Basic Machine Guarding

A Review

Ana Cammarata, CSP
Safety Specialist
BWC-Division of Safety & Hygiene

Ohio | Bureau of Workers' Compensation

Basic Machine Guarding-Review

- Machine guarding - Statistics
- Safeguards –Basic Criteria
- Hazardous Motions and Hazardous Actions
- Type of guards
- Devices
- Hazard Recognition
- Group scenarios

The Problem

Workers who operate and maintain machinery each year suffer approximately

- 18,000 amputations, lacerations, crushing injuries, and abrasions
- 800 deaths

Estimated Costs of Occupational Injuries and Illnesses and Estimated Impact on a Company's Profitability Worksheet

Direct Costs

1. Select an injury type from the drop-down menu OR enter the total workers' compensation costs.
2. Enter the profit margin (leave blank to use default of 3%).
3. Enter the number of injuries (leave blank to use default of one).
4. Select "Add/Calculate" to compute the total direct and indirect costs.
5. Repeat the step to add additional injuries to the list.

Injury Type Select an Injury Type

OR

or

Workers' Compensation Costs *(annual sum of costs)*

Enter Profit Margin (%) *(leave blank to use default of 3%)* 3

Enter Number of Injuries *(leave blank to use default of one)*

Add/Calculate Clear

Estimated Total Cost

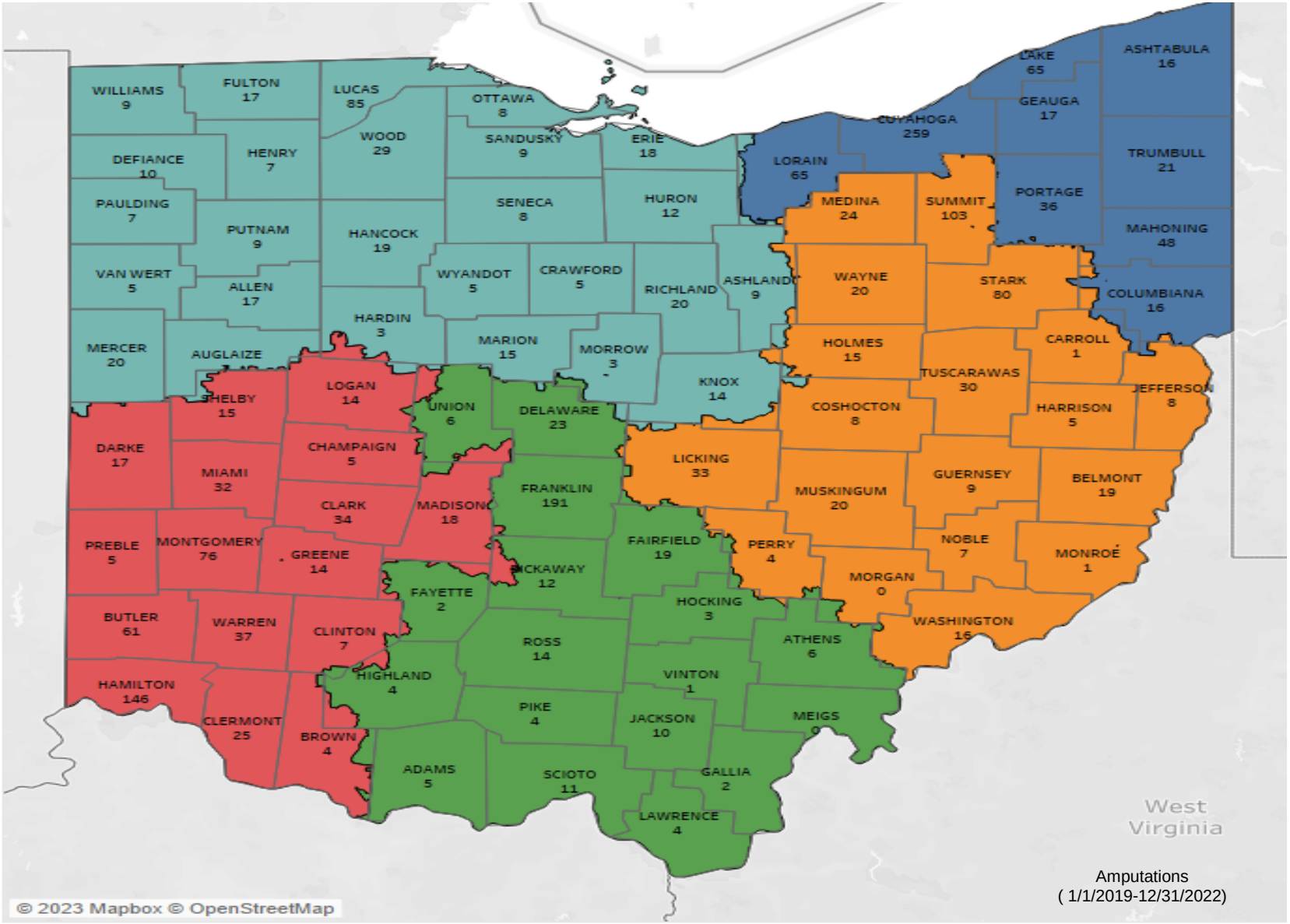
The extent to which the employer pays the direct costs depends on the nature of the employer's workers' compensation insurance policy. The employer always pays the indirect costs.

Injury Type	Instances	Direct Cost	Indirect Cost	Total Cost	Additional Sale (Indirect)	Additional Sale (Total)	
Amputation	1	$ 96,003	$ 105,603	$ 201,606	$ 3,520,110	$ 6,720,200	Remove

Totals

Estimated Direct Costs:	$ 96,003
Estimated Indirect Costs:	$ 105,603
Combined Total (Direct and Indirect Costs):	$ 201,606
Sales To Cover Indirect Costs:	$ 3,520,110
Sales To Cover Total Costs:	$ 6,720,200

Ohio | Bureau of Workers' Compensation



Amputations
(1/1/2019-12/31/2022)

Ohio | Bureau of Workers' Compensation

Applicable OSHA Standards

29 CFR Part 1910

- Subpart J (1910.147): The control of hazardous energy (Lockout/Tagout)
- Subpart O (1910.211-219): Machinery and machine guarding
- Subpart P (1910.243): Guarding of portable powered tools
- Subpart R: Special industries (e.g., Bakery equipment)

Understanding Machine Guarding

Understanding Hazardous Motions/Actions

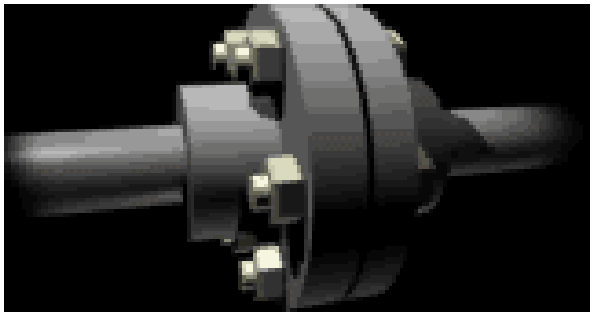
Ohio | Bureau of Workers' Compensation

Hazardous Motions

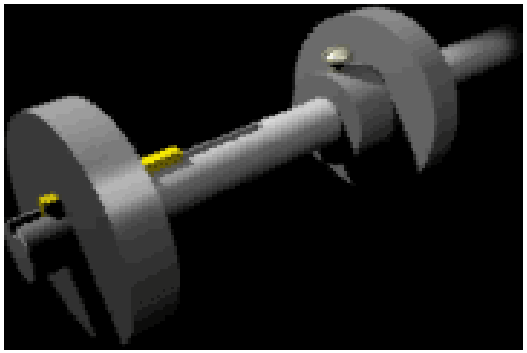
1. Rotating
2. In-running nip points
3. Reciprocating
4. Transverse

