Better Plane Blades?

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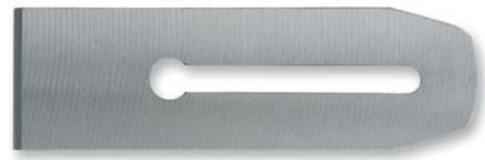
Having recently been through of bout of repeated resharpening of a standard Stanley blade in my Bailey #4 plane while planing end grain Saligna, I was frustrated enough to seek an alternative. There are a number of aftermarket blades available, so clearly there is widespread dissatisfaction with the standard offerings.



I own a **Samurai** brand laminated blade, which is installed in my Record #5, and this seems to be significantly more durable than the standard Stanley. The Samurai blade is made from a lamination of high carbon steel on the back (probably made to the Blue steel spec in the table below) and low carbon steel for the rest of the blade. You can actually see the difference in the two layers. As the back is the part that forms the cutting edge, it is the part where hardness counts. The rest of the blade just provides mechanical support. Sharpening is easier, as only a small part of the blade is really hard (claimed 68 HRC). These blades are very good, but they do have two disadvantages, price and thinness. They are £40- from Axminster, (www.axminster.co.uk) and they are the standard thickness, which in a standard Bailey pattern plane can lead to some chatter.

I was curious to see if I could do better. There are several suppliers of improved blades, and some of the blades are also thicker too.

Ron Hock started making blades for the wooden smoothers that the students of James Krenov at the College of the Redwoods made as part of their course (see left). He then expanded from there and makes a variety of replacement blades in O1 and A2, 3/32" = 2.4mm thick. They are priced around $40- to $50-. He also sells chip-breakers that are thicker than normal. (3mm) (See http://www.hocktools.com/BP.htm) If you want to make a Krenov style wooden smoother, then Ron Hock sells the irons, plans and kits you need.

Victor (Clico in Sheffield) offer replacement blades at £34- to £38- from Axminster. (See above) Claimed 60 - 62 HRC. Standard thickness and sizes. (See www.axminster.co.uk)

Lee Valley / Veritas offer replacement O1 and A2 blades in 0.1" (2.54mm), also with thicker cap-irons (1/8" = 3.175 mm) if required. Blades are $33 to $38 in both O1 and A2, in a variety of sizes. Combination blades and cap-irons are $52 to $62 each. See www.leevalley.com

Lie Nielsen offer replacement blades in cryogenically treated A2 steel. Thickness is 0.095" = 2.4mm and 1/8" = 3.175mm, prices range $40 to $60 depending on size. They also offer 1/8" chip breakers in various sizes. See www.lie-nielsen.com

It helps to have some understanding of the metallurgy of steels, so you know what you are buying when looking for a better blade. The table below is reproduced from http://www3.telus.net/BrentBeach/Sharpen/jig%20faq%2006.html where you will find more detailed discussion on steels.

Many of the earlier plane and chisel blades were made from plain carbon steel – called W-1 these days. This is a plain carbon steel that was freely available one to two centuries ago, probably as so-called "cast steel". This is steel with a carbon content ranging from 0.6% to 1.3% and is quenched in water, hence the W label. At the lower end (0.6% C), the steel once properly treated, is not exceptionally hard, but is quite tough. At the top end (1.3% C) it can be made exceptionally hard, but is also brittle. There is a trade-off between hardness and toughness. Harder will wear better, but may chip out more. Most of the older plane blades probably have about

1.0% carbon, which is a good compromise. Hardness after quenching of up to 65 HRC is possible, although to avoid chipping of the edge, it is usually tempered back to about 62 HRC.

Good quality, modern high-carbon steel plane blades are often made from O-1, which has about 0.95% carbon, as well as 1.0–1.4% manganese, 0.50% chromium, 0.50% nickel, and 0.50% tungsten. The additional elements improve the toughness and hardenability. The "O" means that it is designed to be quenched in oil, which is not as brutal as water, due to the lower thermal conductivity. Oil quenching has lower risks of cracking and distortion. O-1 is sold locally by Bohler as K460, and is available as gauge plate in various thicknesses, which is ideal for making plane blades.

Record plane blades claim to be Tungsten Vanadium steel, which should improve the properties somewhat, but this will depend on the quantities – the description is vague – looking at the table below, even O1 could qualify.

Class	Code	Carbon	Manganese	Silicon	Chrome	Vanadium	Tungsten	Molybdenum
High Carbon	01	0.95	1.20	0.3	0.5	0.2	0.5	
	W1	1.0	0.35	0.35				
	L6	0.75	0.70	0.25	0.80			0.30
	Blue	1.15	0.25	0.15	0.35		1.25	
	A2	1.0	0.6	0.3	5.2	0.3		1.1
	D2	1.5	0.4	0.4	12.0	0.95		0.9
Stainless	F2	1.3	0.25	0.25	0.3	0.25	3.5	0.3
	440A	0.75	1.00	1.00	17.0			0.75
High Speed	M2	0.83	0.275	0.325	4.125	1.85	6.4	5.0
	S390	1.60			4.80	5.0	10.5	2.0
	CPM3V	0.8			7.5	2.75		1.3
	T15	1.55	0.4	0.3	4.5	4.75	12.5	1.

