1

Hazard Recognition

Machinery and equipment hazards

Hazards created by machinery and equipment can be classified as **mechanical** and **non-mechanical.**

Mechanical hazards

Recognizing mechanical hazards

A good way to recognize mechanical hazards is to observe how the moving parts of a machine operate and how parts of a worker's body are likely to come into harmful contact with them.

Machine parts generally move in one of three ways: they rotate, they slide, or they can rupture, fragment, and/or eject.

- Single **rotating** parts, such as shafts or couplings, present a risk of snagging or entanglement. Two or more parts rotating together, such as feed rolls and V-belt and pulley drives, create nip points (see Figures 1.1 and 1.2).
- Parts that **slide** or **reciprocate,** such as dies in punch presses, create shearing or crushing hazards.
- Parts that can **rupture** or **fragment,** such as an abrasive wheel, may cause impact injuries.

Some moving machinery and equipment parts can endanger a worker in more than one way. For example, an abrasive wheel can explode and cause serious impact injuries. Or, minor abrasion can result when a worker's hand accidentally rubs against the wheel.

Figures 1.1 to 1.5 illustrate common mechanical hazards where hands, limbs, hair, clothing, and sometimes the entire body can be injured from harmful contact with unguarded moving machine parts. The illustrations show typical cases, not all possibilities.

Principal mechanical components of machinery

Most machines have three principal components:

- A power source (often an electrical motor)
- A power train that transfers moving energy
- Tooling

Hazards from these components generally involve the following:

- **Power transmission parts.** These are the moving parts of the power train. They usually consist of belts, pulleys, chains, sprockets, gears, shafts, and couplings. Many of the moving parts illustrated in Figures 1.1 and 1.2 are power transmission parts.
- **Point of operation.** This is where the tooling of the machine is contained and the machine's work is performed. The term "feed point" is sometimes used to describe the working area of the machine.

The types of machine components and drives shown in Figures 1.1 to 1.5 are very common in most industrial operations. They account for a large number of serious injuries in the workplace.

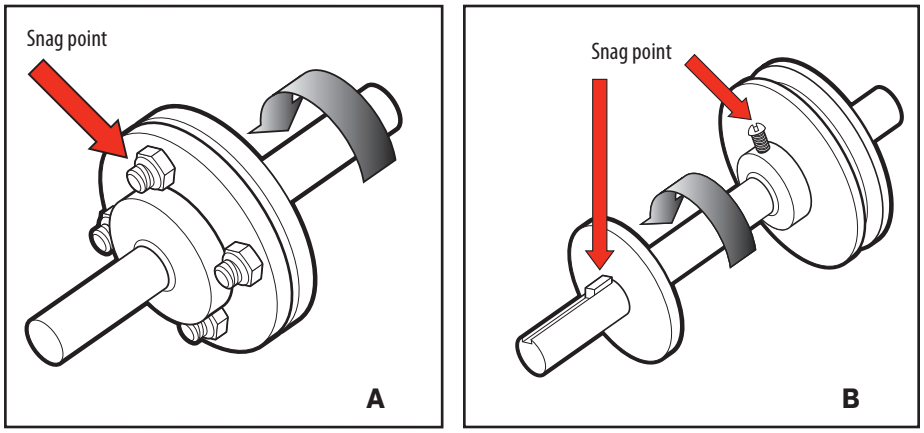

Figure 1.1. Single rotating parts presenting a snagging/entanglement hazard. (A) Snagging hazard from projecting flange bolts on rotating coupling. (B) Snagging hazard from projecting keyway and set screw on rotating shaft.