Rotating

Rotating Coupling with Projecting Bolt Heads

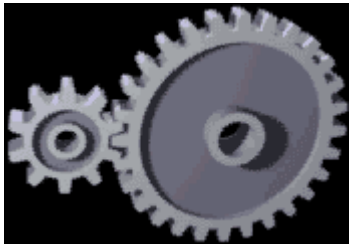


Rotating Shaft and Pulleys with Projecting Key and Set Screw



In-Running nip points

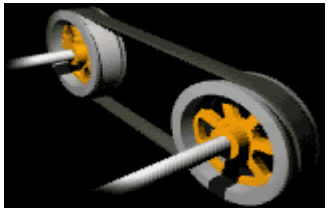
Parts Rotating in opposite directions



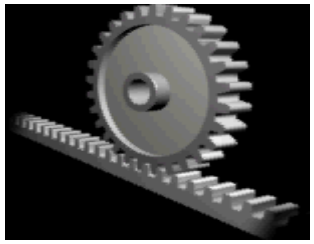
Intermeshing Gears

Rolling Mill

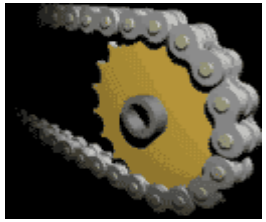
Rotating parts



Transmission belt and pulley



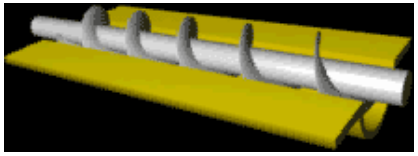
Rack and Pinion



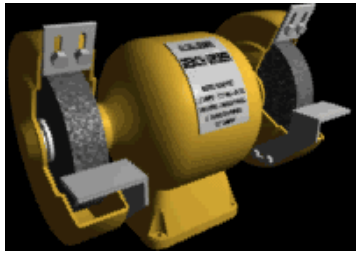
Chain and a Sprocket

Rotating elements and fixed parts

Flywheel



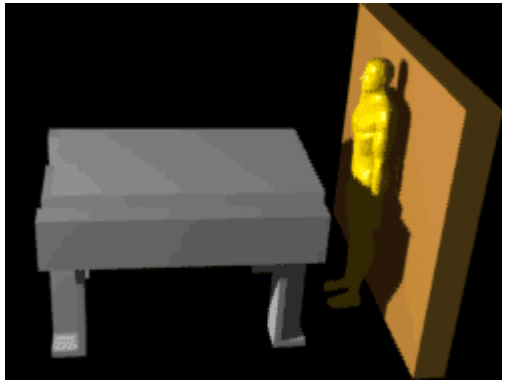
Rotating Screw Conveyor and Fixed Trough



Rotating Abrasive Wheel on a Grinder

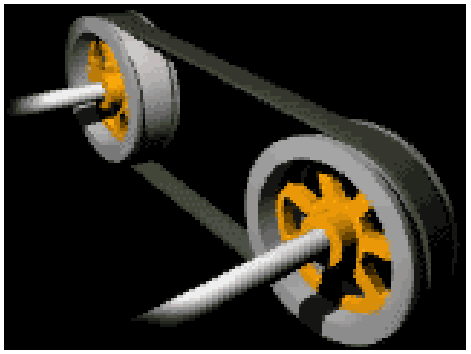
Reciprocating

Worker Caught Between a Reciprocating Table Piece and a Stationary Part



Transverse

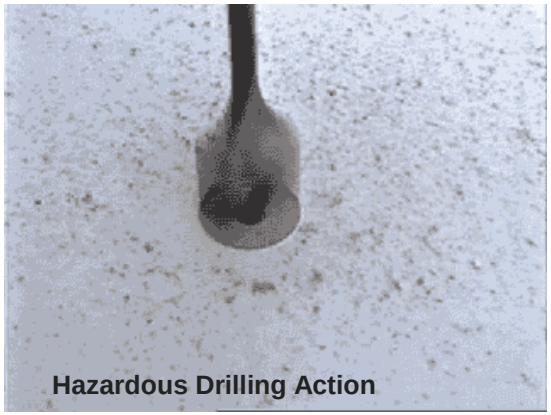
Point of Contact Between a Power Transmission Belt and Its Pulley



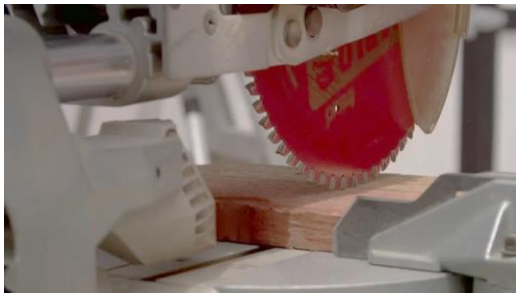
Hazardous Actions

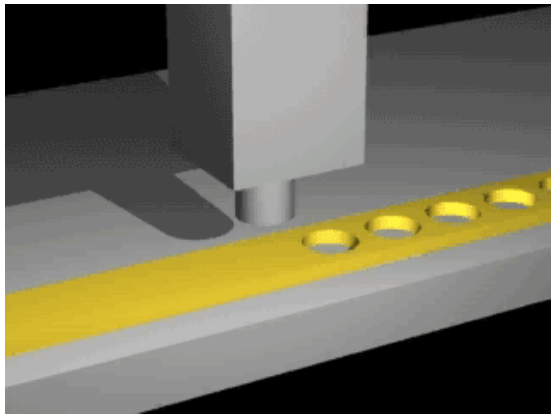
- Cutting
- Punching
- Shearing
- Bending

Hazardous Actions

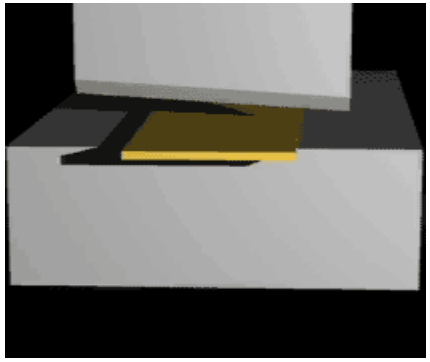


Cutting

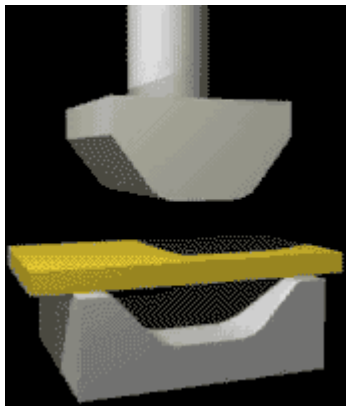




Punching



Shearing



Bending

Basic Criteria

- Any machine part, function, or process which may cause injury must be safeguarded.
- A guard should not allow **someone** to reach over, under, around or through.
- Guards must be affixed, can not be removed without the use of special tools.

Safeguard minimum requirements

- Prevent contact
- Secure
- Create no new hazards
- Create no interference
- Allow safe lubrication without removing the safeguards.

Basic Criteria

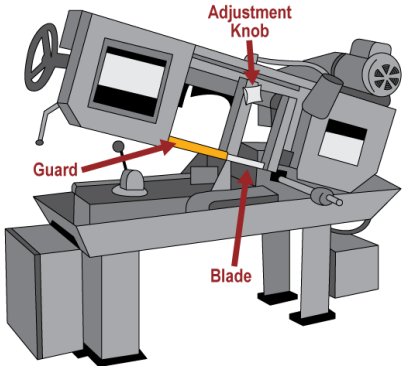
Basics Areas of Safeguarding

- The point of operation
- Power transmission apparatus
- Other moving parts (reciprocating, transverse, or rotating)

