

Reducing School Liability by Incorporating Brake Activation Devices on Woodworking Equipment

Introduction and Need

Agricultural mechanics courses are popular among secondary students throughout the United States (Anderson et al., 2011). This increase in popularity adds to the importance of maintaining a safe laboratory environment. The nature of the agricultural mechanics laboratory combined with the inexperience of secondary students and the proximity to dangerous equipment and chemicals creates the potential for injury (Dyer and Andreasen, 1999). The prevention of these potential injuries is the responsibility of the instructors, administrators, and school district. Alternatively, Gliem and Miller (1993) reported that administrators believe laboratory equipment safety is primarily the teacher's responsibility.

Ultimately, safety in the classroom is not only essential for learning, but a legal obligation as well (Daniels, 1980; Gliem and Hard, 1988). Even though agricultural educators may appear to be adequately providing instructional safety to students, susceptibility to legal action resulting from student injuries still exists (Dyer and Andreasen, 1999). In a study of Utah school shop accidents, Knight et al. (2000) reported that in-patient charges for student injuries sustained in the shop averaged \$3,821. This does not include potential pain and suffering compensation or personal injury settlements which typically exceed actual medical costs. In two thirds of school related injury settlements, school districts paid an average award of \$562,915 (Barrios et al., 2007).

Injuries sustained from woodworking are relatively common due in part to the unpredictability of wood as it moves through the saw blade. In a report for the Consumer Product Safety Commission, Adler (2002) estimated that 93,880 saw-related injuries were treated in U.S. hospital emergency rooms in 2001 alone. Of these saw-related injuries, 55% involved table or other stationary saws, 15% involved miter saws, 8% were the result of band saw accidents, and 4% involved the use of radial arm saws. Specifically relating to secondary school incidents, Knight et al. found that 1,008 students from grades 7-12 were involved in shop class injuries in Utah from 1992-1996. Of these injuries, 88% were the result of equipment use (Knight et al., 2000).

The use of brake activation devices may prevent many of these types of woodworking accidents. Brake activation devices are currently available on various types and sizes of table and cabinet saws. Band saws, jointers, and miter saws with brake activation devices are in the advanced stages of development and will soon be commercially available. The development of these tools represents an opportunity for schools to reduce their liability in the woodworking area of the agricultural mechanics laboratory.

How it Works

A table saw blade is essentially a flywheel which stores a tremendous amount of energy. This inertia, combined with the power generated from a standard table saw motor creates a significant amount of force. This force must be stopped in a matter of milliseconds if an injury is to be prevented. In order to accomplish this, the brake activation system is composed of several parts. Initial activation is triggered by an electronic detection system. This system relies on the relative difference in conductivities between wood and the human body. A constant electrical current flows across the saw's blade and through the monitoring device. In the event that a human body part makes contact with the saw blade, the current is disrupted, thereby signaling the monitoring device to activate the brake. The brake apparatus is composed of a spring and

aluminum block, called a brake pawl. The spring is compressed by a fuse wire, which is burned by a surge of electricity generated by the monitoring device. Once the spring is released, the brake pawl is pushed into the teeth of the blade, stopping rotation almost immediately. Simultaneously, the entire blade is retracted below the table surface and the power is turned off. The entire braking process occurs in approximately 1/200th of a second.

Implications

A survey conducted by Becker et al. (1996) found that 65% of 283 amateur and professional woodworkers in New Mexico had reported tool-related injuries. Of those 184 woodworkers, 61 had reported sustaining injuries of enough severity to require medical attention. Specifically relating to secondary agricultural education, Dyer and Andreasen (1999) reported that a mean of 1.3 student accidents requiring medical attention and 13.3 minor accidents occurred per year when high school agricultural programs were examined. To date, no lacerating table saw injuries requiring medical attention have been reported from table saws properly equipped with brake activation devices. The addition of these saws to secondary and postsecondary agricultural mechanics laboratories can significantly reduce the liability caused by students using standard table saw equipment. Moreover, Saucier et al. (2011) concluded that teachers who continue to use equipment not equipped with these devices are positioning both the teacher and administration for possible liability for professional negligence.

It should be noted that brake activation devices do not prevent all types of woodworking accidents, and do present some negative implications as well. Brake activation devices do not prevent wood kickback, as this phenomenon does not involve contact between the human body and the saw blade. Additionally, the electrical nature of the detection system creates limitations when cutting lumber with high moisture content. Keyed access also allows the brake activation system to be temporarily disarmed, or placed into bypass mode, for cutting this high moisture lumber or other conductive materials. Instructors leaving the saw in bypass mode will render the saw no safer than a standard table saw.

Future Plans & Advice to Others

Iowa State University intends to immediately purchase the miter saw, band saw, and jointer equipped with brake activation technology as soon as this equipment becomes commercially available. However, this advanced equipment is not intended as a replacement for traditional safety training. Secondary school budget restraints may create a barrier to the acquisition of this type of equipment. Saucier, et al. (2011) reported that reduced school budgets may lead to the use of unsafe equipment. However, given the exceeding high potential liability costs, the equipment is a relatively small investment. Nontraditional funding sources are available from the industrial sector, safety organizations, and labor unions.

Cost

The costs for the table saw equipped with brake activation at Iowa State University included \$2,569 for the cabinet saw, \$199 for the mobile base, \$139 for a dust-collecting blade guard, and \$69 for an additional brake cartridge. The total project cost was \$2,976. Other brake activating table and cabinet saws are available and range in price from \$1,600 to \$4,800. Multiple saw sizes, configurations, power options, and accessories account for the wide range of prices.

References

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