double iron down (toward the sole). In this direction, the friction between the iron and the bed must be overcome, and so the adjustment requires relatively more effort.

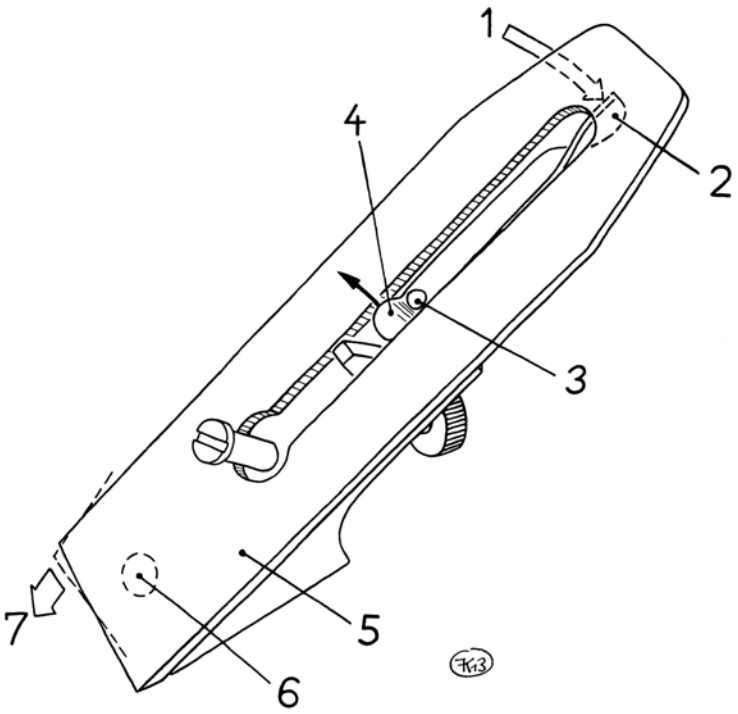
► The shaving becomes thicker when you turn the knurled nut clockwise (right as seen from the back of the plane), and thinner as you turn the knurled nut counter-clockwise (left).

To reduce the chance of an unwanted change in the depth of cut setting while using the plane, one should not set the tension particularly high, but rather get into the habit of, using normal tension, making sure the knurled knob is always set to engage the threads in the clockwise or “thicker shaving” direction. This is also important when you need to reduce the depth of cut: you turn the knurled nut counter-clockwise to take a thinner shaving than desired, and then by turning back clockwise slightly, re-tension the setting at the desired point (shaving thickness). Set like that, the iron is not held in position only by the friction between it and the bed, but is also solidly fixed in place by the angle lever, bearing both on the chip breaker and the knurled nut.

3.3 Adjusting a uniform depth of cut across the width of the iron („Lateral adjustment“)

This adjustment is, fundamentally, only necessary when the iron (for example after sharpening) has been re-installed in the plane, though sometimes it is also necessary when using the plane. By using the lateral adjustment the iron can be slightly angled on the bed so that the shaving taken has the same thickness across its width. A iron installed at a slight angle, or sharpened so that its edge is not exactly square to the sides can in this way be straightened to cut square.

The lateral adjustment lever can be moved with one’s hand on the grip, it is simply pushed with thumb or index finger to adjust the blade.



1 Adjustment (push on either side)

2 Adjustment lever, upper end

3 Fulcrum pin (rivet)

4 Push plate on adjustment lever

5 Iron

6 Pivot point of the iron

7 Movement of the cutting edge of the iron

Picture 7: Lateral adjustment of the iron (illustrated without the chipbreaker and the cap iron)

This adjustment obviously must be made with the plane completely assembled - with the chipbreaker screwed to the iron, the double iron in place on the frog, and the cap iron installed with the tension lever engaged. It is only to make the adjustment easier to see that the diagram does not show the chipbreaker and cap iron!

The adjustment lever is pushed to one side or the other (for example, left as illustration 7 shows) and pivots on the rivet attaching it to the frog. The rounded push plate at the bottom of the lever bears on the slot in the iron and tilts it in the opposite direction the top of the lever was moved. The edge of the iron then moves slightly in the desired direction around its fulcrum point which lies more or less where it bears on the end of the frog near the mouth of the plane. (see illustration 5) This moves the right corner of the edge forward making the shaving thicker there, and the left corner moves back making the shaving thinner at that end.