Hazardous motions/ functions

Type of Guards

Fixed



Adjustable

Self-adjusting

Interlocked

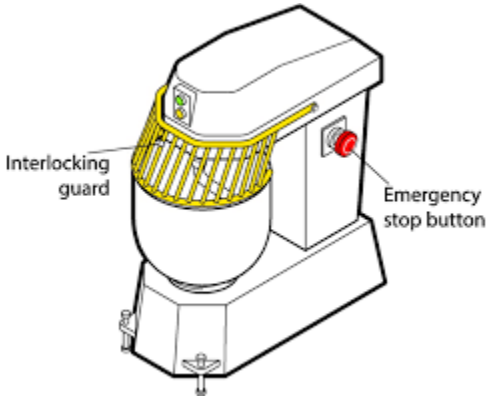


Photo courtesy of Division of Safety and Hygiene

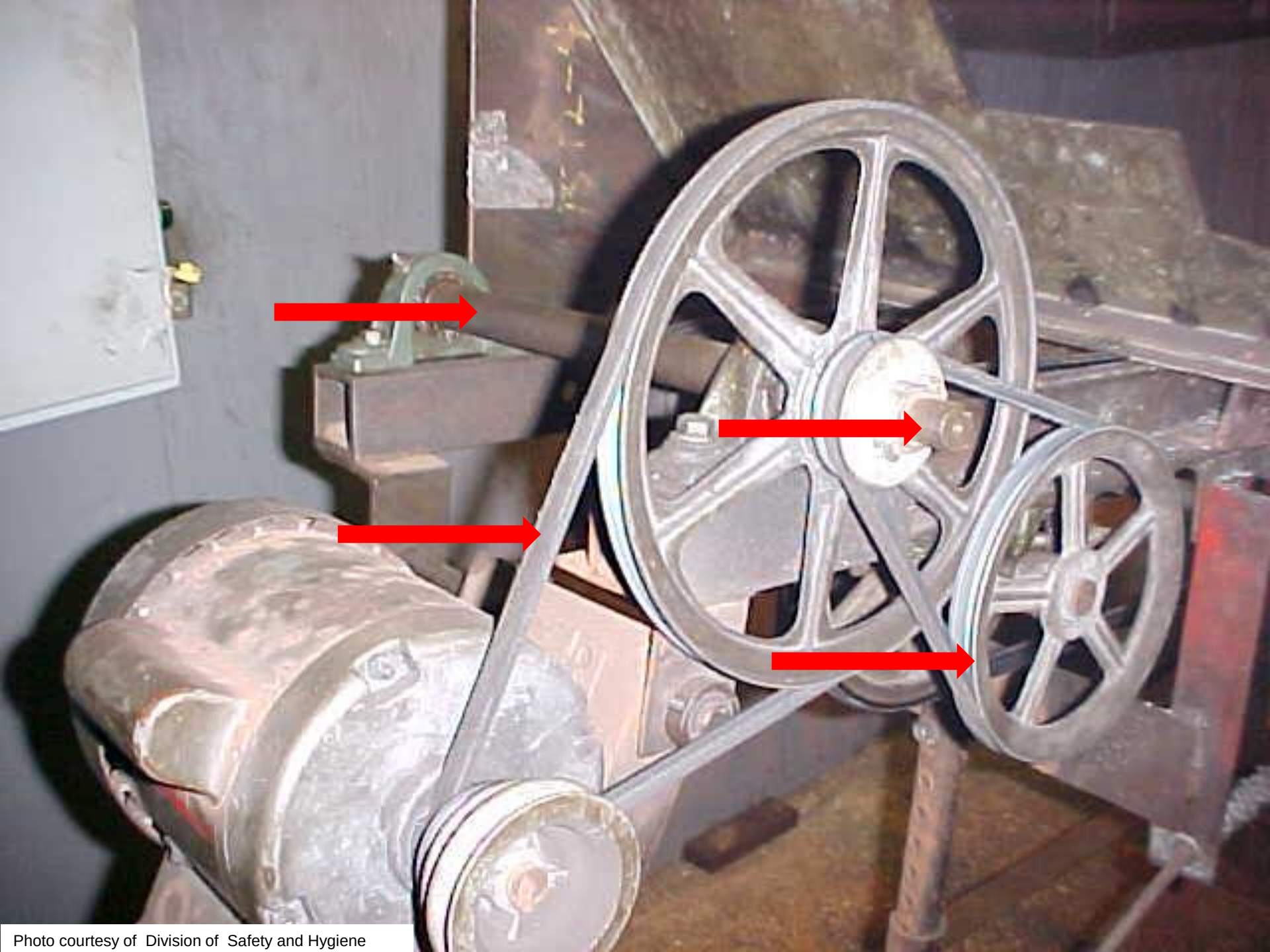


Photo courtesy of Division of Safety and Hygiene

Photo courtesy of Division of Safety and Hygiene

