A Slice of Design Engineering

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Unique coupling provides solution for veneer production system

Manufacturer Louis Merritt wrote in 1929 of the importance of designing machines that are simple yet modern. Responsible for several patents that led to the international demand for his company's veneer lathes, Merritt worked with his father and brother to establish their company as a leading woodworking machinery manufacturer. The company is known today as Merritt Plywood Machinery Inc. and makes cutting-edge machinery for the veneer and plywood industry. The "simple yet modern" sentiment that Louis Merritt championed all those years ago can be seen today in the engineering of the company's latest machine—a vertical veneer slicer.

Merritt Plywood Machinery, located in Lockport, NY, worked closely with International Veneer Co. Inc. of South Hill, VA, to develop the specifications for the new slicer and contracted MAB-Engineering in Germany to handle the mechanical design. The collaboration resulted in a heavy-duty upcut slicer that boasts high production rates and high yield. It can produce up to 90 sheets of high-quality wood veneer per minute in sheet sizes up to four meters long by 900 mm wide and 0.5 mm thick. It also uses the latest servo drive technology so that it can handle two to three shifts per 24 hours with virtually no downtime for maintenance.

The design criteria for the new slicer focused on simplifying as many components as possible. User-friendly controls and a local pressure bar adjustment were essential so that both experienced and inexperienced operators could handle setup and produce quality veneer. The slicer delivers fast, safe flitch (wood log) loading, thanks to a patented vacuum flitch-loading mechanism. This mechanism also provides thinner backing boards, which results in higher veneer yield. Integrated in the slicer are several safety features such as emergency stop cables inside the knife area and at the outfeed, a mechanical safety lever to physically prohibit carriage motion, and safety light curtains at each end. The slicer's design also allows knife angle changing during slicing without the need to alter the pressure gap.

To achieve 90 sheets per minute, the slicer's servo drive turns at 2,400 rpm with an intermittent clockwise and counter-clockwise cycle of 0.6 seconds every five minutes. When considering the design challenges for the slicer's servo system, the engineering team knew components were needed that would ensure precision positioning and slicing, high reverse loads, and continuous operation. To absorb the high torque loads and reciprocating motion, CD Couplings from Zero-Max Inc. were selected. Zero-Max is a leading manufacturer of power transmission components in Plymouth, MN.

"With the rapid start/stop cycling of this system, motion control is really critical," says Mark Lorenc, a design engineer at Merritt Plywood Machinery. "The couplings

absorb any backlash tendencies in the power train so there are no damaging forces imposed on the servo motor or other connected components in the system's drive train."

The power train, which has a T-shaped configuration, uses three CD Couplings. The servo motor's power source is at the base of the T. Its output shaft connects to a coupling, and the coupling connects to the input shaft of a right-angle cone-drive gearbox, which forms the top of the T. The gearbox's two output shafts are connected to two additional couplings, which connect to two lead screws. These lead screws drive the reciprocating knife carriage, which slices the sheets of wood veneer.

The coupling that connects the servo motor and gearbox is the Model 6A76QD. It has a 7.75-in. diameter with rated torque of 15,600 in./lbs (1,763 Nm) and torsional stiffness of 94,107 in./lbs/deg (609,303 Nm/Rad) with a maximum HP of 24.75/100 rpm. The two couplings used to connect the cross shaft and bevel gearbox are Models 6A52QD. With a 5.25-in. diameter, they have continuous rated torque of 3,560 in./lbs (402 Nm) and torsional stiffness of 26,049 in./lbs/deg (168,656 Nm/Rad) with a maximum HP of 5.65/100 rpm. Both couplings are the CD QD quick-disconnect variety, which means hubs are machined to accept standard QD bushings and are assembled into the system without alignment tools.

"We needed the most durable coupling we could find," recalls Lorenc. "Acceleration is fast and the change from clockwise to counter-clockwise rotation can create problems for the system unless motion forces are controlled properly. The torque loads imposed on the components are handled very well because of the CD Coupling's unique torsional stiffness design." This high torsional stiffness is the result of the coupling's patented open arm disc pack. Made of rugged composite material, the disc pack reacts to coupling forces with high torsional stiffness. The composite material has a ply or fiber orientation to it, which not only gives the disc rigidity but also a damping effect on shock and noise. Thus, the coupling has the ability to lessen reaction loads in heavy-duty applications, such as the vertical veneer slicer, while absorbing and dampening shock and vibration.

Moreover, the couplings withstand harsh chemical environments and temperature extremes from –70° to +250°F, which enables them to operate in the moisture rich environment of the slicer without encountering contamination problems. By comparison, conventional steel disc and elastomeric couplings often fail in such harsh environments.