[L6 -- used in band saw blades and user make carving knives -- includes 1.5% Nickel.]
[Blue - the steel in the Tsunesaburo blades, which it turns out is made by Hitachi specifically to be "forge-welded to a wrought iron base to make high-quality tool blades and knives".]
[440A - commonly used Stainless Steel for knives, includes up to 0.5% Nickel.]
[S390 - powered metallurgy, includes 8% Cobalt.]
[T15 is a microfine powder **super** high speed steel and includes 5% Cobalt. It would probably not be used for hand tools.]

You can see that the principal additive that distinguishes A2 is 5% Chrome, which greatly increases the wear resistance. D2 has even more Chrome at 12% - it also has 1.5% Carbon, which is about the maximum that is effective. A2 and D2 can be made extremely hard, but there is a disadvantage in both these – they are heat sensitive, like O1 and W1. If you overheat the edge, which is very easy to do with high-speed grinding, the hardness is reduced. D2 gauge plate is sold locally as K110 by Bohler.

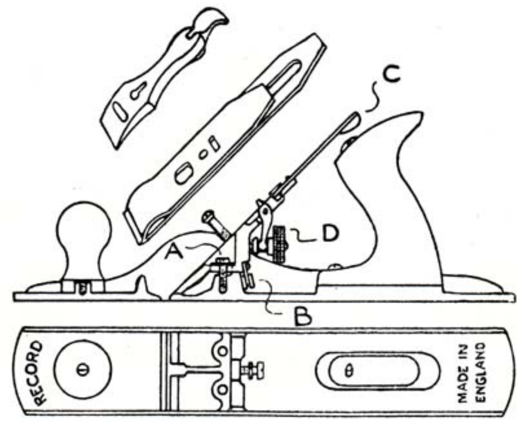
If A2 is good, perhaps D2 is better? So why are blades not offered in D2? Perhaps because the additional hardness offered by D2 makes the blade very difficult to sharpen by hand. (Don't ask me how I know this.)

M2 is also recommended for plane blades, being hard and wear resistant. It has an additional property of being heat resistant, which means that less care is required with high-speed grinding. I haven't seen plane blades offered in M2. Some people say that the grain sizes in A2, D2, and M2 are coarser than that found in O1, so a coarser edge results. Perhaps for a razor blade, this is important, but for everyday usage, the very fine edge is lost quite quickly, so it may not be significant.

What is not apparent from reading the specifications above is the importance of the manufacturing process to make best use of inherent properties of the steel. The metallurgical processes and the final hardening and tempering process are crucial to achieve the best results. This is perhaps what you are paying for when you buy a premium blade.

Since thicker is better for plane blades, why don't they all just make thicker blades? Well they won't all fit into the plane. Apparently, most 3mm thick blades will fit – the adjuster will reach the chip-breaker and the frog can

be adjusted far enough backwards to accommodate the thicker blade (Refer to the diagram - by loosening the clamping screws at [A] and turning the setting screw at [B]).
Also, for blades up to 3mm thickness the screw that holds the blade to the chip-breaker is usually long enough to reach. The depth setting yoke that is moved by the adjustment wheel [D], may also be too short for blades over 4mm. Over 3mm thickness, you need a modified chip-breaker (They are offered by Woodcraft in the USA).



Also, the plane body may not accommodate the required rearward movement of the frog. The user will have to modify the body of his plane, and not all users have the inclination or ability to do this successfully. Like all production items, planes are subject to design variations and tolerances, so thicker blades may not fit in all cases and the after-market blade sellers tend to be conservative to avoid come-backs.

It is also important to note that your plane must be set up properly. If the frog is not properly seated or the blade does not bed properly onto the frog, you may not get the performance you need. The blade must be supported underneath as close to the sole as the geometry of the plane allows. This is to reduce the leverage of the forces on the cutting edge and hence flexing of the blade. This is one reason why the bevel-up planes have an advantage in rigidity – the blade is supported all the way down the back, as close as possible to the sole.

O1 (K460) gauge plate is offered in 3mm thickness by Bohler, which is an ideal thickness for a replacement iron. D2 (K110) is only offered down to 4mm thickness, because they have difficulty meeting the gauge plate tolerances in thinner. Unfortunately, 4mm blades are not likely to be a direct fit into a standard Bailey pattern plane. I have made a 4mm blade to fit into my Stanley Bailey #4, but some modifications are required. If you are interested, I can show you what is required.