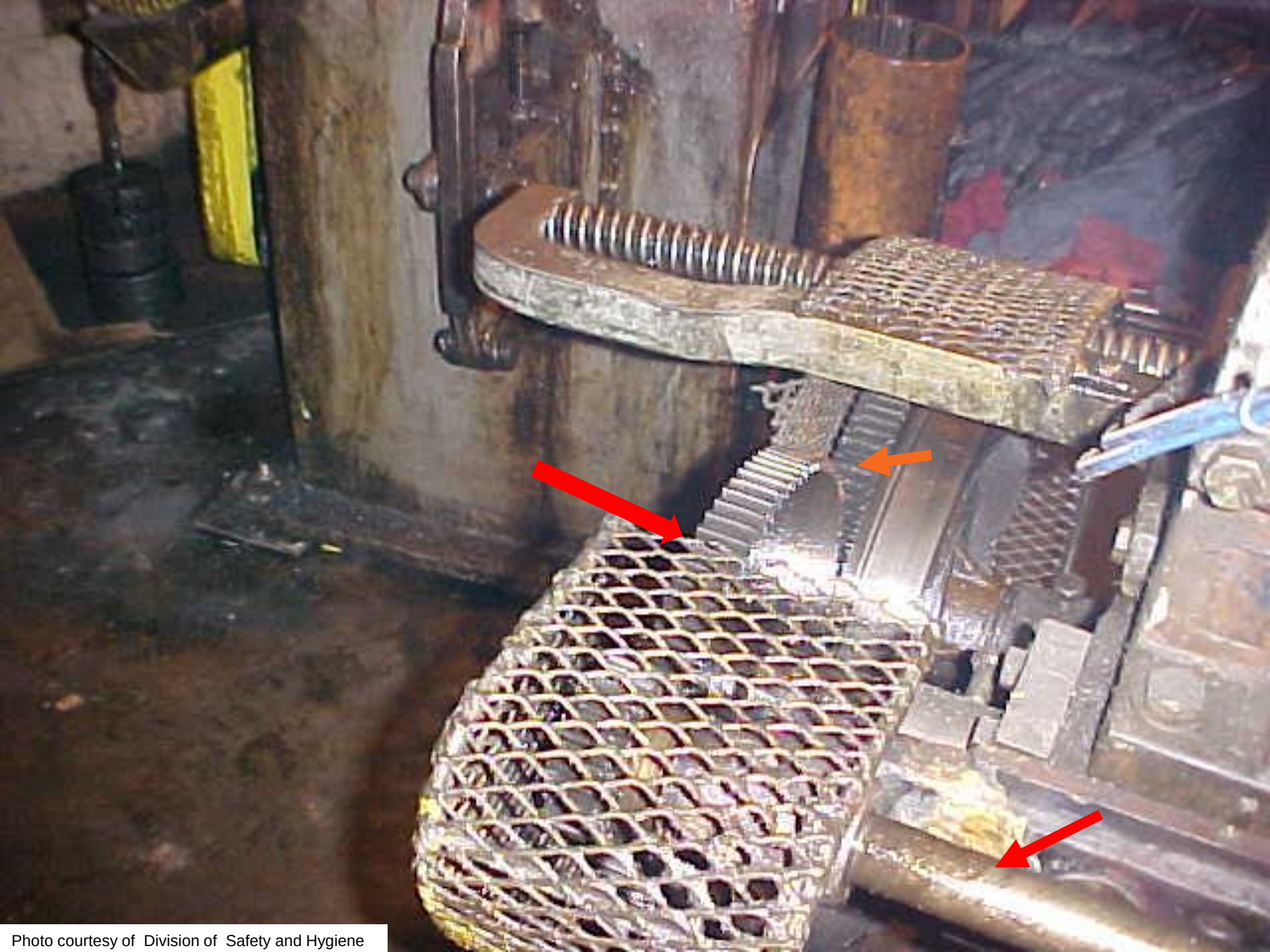


Photo courtesy of Division of Safety and Hygiene

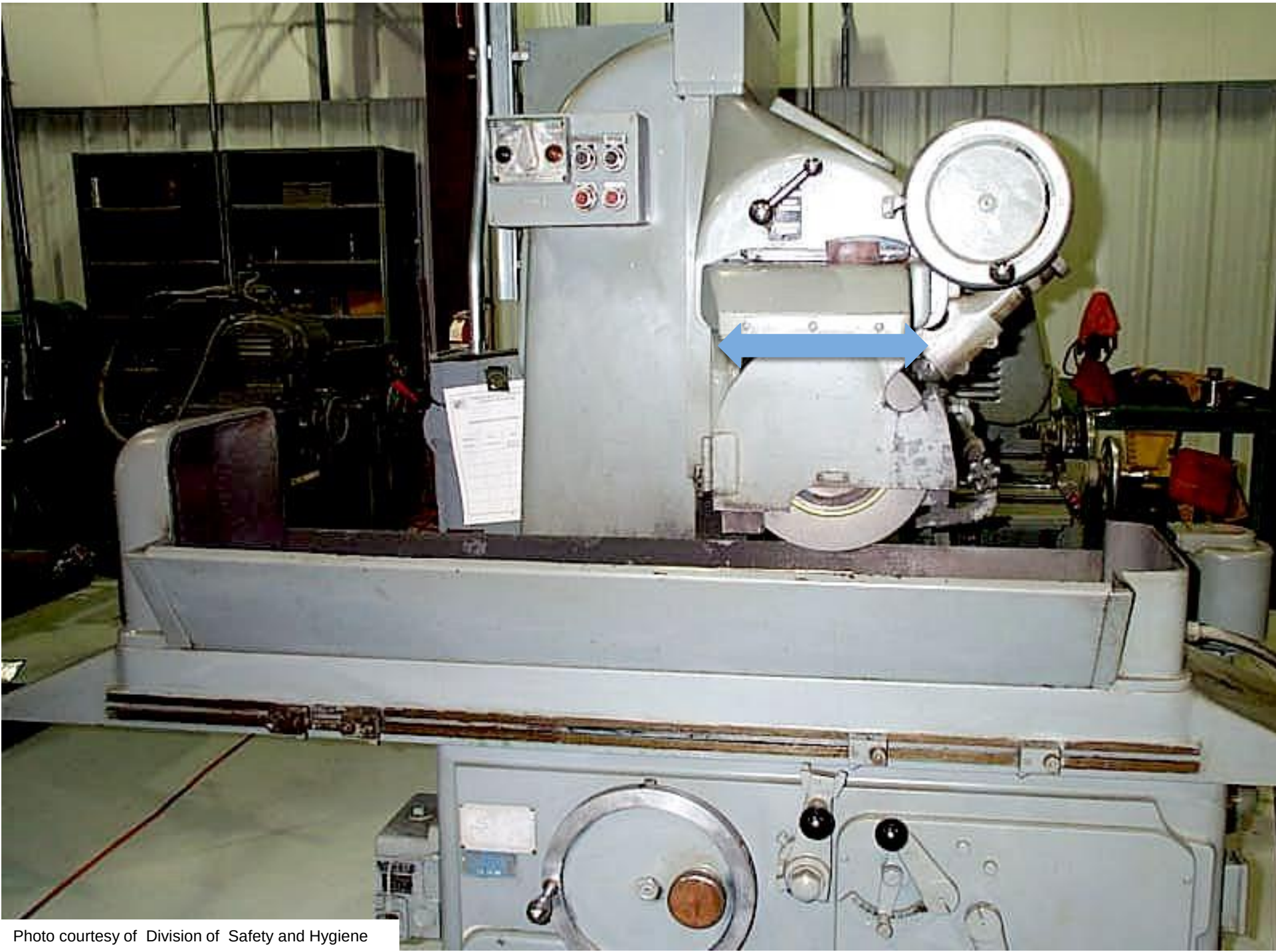
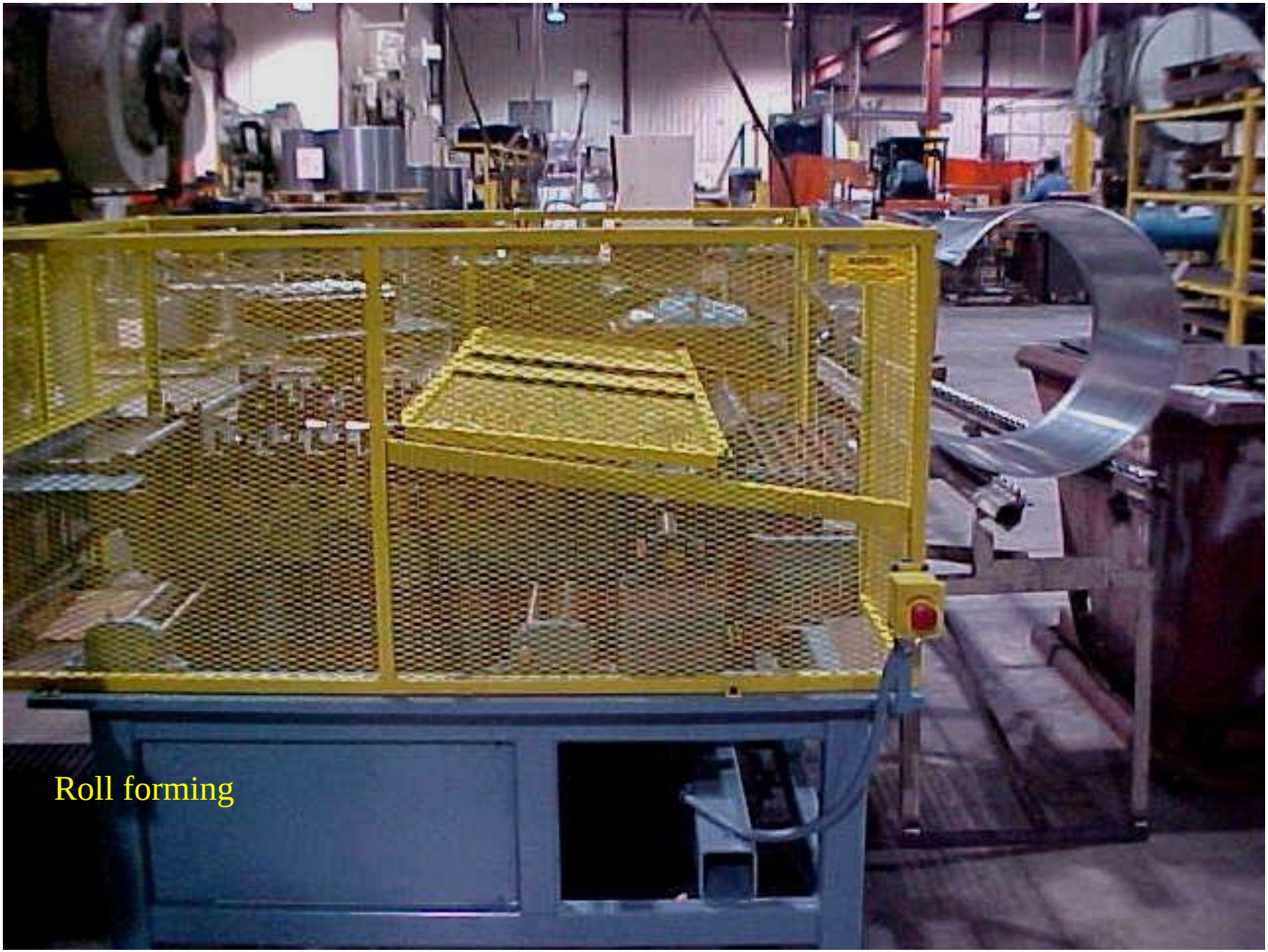
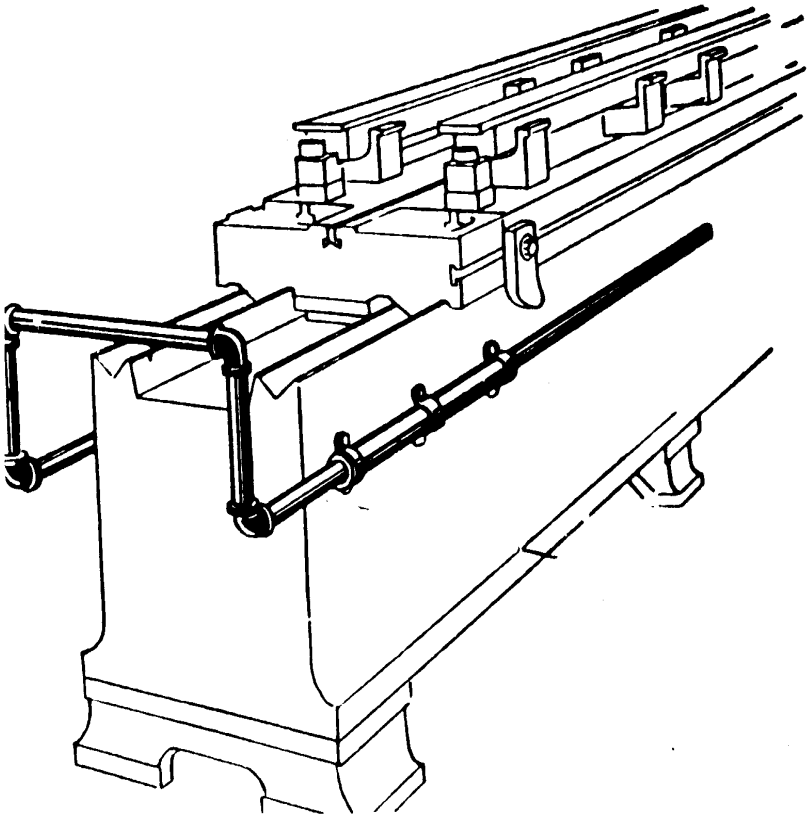


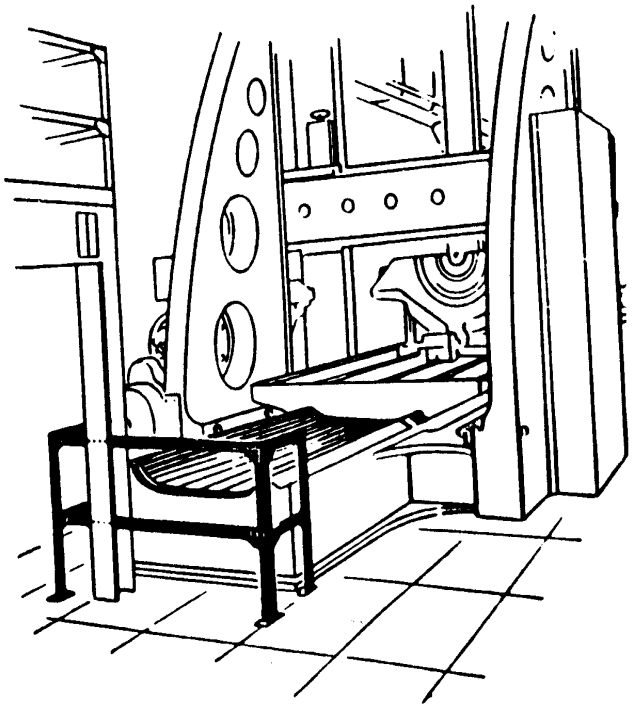
Photo courtesy of Division of Safety and Hygiene