► The shaving will be thicker on the right when the lateral adjustment lever is pushed left on its upper end, and vice versa.

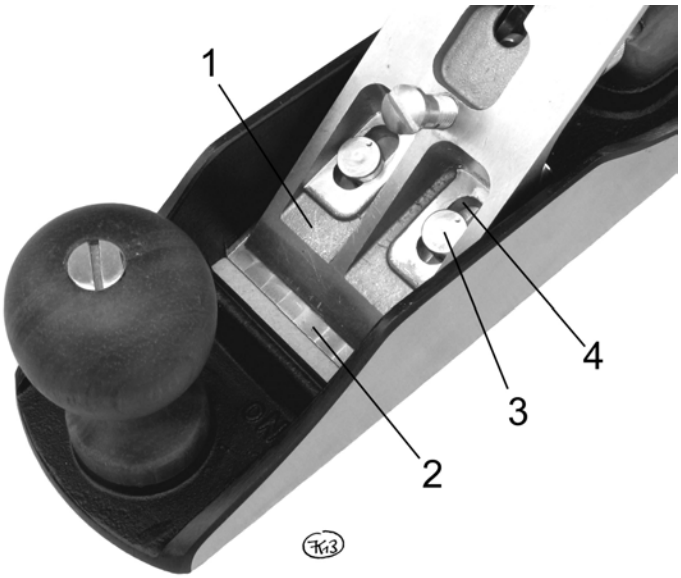
Right and left are here defined in the sense of the movement of the plane, or looking from behind.

3.4 Adjusting the width of the mouth

The better the mouth is set for the work that needs to be done, the better the plane will work. To take very fine shavings on difficult wood, the mouth must be set very narrow, for thicker shavings, and ease of use is more important than the possibility of tearout on the wood surface, then wider is better. If the mouth is set too narrowly, the plane often clogs up -- so one should not overdo this setting. There are also people who find a mouth setting that works for them, and never change it.

With the Juuma planes, the iron can remain installed in the plane while adjusting mouth width by moving the frog, and so the adjustment can be tracked visually. This is a big time saver over simpler plane designs, where the iron has to be removed for this adjustment, and finding the right setting needs trial and error.

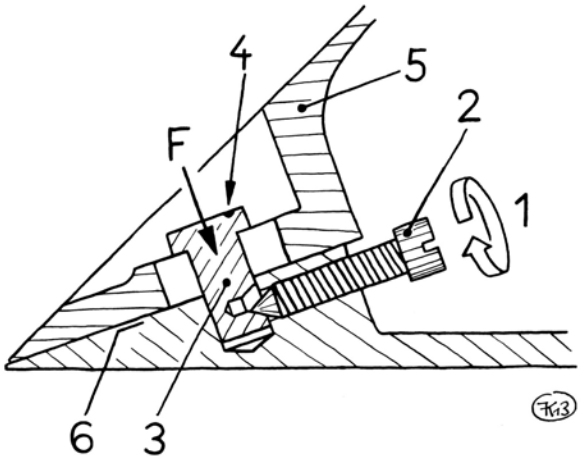
Tightening and loosening the frog



1 Frog
2 Base
3 Head pin with marking (in holes)
4 Slot

Picture 8: Frog with machine screws (Iron removed, frog moved very far back)

The frog beds on the slightly inclined base of the plane body. To make the mouth narrower, the frog, with the iron in place, is pushed forward, for a wider mouth, it is pulled back. On the back side of the frog, there are two other machine screws can then be tightened to clamp the frog in the desired position. For this to work, the marks on the machine screws on top must be positioned toward the back (toward the grip) as shown in illustration 8.



