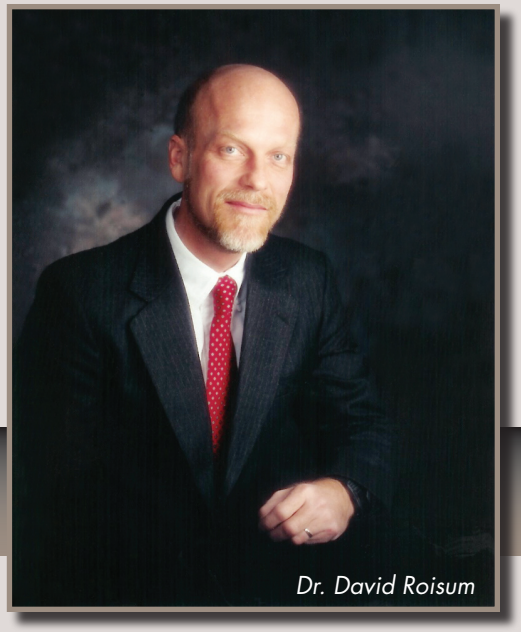
CRITICAL THINKING

by Dr. David Roisum



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Why Are Rollers Grooved?

Roller topology is at least as important as chemistry. The most common topology is merely the normal finish of the roller body, which may be around 32 rms roughness. Tolerant products may only need a less expensive 125 rms coarse finish for things like transport rollers. Drums used for casting optical film, on the other hand, may need super finishing to mirror smoothness.

The next most common roller topology is grooving. Here there is much more mythology than understanding. A near universal belief is that spiral grooving (or tape) spreads the web. Yet, measurement after measurement indicates no spreading. In fact, wide grooving has the contrary effect; producing a wrinkling tendency when tension pulls the web into the grooves. Yet the "barber pole" optical illusion is so convincing to the eye that people look no further, as their minds are already made up.

The primary purpose of most grooving is the same as the treads on your car: to maintain traction in spite of fluid lubrication. In tires, the point is to avoid hydroplaning on wet roads. In rollers, the point is air handling to maintain traction. Treads do not increase traction per se, and in fact decrease it. That is why race car tires are slick. In other words, grooving does not make traction, it merely maintains it over the desired speed range of the machine.

What grooving pattern works best? At the time I worked at Beloit Corp., it was the largest web-machine builder in the world. A staff of 100 engineers, working for more than 100 years, produced as much web machine understanding as any other organization. Beloit had more than 1,000 grooving pattern drawings in its vault, including variations for the idler and drum rollers. One of these patterns became the de facto standard. It was called the venta-groove.

The venta-groove is about 1/16 in. wide by 1/8 in. deep on a 1/2-in. pitch. Why? A 1/16 in. is about as narrow as can be cut economically with a saw and is not so narrow as to foul easily. The depth and pitch is enough to give the volume needed to handle air at speeds up to 10,000 fpm. The annular groove is simply an economical way to cut a groove—sometimes cut on an outward spiral as a nod to spreading mythology.

For converting needs of perhaps 2000 fpm, the grooving required to handle the tiny skin of air film would only need to be similar to the texture of an old-fashioned vinyl record. Though some offer a micro-groove, using this surface fills the valleys and wears down the peaks. Instead of many tiny grooves, fewer big grooves.

Even the air-handling aspects of grooving are misunderstood. Air does not flow through the grooving, rather to it. The best way of thinking about the groove is that it's just a place to "park" the air. Other topologies—shot peening, knurling, rough spray coatings—would be equally good candidates for air-parking. In fact, the simplest is masking tape. We now know, however, that spiral taping does not spread. Rather, it is just a convenient way of applying the tape. Spiral front, spiral back, spiral center or no spiral at all—there is no difference that we can see—if we ignore the optical illusion.

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David Roisum • Finishing Technologies™ • 1305 Orchard Ct. • Neenah, WI 54956 • P: 920.725.7671 • www.roisum.com