KAM 8

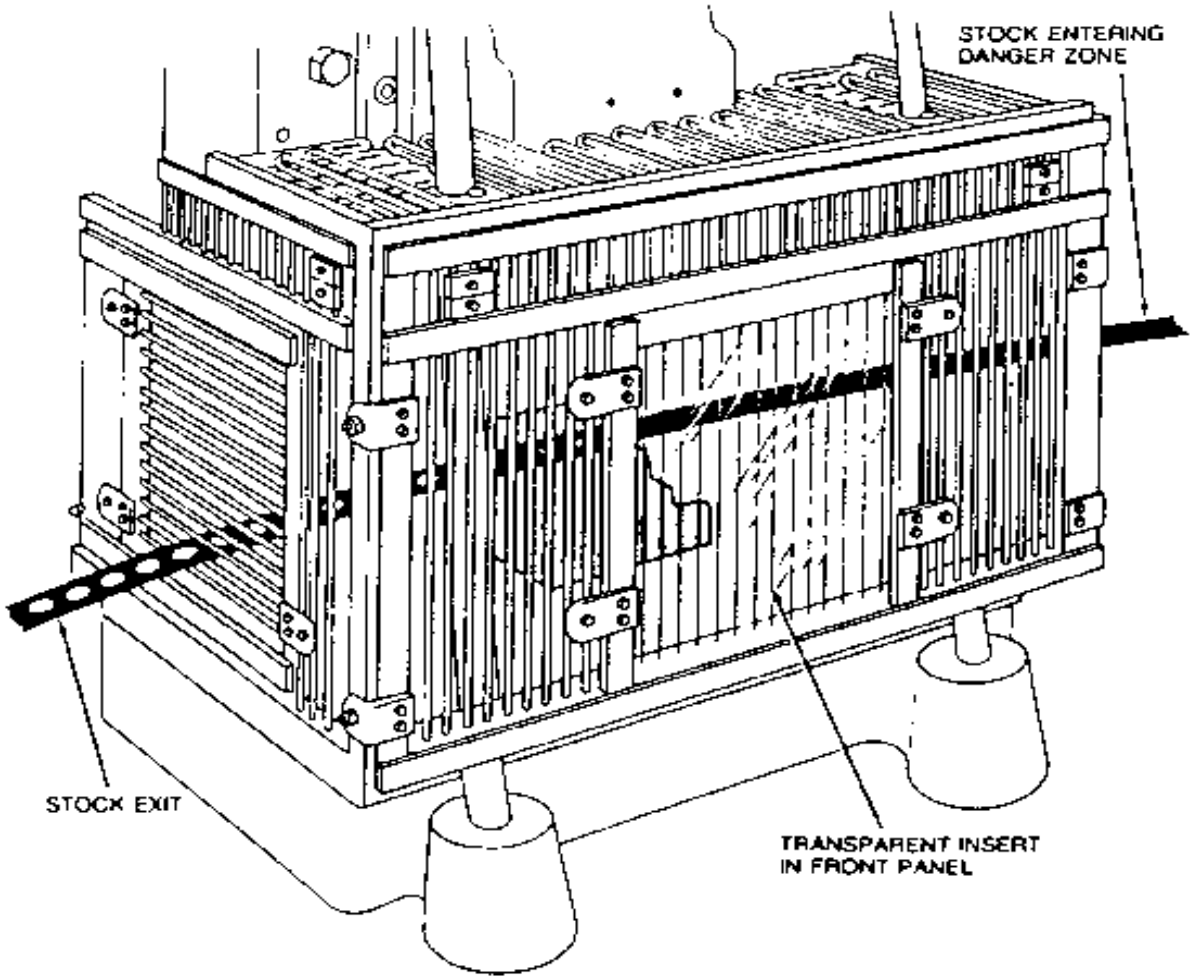

Roll straightener


Roll forming



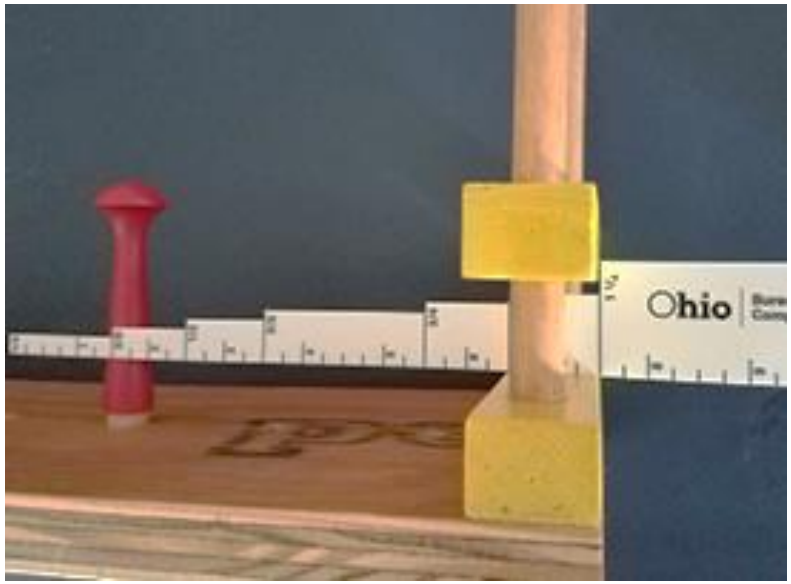


Guarding Table Pinch Points

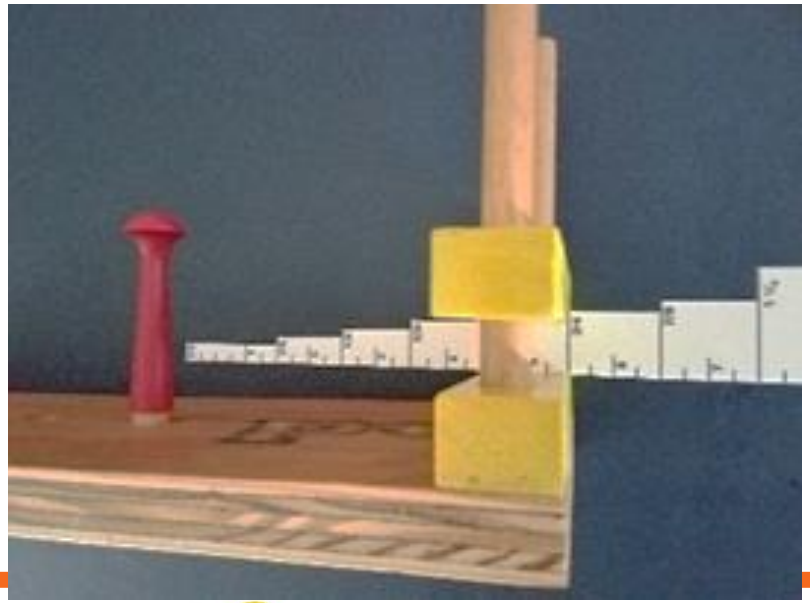


Fixed Guard On A Power Press

Fixed guards - shear



Guard opening is too wide, or the hazard is too close based on the opening size.



Guard opening is small enough to prevent access to hazard.