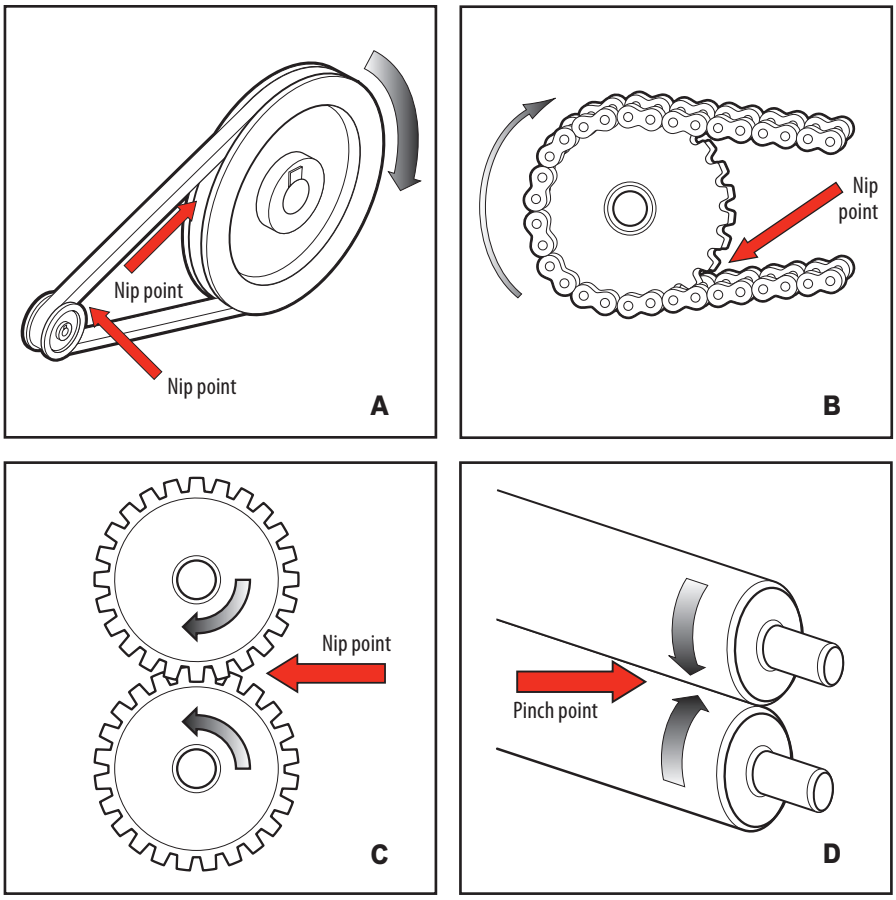

Figure 1.2. Multiple rotating parts presenting an in-running nip point hazard. (A) V-belt and pulley drive: a common source of in-running nip points on powered industrial machinery. (B) Typical chain-sprocket drive. (C) Typical exposed gears. (D) Typical feed rolls.

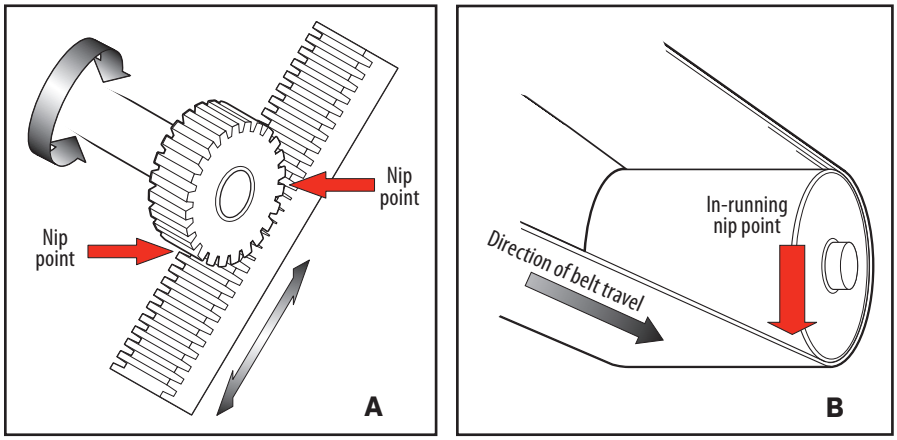

Figure 1.3. Combination of rotating and sliding parts and reversing parts, creating two in-running nip point hazards. (A) Rack and pinion gears. (B) Conveyor belt spool.

