BY CASEY CREAMER

I have a mill with a 56" head saw that runs at 600 RPM. I am planning on adding a 36" top saw to the operation. Should I run it at the same speed as the head saw?

The simple answer is that yes, the two saws that will be sawing at the same time should definitely be running at the same speed so that you will have the same feed and speed relationship for both saws at any given moment.

But there is one very big problem with that answer. It all depends on what you mean by speed. Many people in our industry, when talking about speed, tend to be talking about revolutions per minute, (RPM). The problem is that RPM in and of itself is quite meaningless. The only use I have for RPM is for it to be just one part of an equation that along with some more information can get us to the speed that really matters.

RPM tells us how many times the shaft that is attached to some sort of cutter rotates per minute. But the interaction between the cutter, (saw blade) and the work piece (log) isn't related to how many times one tooth comes around in the log. The interaction between the saw and the log is all about the feed and speed relationship. The "speed" that the log actually interacts with is the speed of the tooth, not the amount of revolutions. That is called surface feet per minute or SFPM. It is not about how many times the log sees the same tooth in a minute. It is all about how fast that tooth is traveling, and how far it travels in a minute. From there, based on a given feed rate, you can start to determine how big a chip you will be making, and based on the gullet capacity of the saw, you can look at maximizing the gullet capacity without overloading the gullet and stalling the saw. You also want to make sure you are making big enough chips that they don't spill out of the gullet, heat the saw, and force it off line.

Some people think that it is better to err on the side of feeding too slowly than to feed too fast. Not true. Feeding too fast is definitely a problem since the result can be stalling the saw and shearing the lug pins. In that process, when the lug pins shear, the saw will stop while the fast collar will continue rotating until you shut down the power source. This will result in leaving a deposit of collar metal on the collar line of your saw. And of course, if you left a deposit of metal from the collar, that also means that your collars now have to be re-machined because taking away that metal means getting rid of the all-important taper that is needed on both collars.

Speaking of shearing the lug pins, not everyone is born knowing that when you mount a saw on the mandrel it is very important to turn the saw back against the lug pins before tightening the nut so that the saw doesn't have an opportunity to get a head start and easily shear the pins the first time it encounters some extra resistance.

Let's get back to under feeding. It won't shear the pins and make you shut down to re-machine the collars. But it will cause a lot of other problems. First, there is just plane efficiency. Everything that rotates as a result of the mandrel rotation is only going to rotate so many times before it has to be replaced. That means belts, pulleys, bearings, saws, and even the bits and shanks that are in the saw. You sell your lumber by the board foot and you also have sawing costs per board foot. So the more times that saw rotates per board foot the more it costs you per board foot to make lumber. Running too high an RPM for a given application, or just feeding too slow crates essentially the same errant feed and speed relationship. When that occurs it is like driving your truck or car around in low gear all day. Not the most efficient use of your fuel and not the way to reduce your cost per mile.

When you feed too slow, you make a smaller chip and if that chip is smaller than your side clearance, the chips (dust) will spill out of the gullet, which will wear out the shanks even quicker, and also heat the saw, force it off line, and cause it to need to be hammered sooner instead of later. Not to mention turning nice logs into unsaleable lumber. By the way, if you measure the thickness of your saw, take the difference between the kerf and the saw thickness, and divide by two, you get the amount of side clearance. For example, an eight-gauge saw should measure 0.165" on the rim. If you run 9/32" bits that would be 0.281". So 0.281 minus 0.165 equals 0.116. Divide that by 2 and it gives you a side clearance of 0.058" per side. Each different saw pattern has a different gullet capacity. If I remember correctly, the B pattern has 2.5 square inches of gullet capacity, the F pattern has 2 square inches, and I think the 2.5 pattern has only 1.5 square inches.

In a very large depth of cut the larger gullet capacity is the best because each tooth is taking a long arc in the cut and therefore carrying that much more sawdust in the gullets before it gets ejected as the tooth exits the cut. In a very small depth of cut, the combination of smaller gullet capacity with a larger number of teeth, put more teeth in the cut at the same time to prevent dodging knots. In a large depth of cut, even though you have fewer teeth you will have enough teeth in the cut because of the long arc the teeth take in a larger depth of cut. If you are sawing nothing but small knotty logs I would recommend the 2.5 pattern. And if you are sawing nothing but large depth of cut relative to the diameter of the saw, I would recommend the B pattern. But if you saw a little bit of everything, you will find that the F pattern has a large enough gullet to handle the big logs and a high enough number of teeth to handle the small knotty logs. This is one of those rare occasions when a decent compromise actually works out well.

Getting back to the real speed of your saws. We can call it tooth speed, rim speed, or simply surface feet per minute. Calculating rim speed is easy as long as you know the RPM and the diameter of the saw. If you want to know how fast the rim of the saw is traveling you first have to know the circumference of the saw. If you multiply the diameter by 3.14 you will get the circumference of the saw or any circle. The circumference is the distance a tooth will travel per revolution. So, now you know how far the tooth travels in a revolution in inches and you already know how many revolutions the saw takes per minute (RPM). Now all you have to do is multiply the circumference by the RPM and then divide that answer by 12 to get from surface inches per minute to surface feet per minute, (SFPM).

You have a 56" saw running 600 RPM. 56 x 3.14 = 175.84. 175.84 x 600 = 105,504. 105,504 divided by 12 = 8,792 SFPM. The more compact version is 56 x 3.14 x 600 divided by 12 = 8792 SFPM. Now if you are adding a 36" top saw, we want to match their rim speeds because they will both be fed at the same speed at the same time, even though their depth of cut will vary. All we have to do is run the equation backward because we have a given SFPM, a given diameter, and we are trying to solve for RPM of the smaller saw. Here is what that looks like. 8,792 x12 divided by 3.14, divided by 36 = 933 RPM.

Now we know that if we really want our 36" saw going at the same speed as our 56" saw, it will have to turn at 933 RPM. It is interesting that band saw filers usually know what speed their band saws are running in SFPM, because they just do the math using the diameter of the band wheels and of course the RPM they are turning. From there they decide how much tension their saws need and order tension gauges with the appropriate radius which is designated as a specific foot circle. But saw doctors who work on circular saws can sometimes order tension gauges with a specific curvature designated in RPM. For instance, they might order a 600 RPM tension gauge. Well, is that 600 RPM for a 48" saw which would mean 7,536 SFPM or is that 600 RPM for a 60" saw which would be turning 9,420 SFPM? I wouldn't dream of running the same amount of tension in both of those saws.

As long as we are on the subject of speed I recommend that if you are sawing frozen and unfrozen hardwood, you should run 8,000 to 8500 SFPM and if you are sawing frozen and unfrozen softwood, you should run 9,000 to 9,500. If you never saw frozen or even partially frozen logs, I would look at 8,500 for hardwoods and 9,500 for softwoods. Whatever you are doing, you don't have to run those exact speeds, but you should at least be in the ballpark. Running the saw too fast is inefficient and you tend to run into the situation where the tooth hits the wood so hard that it pulverizes the wood instead of making a clean chip that is big enough to stay in the gullet until it gets ejected. That just amounts to wasted motion and wasted wear. And by the way, trying to run a 42" saw at 540 RPM (power takeoff speed) doesn't work well either because the tooth is not impacting the wood hard enough to make a proper chip. Do the math.

Send your questions about sawmills and their operation to Casey Creamer, president of Seneca Saw Works, Inc., PO Box 681, Burdett, NY 14818, (607) 546-5887. Email: casey@senecasaw.com.