NOTICE

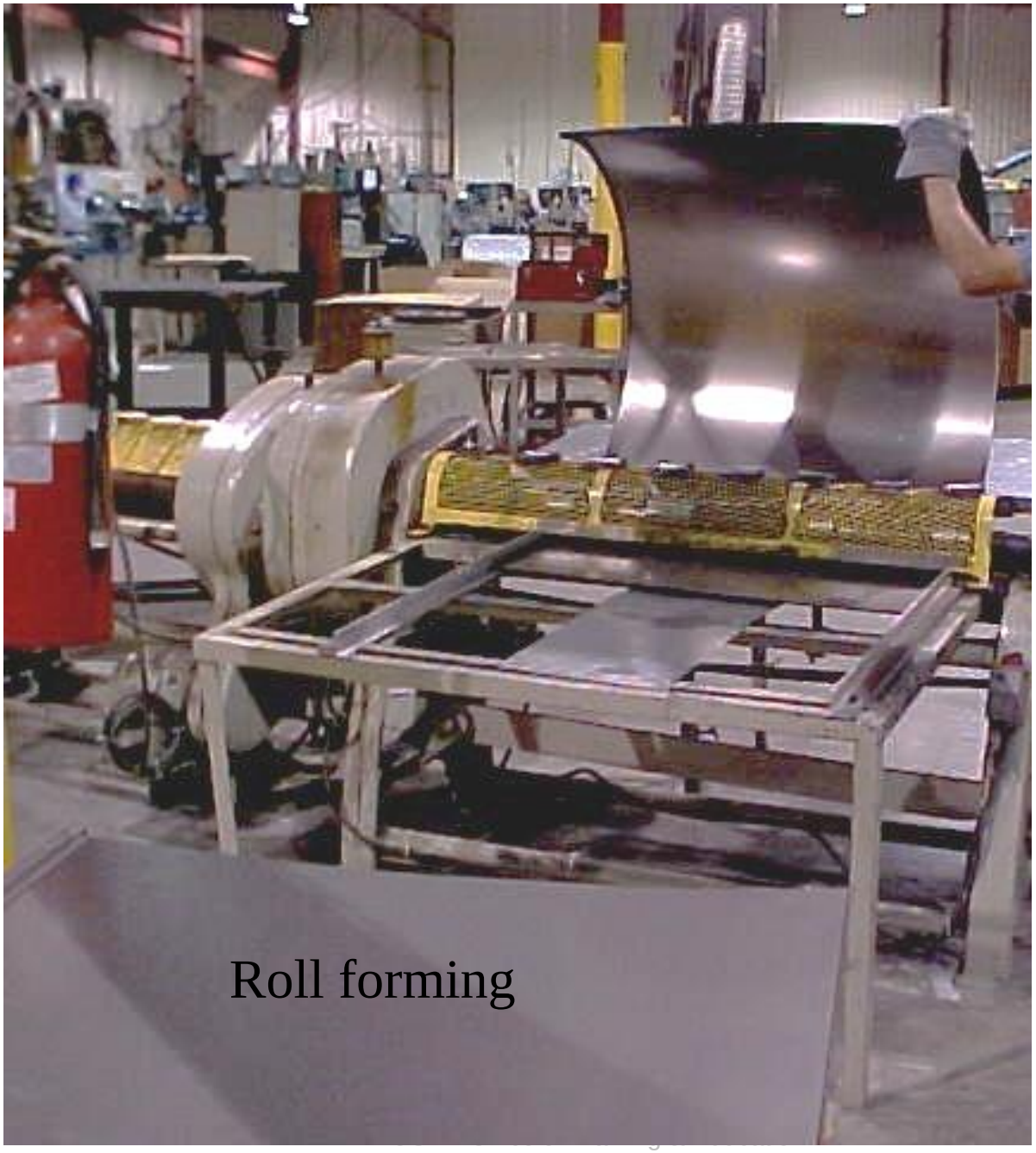


Photo courtesy of Division of Safety and Hygiene

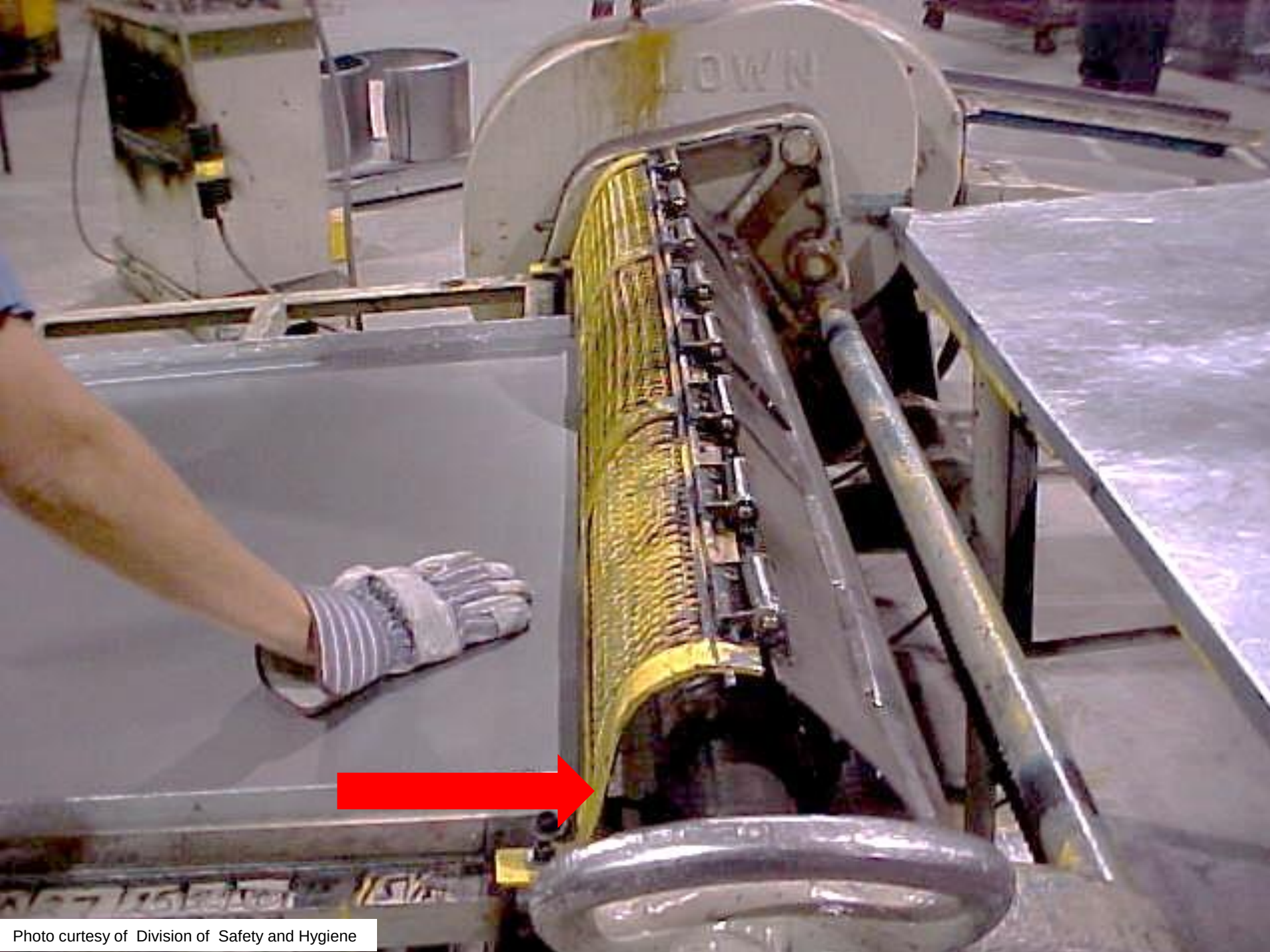
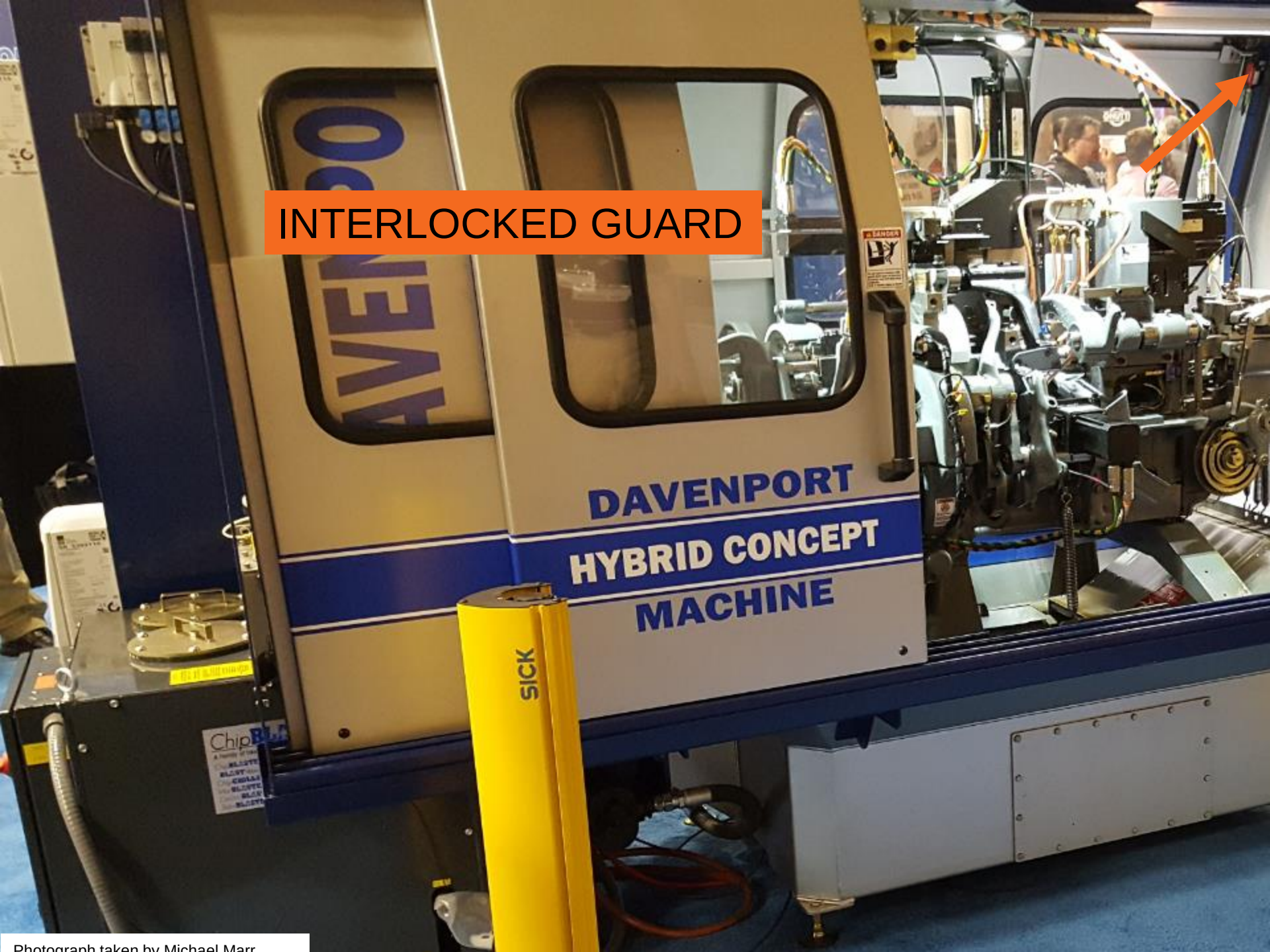