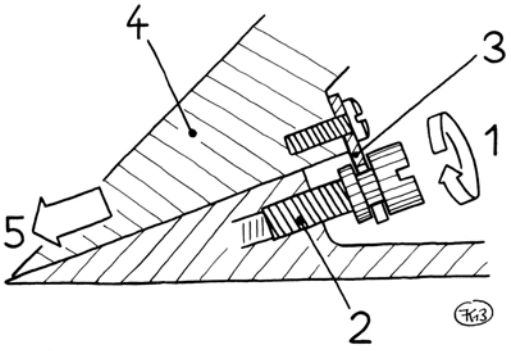
1 Adjustment with screwdriver
2 Machine screw with cone end
3 Head pin with female cone (slightly offset)
4 Marking on machine screw
5 Frog
6 Base of plane
F Clamping force on the machine screws

Picture 9: Clamping the head pins with the conical ends of the machine screws. Illustration in cross section

Both head pins have an offset conical hole, which receives the slightly under-set conical tip of the machine screw. When the screws are turned in, they pull the head pins downward, and clamp the frog in position on the base. By loosening the machine screws the position of the frog can be changed.

► The frog is clamped by turning the two machine screws clockwise (right) and loosened by turning the screws counterclockwise.

Frog position adjustment



1 Adjustment with screwdriver
2 Adjustment screw
3 U - plate
4 Frog
5 Frog movement

Picture 10: Moving the frog with the adjustment screw, illustration in cross section

After the frog has been loosened, it can be moved. To do this you turn the adjustment screw, which has a right-hand thread, in or out of its threaded hole, and the U - plate moves the frog with it. After it is in position, the two conical pointed screws are used to clamp it in place.

► The mouth is narrowed by turning the adjustment screw clockwise (right) and widened by turning the screw counter-clockwise (left) Be sure to loosen the frog before trying to adjust the mouth! And be sure to tighten it back down after!

If the frog is slightly askew on the bed (uneven mouth width with the same shaving thickness), then after loosening one of the conical screws - the other should not be too tightly clamped - the frog can be shifted slightly forward or backward.

Because the base on which the frog moves is inclined, after you adjust the mouth width of the plane, the shaving thickness adjustment must also be corrected.

4 Removal of the iron (to sharpen for example), Re-assembly and re-adjustment

4.1 Removal of the iron

Before the iron is removed, one should withdraw the iron up into the body (to no shaving thickness and a little bit farther), which makes removal and installation easier. The cap iron's clamping lever is lifted and it is removed. The double iron is removed. To sharpen the iron, the chipbreaker and iron must also be taken apart.

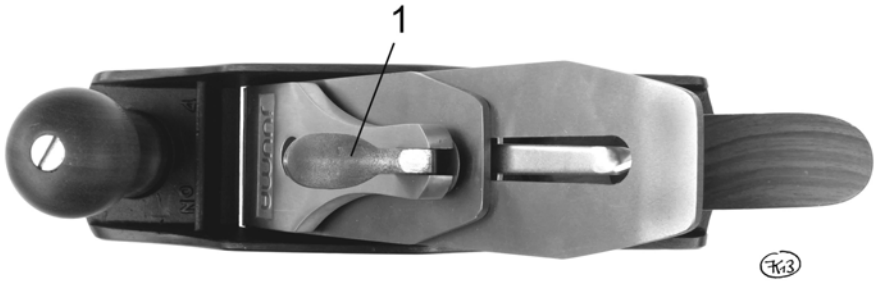
After sharpening, the chipbreaker is re-installed and screwed down (see illustration 2) and the double iron re-installed.

4.2 Re-installing the irons

The iron is set onto the frog with the chipbreaker up. Be careful not to damage the freshly sharpened edge!

The disk at the end of the lateral adjustment lever must engage in the wide slot of the iron, and the upper end of the Y depth adjustment lever in the slot in the chipbreaker. When these parts are properly installed, the iron will rest flat, solidly bedded on the face of the frog.

The lever cap is then installed, slotting the tensioning screw into the "keyhole" in the cap and sliding it down as far as it will go.



1 Tensioning lever up

Picture 11: before engaging the tensioning lever: Is everything properly alligned?

Now align the iron and the lever cap. The mouth should, seen from above, be even in width across the edge of the iron, and the lever cap be symmetrically positioned on the iron-chipbreaker assembly. Then push down the lever to tension the assembly. If this takes too much effort there is something misassembled, often the lateral adjustment lever or the small end of the Y depth adjustment lever are not properly engaged in their slots. Sometimes the problem is that the tensioning screw has been turned too deep into its hole. Tensioning the iron assembly should require only very moderate pressure to engage the lever.

