PRIME CUTS

Hugh Tilley looks at ways of achieving mower sharpness, to deliver the cut you need.

There is no dispute that cutting fine turf needs a sharp, well adjusted cylinder mower. However, when it comes to sharpening and adjusting the cylinder there are a number of opinions which seem to vary by manufacturer, nor are greenkeepers unknown to have strong views on how their machines should be set up.

It seems surprising that no research has been done into this critical area of greens maintenance or, if it has been, it is not known about. The original 'lawnmower' design comes from machines built to trim the nap of carpets, however there are fundamental differences between cutting wool in factory conditions and cutting grass (often with sand and soil) in radically different conditions.

Assuming that the shearing principle is the most ideal for cutting fine turf, and this may be debated, then several parameters are immediately set. It also begs a number of questions such as whether it is best to single blade grind or spin grind, what (if any) relief angle to grind and is there a place for backlapping? Arguments such as whether to in-situ or out of frame grind add to the confusion. Changes in recent years with more precise grinding means that spin grinding is now acceptable without any real need for backlapping or need to bed bottom blade and cylinder in together.

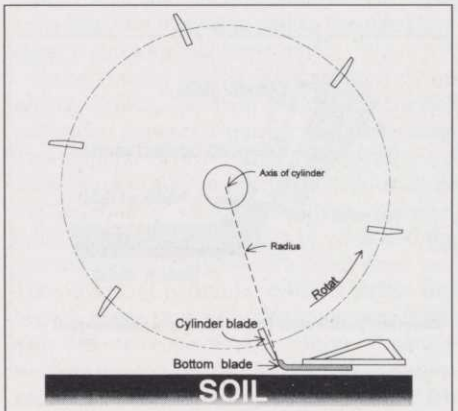

Diagram 1: General layout of cylinder, bottom blade

Having talked to a number of manufacturers of both mower and grinding machines it is obvious that a definitive answer need not be specific, and what is all important is what works in the field, in field conditions. Less disputed is the means of testing for sharpness, the usual method being to use a bit of thin paper (occasionally even a blade of grass) – perhaps not very scientific, but nevertheless effective. Some people (manufacturers) suggest there should be clearance between cylinder and bottom blades – a few thousandths of an inch, but most people find it more practical to adjust the blades to give the lightest possible touch.

Perhaps the first step in resolving some of these arguments is to get a clear understanding of the terms and geometry of cutting – not everyone is very clear of these and there is some ambiguity over how relief angles are measured.

Diagram 1, which is representative rather than typical, shows a general arrangement of bottom blade and cylinder – a fine turf mower has a much thinner bottom blade simply to enable it to cut exceptionally close to the ground. Each manufacturer has his own design in which the relationship between cylinder blades and the axis, and between axis and the bottom blade, varies. None sug-

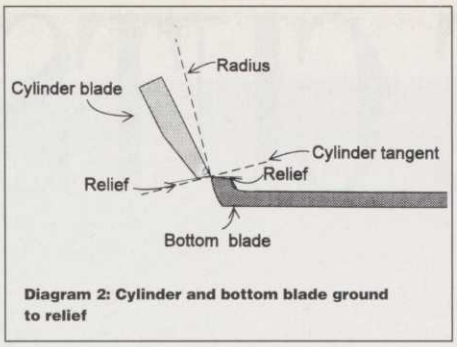

Diagram 2: Cylinder and bottom blade ground to relief

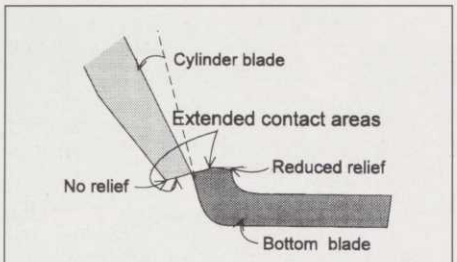

Diagram 3: Effect of back lapping (exaggerated)

gest any formula for these, but perhaps this is because the designs have been proven over time, or perhaps (more likely) there is some latitude in such relationships.

While the need to have sharp shear edges is obvious, the need for having any relief may not be. Relief angles are often described as the angle by which a blade edge slopes back from 'square' – but what is square? With cylinders this usually actually means the angle between a tangent to the cylinder radius and this is not the same as square to the blade because these are not radial (see diagram 2). One advantage of a large relief angle is that it allows backlapping to be carried out between re-grinds with the minimum of increase in the metal-to-metal contact area and in power consumption. More complex to assess is the best relief angle to grind onto the bottom blade as this depends on its relationship to the cylinder axis. If the cylinder leads the bottom blade (assuming it is horizontal) by a significant distance – ie its axis is well in front of the bottom blade – then a relief angle may be unnecessary. The less the lead, the greater the angle needed. This is highly academic when what is important is how cleanly and easily the machine cuts, in simple terms the aim is to minimise metal-to-metal contact and provide adequate clearance behind the cut point.