Photo curtesy of Division of Safety and Hygiene


Perimeter guard
NOTICE

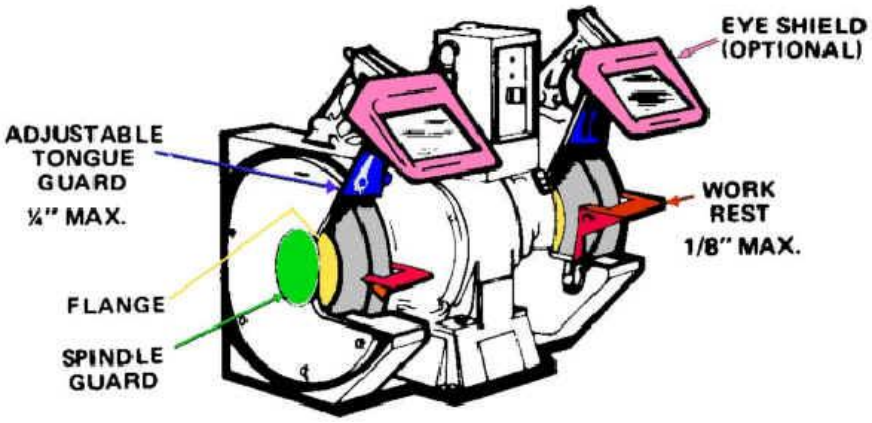
Photo courtesy of Division of Safety and Hygiene



Photograph taken by Michael Marr


17"
10/21/2014

Adjustable

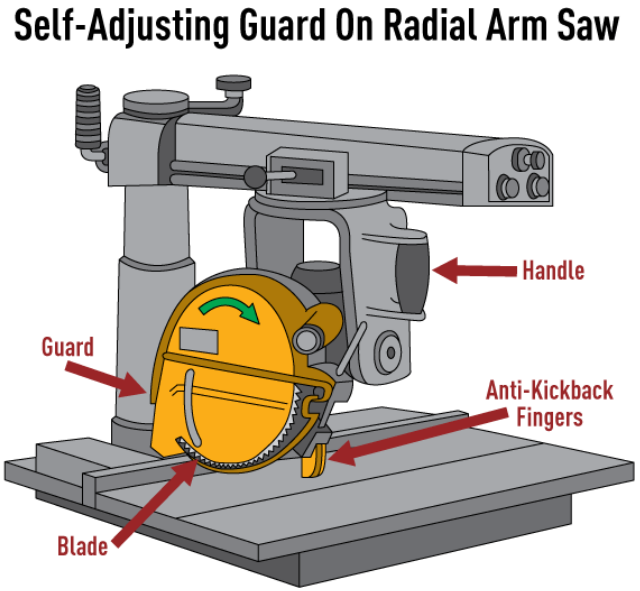


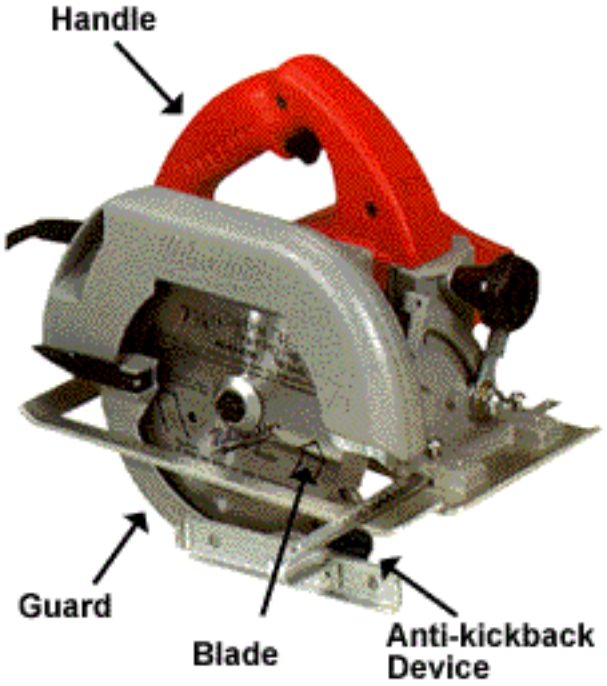
Horizontal Band Saw

Vertical Band Saw

iStock

Self adjusting guard

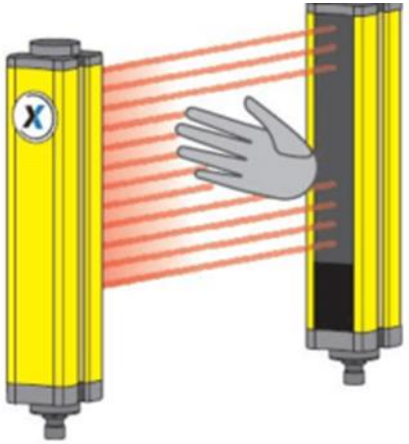




Self Adjusting Guard on Radial Arm Saw

Devices

- **Presence Sensing**
- Pullback
- Restraint
- **Two hand control**



Safeguarding

Remember;

- Guards--- Prevents access to the danger areas.

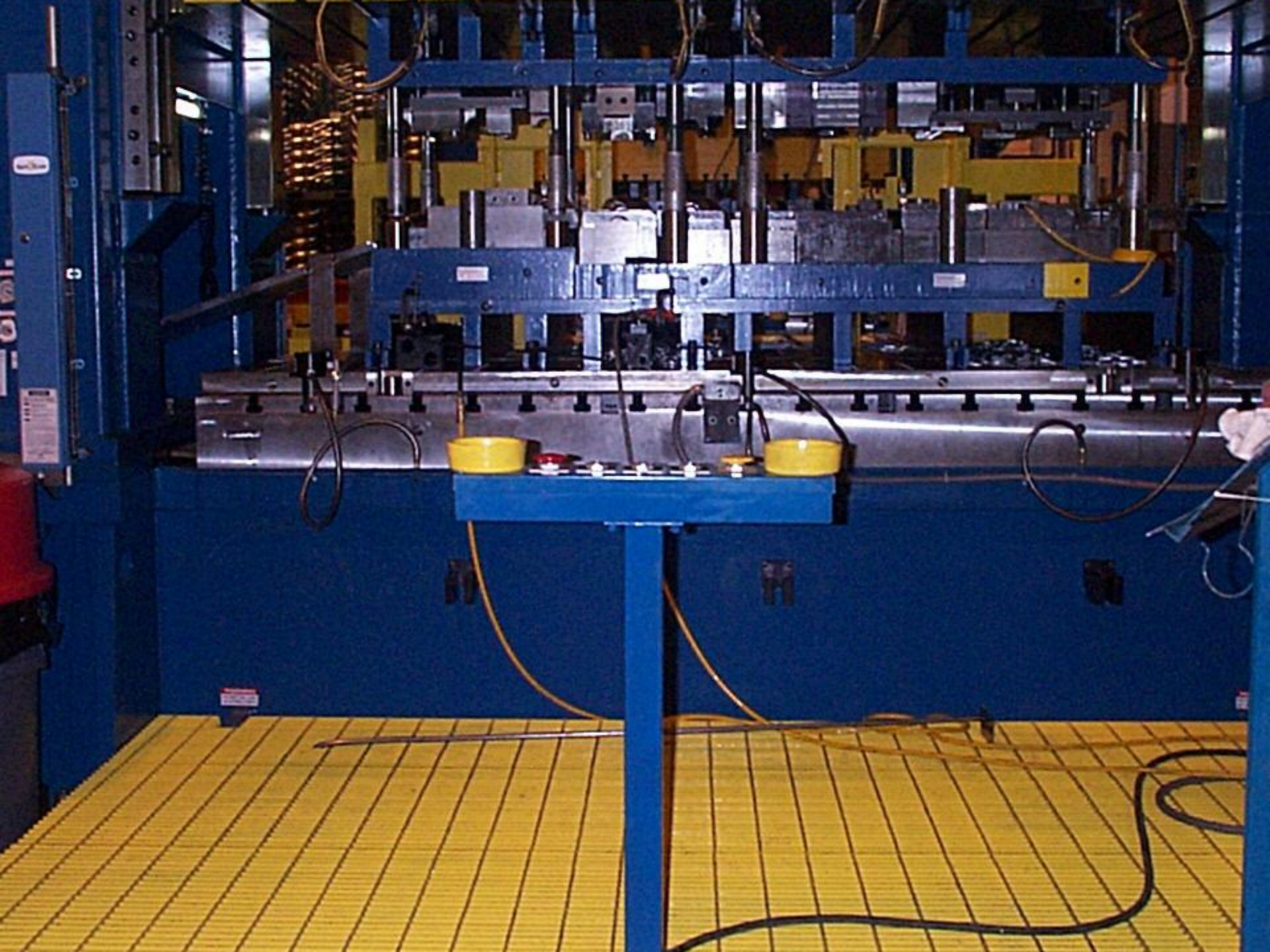
- Devices---Controls access to the Point of Operation.