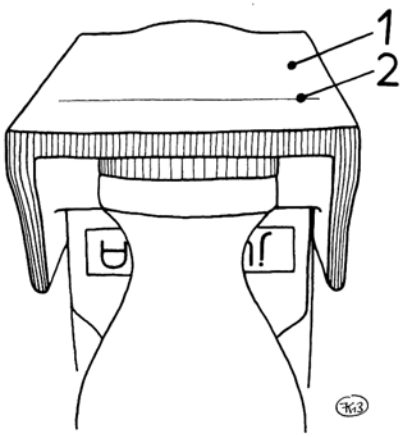
Never, ever, force the lever down!

4.3 Readjusting the iron

Now the iron must be adjusted in order that it can cut a thin, even, shaving across its entire width. How thin? Really fine shavings are are only a few hundredths of a millimeter thick! To get these fine shavings, the iron must be set to protrude just a hair below the sole of the plane. It is difficult to measure this, but with a little practice and experimentation, you will be able to easily see when the iron is well adjusted:

1 Sole

2 Protruding iron



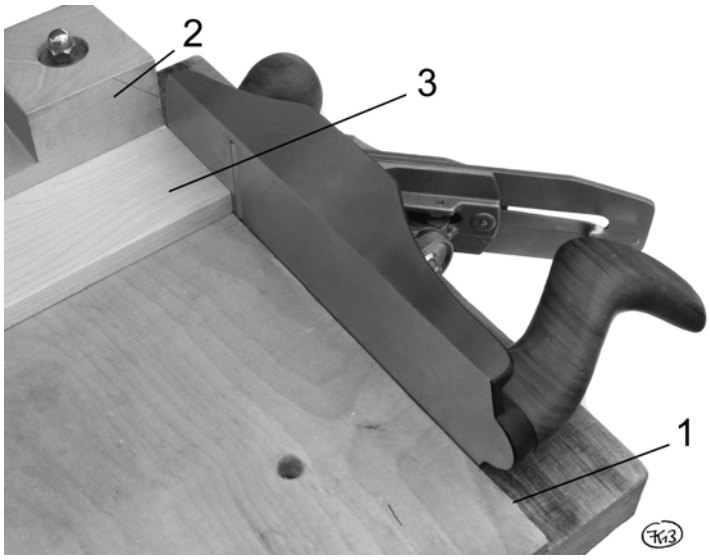
Picture 12: First adjustment of the iron “by eye”

The iron is first adjusted (turn the knurled thumb screw) down until it is just short of protruding below the sole. Now you hold the sole of the plane up flat in front of your eye against a light background, so that the mouth of the plane is no longer visible as a dark line. Then you turn the knurled knob until you see a dark line emerge from the sole - the cutting edge. This line should be very narrow, and most importantly, even across its width. Normally this requires very slight adjustments using the lateral adjustment lever.

Finally, you put the plane on a test piece of wood and take your first shaving. Normally after examining the shaving, you will need to further refine the settings to take an appropriate and even shaving thickness: finer or thicker shaving (by turning the thumbscrew) and adjusting the angle of the iron (by using the lateral adjustment lever).

5 Using your Juuma bench plane with a shooting board

Because the sides of the Juuma planes are precision-ground to be at a precise 90° angle to the sole, they can turned on their sides and used (mostly for squaring end-grain and trimming miter joints), in conjunction with a shooting board.



1 Shooting board

2 Stop block on the shooting board

3 Workpiece

Picture 13: Juuma #4 used with shooting board

6 Advise on sharpening plane irons

Bladed working tools are, no matter which manufacturer one is talking about, are, at best, delivered with a preliminary sharpening, and so not really near their optimal sharpness. With Juuma bench planes, you can use them right out of the box, which is not very common. But their performance will improve dramatically if you take the time to sharpen the iron properly.

The alloy steel used in the Juuma irons is a very high-quality steel, and holds its edge for a remarkably long time. But after a while, like every iron, it will never-the-less become dull and need to be resharpened. Sharpening the iron is an integral part of using a hand plane. Anyone who knows anything about using planes doesn't wait for the blade to become dull, they sharpen often, at the first hint that it needs it, because working with a dull plane blade is a misery.

Very Important: the common, and fast-running dry grinding wheels are a very bad choice for sharpening tools like plane irons. They cannot provide the quality of grind needed for precision tools (the grit is too coarse, and the grind too in-exact). Worse, the iron can on those kinds of machines, very quickly overheat, which damages the blade by destroying its hardness at the cutting edge.