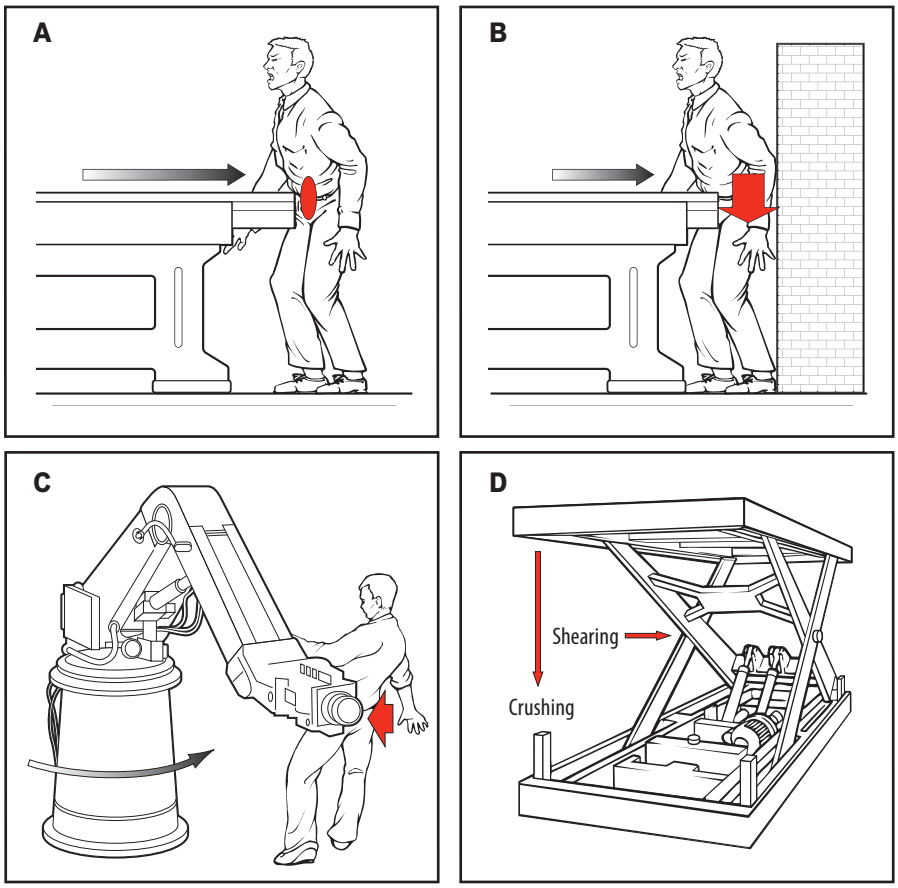

Figure 1.4. Sliding/pivoting movement creating struck by/crushing hazards.
(A) Sliding milling table striking worker in abdomen.
(B) Sliding milling table crushing worker against adjacent wall. (C) Worker struck by robot arm.
(D) Scissor lift creating crushing/shearing hazards.

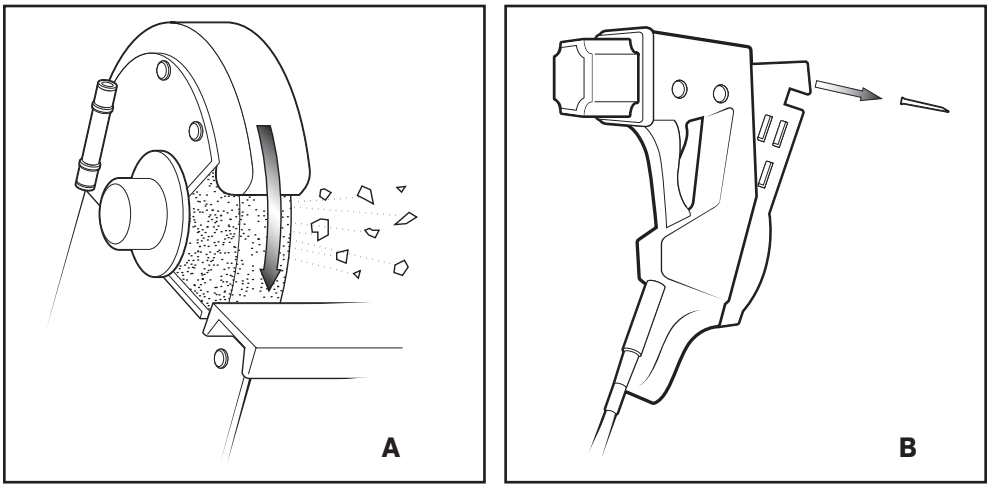

Figure 1.5. Hazards from fragments and projectiles.
(A) Fragments from exploding abrasive wheel. (B) Projectile from pneumatic nail gun.

Health hazards

Workers operating and maintaining machinery can suffer adverse effects other than physical injury caused by moving parts. They can be exposed to hazards through inhalation, ingestion, skin contact, or absorption through skin. For example, without adequate safeguards, control measures, and personal protective equipment, a worker may be at risk of occupational disease resulting from exposure to:

- Toxic or corrosive chemicals that can irritate, burn, or pass through the skin
- Harmful airborne substances that can be inhaled, such as oil mist, metal fumes, solvents, and dust
- Heat, noise, and vibration
- Ionizing radiation such as X-rays and gamma rays
- Non-ionizing radiation such as ultraviolet light (UV), radio frequency (RF) energy, and lasers
- Biological contamination and waste
- Soft tissue injuries (for example, to the hands, arms, shoulders, back, or neck) resulting from repetitive motion, awkward posture, extended lifting, and pressure grip

Other hazards

Some hazards are associated with things other than moving parts:

- Slips and falls from and around machinery during maintenance
- Unstable equipment that is not secured against falling over
- Fire or explosion
- Pressure injection injuries from the release of fluids and gases under high pressure
- Electrocution from faulty or ungrounded electrical components

Machines must be safeguarded to protect workers from these non-mechanical hazards as well as the more obvious mechanical hazards.

Sometimes a safeguard used to eliminate or minimize a mechanical hazard can be modified to also minimize a non-mechanical hazard. For example:

- A guard designed to prevent access to moving parts may also absorb noise.
- Welding curtains designed to shield against arc flash can also protect against spatter and burns.
- Guards surrounding abrasive wheels can also be used as a shroud for local exhaust ventilation.