Spot welder

Electromechanical Sensing Device

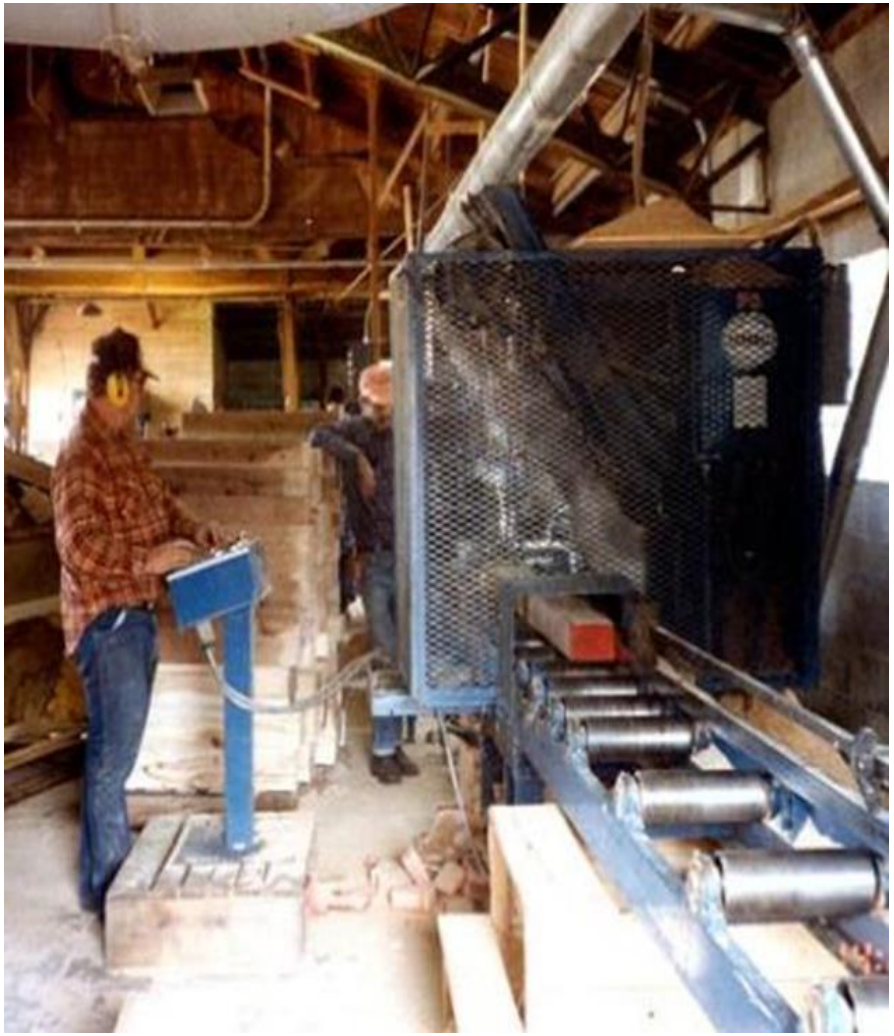
Photoelectric Presence Sensing Device
Horizontal & Vertical

Light Curtain on Ball Sizer



Robots

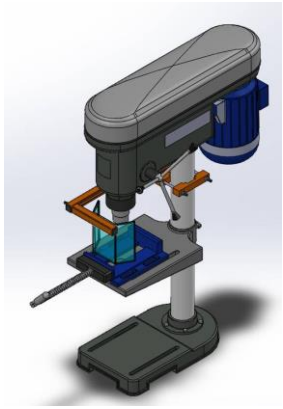
6 inches from floor, 72 inches in height and 18 clearance between end effectors (end of a robotic arm, designed to interact with the)environment) and fence or guard.



- Position dangerous parts of machine in inaccessible areas during normal operation
- Moving parts more than 7 feet above floor
- Control station at safe distance from machine
- Locating a machine so that the hazardous parts of the machine are located away from operator workstations or other areas where employees walk or work.
- Position a machine with its power transmission apparatus against a wall and leave all routine operations on the other side of the machine.

Guarding by location

Guards and Shields



Guards

- Blocks access to recognized hazard
- Prevents reaching over, under, through, or around
- Blocks point of operation

Shields

- Blocks or defends recognized hazard
- Prevents inadvertent contact
- Controls chips, fluids, broken bits and blades

Electrically Interlocked Shield for Small to Medium Size Drill Presses

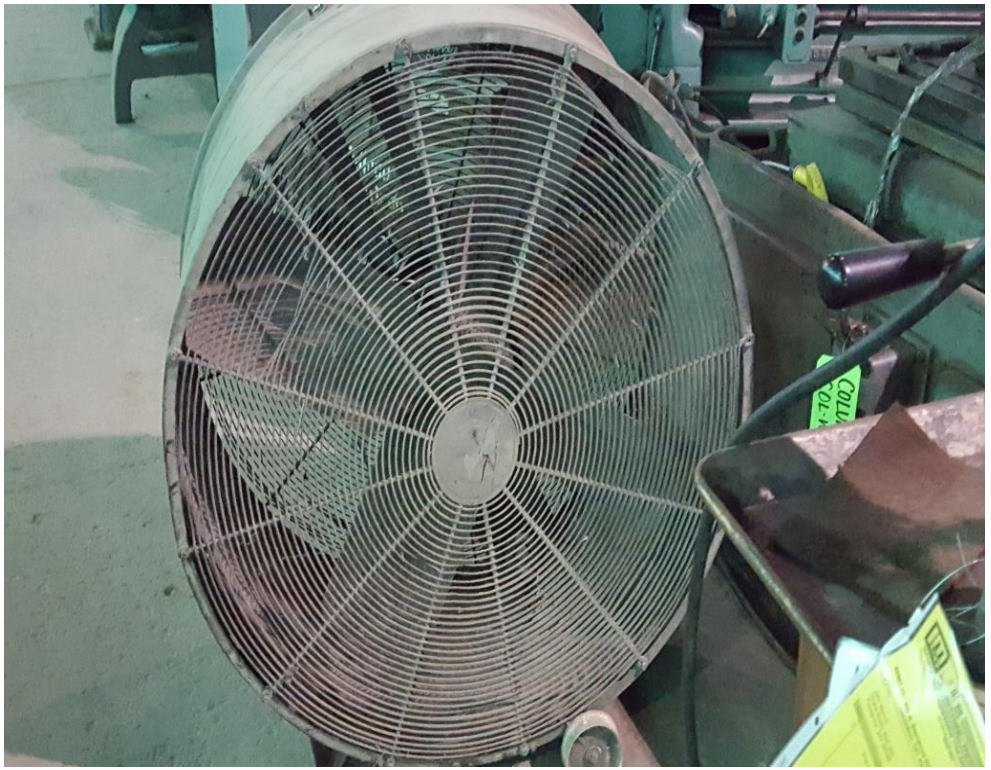
Electrically Interlocked Shield for Larger Drill Presses and Radial Drill Presses

Interlock shields

Rockford Systems

Guarding Fan Blades

- When the periphery of the blades of a fan is less than 7 feet above the floor or working level, the blades must be guarded with a guard having openings no larger than 1/2 inch.



Holding Tools

High-Risk Machinery

- Mechanical power presses
- Power press brakes
- Powered and non-powered conveyors
- Printing presses
- Roll-forming and roll-bending machines
- Shearing machines
- Food slicers
- Meat grinders
- Meat-cutting band saws
- Drill presses
- Milling machines
- Shears, grinders, and slitters
- Table and portable saws

Causes of Machine Incidents

- Reaching in to “clear” equipment
- Not using Lockout/Tagout
- Unauthorized person doing maintenance or using the machines
- Missing or loose machine guards
- Lack of training

Prevention

- Safeguarding any machine part, function, or process which may cause injury
- Controlling or eliminating all hazards where the operation of a machine can injure the operator or other workers
- Training workers on the hazards of machines and how to safely operate and repair machinery

Summary

- Observe the operation
- Identify hazardous motions/ actions
- Evaluate the most appropriate safeguard
- Ensure meet requirements
- Evaluate effectiveness