There are special wet-grinding machines. These can be helpful in the process, but hand sharpening, today often on waterstones, provides just as good results, and once you gain a little experience, provides surprisingly fast results.

A really fine edge on a plane iron has a precise geometry and is razor sharp. To achieve such an edge, there are two steps in the process:

1. Grinding (the bevel) This step removes the old, dull edge and any chips or dings that might have occurred while using the plane. For this step you use a relatively coarse and fast-cutting stone.

2. Honing (using a very fine-grit stone) to form a very sharp new edge.

The bevel and flat sides of the iron can be sharpened completely flat, but this when done by hand, takes quite a bit of time. It is faster to use the honing stone to sharpen a very thin micro-bevel at the edge of the iron. This method provides equally good results, and can be done much more quickly.

Juuma delivers its plane irons with their bevel ground to 25 degrees and at that angle, the iron cuts very easily. But the edge is quite thin and easily damaged in use. It is usually a good idea to re-grind the edge at a higher angle, from 30 to 35 degrees. The edge will become much stronger, and the difference in the force needed to cut is only slightly greater. This modification is easy to make when grinding a new bevel or even just by honing a steeper micro-bevel at the edge to the desired angle.

Sharpening plane irons is a subject too complicated to be thoroughly explained in the framework of these directions. However, you can find very complete information on the subject on the internet, for instance at: *http://www.woodworking.de/schaerfprojekt/schaerf2.html*

7 Proper handling and care

A Juuma bench plane is a precision tool. To keep a quality tool like this working as designed, it must be properly treated and cleaned.

Lubrication and rust protection

If the plane is not in use or going to be stored for any significant length of time in a room that is not perfectly dry, we recommend that the sole and sides of the plane be protected against rust. A light coating of oil is enough, but a little wax can also be used.

The flat side of the iron is especially important to good function, and at the same time especially prone to damage from rust. In order to prevent rust from damaging the iron there, you must always carefully dry the iron after (wet) sharpening and give it a light coat of oil before you screw the chipbreaker to the iron.

There are a few other places on these planes where a drop of oil now and then will keep the plane easy to adjust and help prevent excessive wear. The threaded shaft for the knurled knob to set the shaving thickness, the notch that accept the end of the Y-lever as well as the pin on which that lever pivots. If you often adjust the mouth of the plane, a drop of oil on the threads of the barrel screw is also a good idea.

Use screwdrivers which properly fit the head of the screw

The screws on Juuma planes have - as is traditional - relatively large heads with a wide slot, and the steel used is relatively soft. In order to avoid cosmetic and eventually functional damage to the slots of the screws, you must use a screwdriver with a blade wide and thick enough to properly fit the head of the screw. Considering the value and quality of these planes, it is a good idea to buy one or two screwdrivers that perfectly fit the screw heads and use them only for that purpose. You can also find an old tool, and file or grind it to fit perfectly.

Elimination of damage to the sole

The sole of a plane that you use often never stays as clean and perfect as it was when new. This is not at all a problem. Larger scratches or dings, or rust, can however leave traces on the workpiece. In this case, the sole of the plane should be re-ground. This does not mean that it must be completely resurfaced to look as it did when new, but the important thing is to remove anything that protrudes from the sole of the plane that can damage the work. A scratch, for instance, must not be completely ground away, it is enough to remove the sharp raised burr that often forms along the edges. The most important thing when fixing problems like this is to make sure the sole of the plane remains within its tolerances for flatness.

To flat grind the sole of a plane by hand, you need a large very flat surface with some kind of abrasive. Wet-and-dry sandpaper is a good choice. You can use a thick sheet of glass, or a piece of granite like those used for window sills, etc., as the base for the paper (after removing the price sticker on the back of the sandpaper, of course). After removing the iron assembly from the plane, you wet down the sandpaper and move the plane over the abrasive, being careful to keep it flat and using even pressure over the whole sole. If it is really needed, you can start out with a fairly coarse paper. But the last step should be on paper of at least 240 grit, or even a little bit finer than that. After you have finished resurfacing the sole, everything must be carefully rinsed to remove any traces of the abrasive, then carefully dried and finally lubricated and given a coating of oil to protect from rust.