Designing Machines Safely

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Accidents begin on the drawing board! As surprising as it may seem, many industrial accidents occur because accidents have been designed into machines which cause the workers' injuries. in designing equipment, many designers fail to take into account the most important consideration, that it is how the users of the equipment will interact with it. It is assumed by many product designers that the anticipated users of a newly developed machine will work with, operate and use it in a robot-like, flawless manner. In making this assumption, product designers are actually laying the foundation for accidents to occur with the products once they are put into the marketplace. The time to prevent and eliminate accidents is when the product is on the drawing board. It is at this time that the necessary safety considerations can be addressed in order that the machine may not cause injuries to its users once it is in production.

In the evaluation and development of any new product, three critical factors must be considered by the designer. These are hazard, risk and danger.

A hazard is a condition or changing set of circumstances that rise to a potential injury.

One of the most common and dangerous types of hazards that exists with machinery is the motion or moving type of hazard. These include pinch points, in-running nip points, cutting actions, and rotating or reciprocating motions.

Pinch points occur whenever two parts of the of the machine meet in such a manner to cause a pinching action. An example of a pinch point would be when the ram of a punch press comes in contact with the die.

In-running nip points exist whenever a machines parts rotate toward each other or where one part rotates toward a stationary part. Belt and pulleys and press rolls are illustrations of in-running nip points.

Rotating parts and objects are extremely hazardous. A classic example of a rotary action is that of a flywheel or spindle which is capable of catching and wrapping itself around clothing, gloves and frequently hair.

Cutting hazards exist when the sharpness of the moving tool comes in contact with the material being cut. Typical examples of cutting hazards include woodworking machinery, grinding and milling machines.

When a product is being designed, it is the responsibility of the designer to identify all hazards that could possibly exist with anticipated uses and misuses of the product.

The second factor to be analyzed in the design of any new product is the risks which exist with the use of the product. Risk is a probability of injury. Risk is based on the users' experience or inexperience, knowledge and familiarity with the product and the proximity and number of times he or she is exposed to the products' hazards. Someone who manually feeds by hand, widgets into a punch press eight hours a day is at greater risk of getting injured than the person whose function is to monitor a fully automated machine.

The final element in product design that needs to be addressed by the product designer is the danger imposed by the product. Danger is the unreasonable and unacceptable combination of hazard and risk. If there are reasonable injury prevention systems which would have eliminated or reduced the danger. The job of the product designer is to reduce the danger to a zero level or eliminate it if possible.

It is the task of the machine manufacturer and the product design engineer to identify all hazards that the users of the equipment will be exposed to during the anticipated uses and misuses of the product. Once a hazard has been identified, the next step in the product design is to eliminate the hazard by designing it out of the product to the extent possible. If the hazard can be designed out of the product in such a manner that the product will still be practical and useful then it should be done. Only if the hazard can not be designed out or eliminated entirely then the second step is to safeguard or enclose the hazard at its source to protect the users.

The primary purpose of safeguarding the product, by guards or other safety features, is to prevent injuries caused by foreseeable contact with the moving parts. The contact can be either that of a user making contact with the moving part of the machine because of fatigue, distraction, curiosity or the contact can be a direct result of a machine malfunction, including mechanical and electrical failures or kick-backs.

Products designers and manufactures must take the initiative and responsibility of improving the safety of their products. They can take a large step in the right direction by addressing and hopefully designing out the hazards that exist in a particular design before it becomes too late. Once hazards are designed into products, the damage has been done. Sooner or later the inevitable will happen. A user of the product will be exposed to the hazard and suffer a serious injury that may disfigure or cripple him or her for the rest of their life.

Products should be designed with safety being the first and most important consideration. Until products are designed with the safety of the ultimate users in mind, accidents and injuries will continue to happen. Product liability suits will continue to fill the courts because in most cases the injuries and deaths caused by unsafe machinery and equipment were preventable.