The ideal situation is a single line contact – or even a clearance (max .004ins) – so that there is virtually no drag due to blades in contact, ie as in diagram 2. Large angles can only be achieved by grinding blades individually. However, if little or no relief is required on the cylinder blades then it is possible to grind these to a true cylinder – American practice is changing away from single blade grinding to spin grinding and no relief. Atterton & Ellis claim their machines impart a 4-5deg relief because of the way their grinding wheel cuts in from the back of the blade – and this is probably true of others where grinder and cylinder rotate at different speeds but in the same direction. The maximum angle which can be cut with single blade grinding will depend on the closeness of the blades around the cylinder, however greater angles should not be advantageous for fine turf mowing. This is probably the crux of the matter, cylinder blade relief is possibly more valuable, and easier to apply, to mowers used for less critical turfs. In addition, not all grinders can single blade grind, manufacturers whose machines can't will say that single blade grinding is not for the golf course anyway, and in any case after blade grinding it is essential to either spin grind or backlap to ensure concentricity – an unwelcome second operation.

In-situ versus out-of-frame grinding may also be largely a theoretical argument, however there is the significant advantage with in-situ grinding of not having to remove the cylinder from the machine. The advantage of grinding a cylinder in its own bearings and frame should be a red herring – assuming that both are sound and true – and there is no

Relief grinding attachment

Electric drive lifting table

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way it will be cut true, sharpened in or out of frame, if they are not. Not all cylinder grinders can undertake in-frame grinding easily, if at all.

The argument on grinding bottom blades is not the same, and of course they have to be removed, nevertheless the frame and stiffener must be seen as an integral part of the blade with 'trueness' applied to the complete unit.

So what is the place of backlapping? Firstly, it is the cheapest, simplest and perhaps quickest means of sharpening a cylinder mower on most golf courses – using grinding paste and running the cylinder in reverse and many courses do it as a weekly routine. What this does is shown in exaggerated form in diagram 3, with both cylinder and bottom blades being 'sharpened' to produce an extended metal-to-metal contact area, and a considerably greater power demand. Obviously no greenkeeper would let his machines get to this state. Best practice must be to use backlapping for no more than honing the shear edges, using no more pressure and paste than are necessary. This way there should be little difference between the life of a bottom blade whether it is backlapped or ground, however in practice backlapped edges with greater contact area, and often greater pressure, generate heat and distortion and so become blunt faster – and a vicious circle starts.

Some courses seldom backlap but rely on regular grinds, for them grinding particular pedestrian mowers is quicker and easier than backlapping. How often sharpening is required depends on several factors, such as the amount of sand on the leaf, weather, cylinder adjustment, volume of work and the greenkeeper's definition of a good clean cut. The advent of hydraulic cylinder drives has been a major spur to backlapping, but it has also led to considerable abuse – simply because it is too easy to do, not that manufacturers complain, it leads to extra blade sales. Some machines have a special backlapping facility giving high torque at a slower speed, not just simple reverse drive.

Another disagreement between makers is over whether it is best to adjust the cylinder to the bottom blade or blade to cylinder, and how to do this. While there are significant differences in theory, in practice this is minimised as the all-important adjustment is height – in essence the relationship between the rollers and bottom blade. More important in practice may well be the ease of removing or changing the cylinder – and resetting it. The form of adjusting also has a theoretical effect on relief angles, for instance where either cylinder or bottom blade pivot, however few if anyone takes note of this although it can make several degrees of difference.

As to the economics of grinding, this is complicated by the circumstances of each club, the sharpness demanded, the abrasiveness of the soil on the grass, the number and type of equipment used and staffing. However with sharpening required probably at least twice a year and costing say £2 per inch, and most golf courses having at least 400 inches of cut, then sending mowing cylinders off-site is likely to cost over £800 a year. Additional factors include the cost of having spare machines while others are off-site being sharpened, possible reduced bottom blade wear and perhaps improved overall sharpness. Having spoken to several greenkeepers who do their own sharpening, the suggestion is that the repayment period is only two or three years, shorter than they first envisaged, while the service and sharpness is significantly better. Of course these clubs have a full-time mechanic – and this puts an additional dimension on the argument.