

# *Machine Guarding*







# Introduction

Crushed hands and arms, severed fingers, blindness - the list of possible machinery-related injuries is as long as it is horrifying. Safeguards are essential for protecting workers from needless and preventable injuries.






A good rule to remember is: Any machine part, function, or process which may cause injury must be safeguarded.

Where the operation of a machine can injure the operator or other workers, the hazard must be controlled or eliminated.

# Causes of Machine Accidents

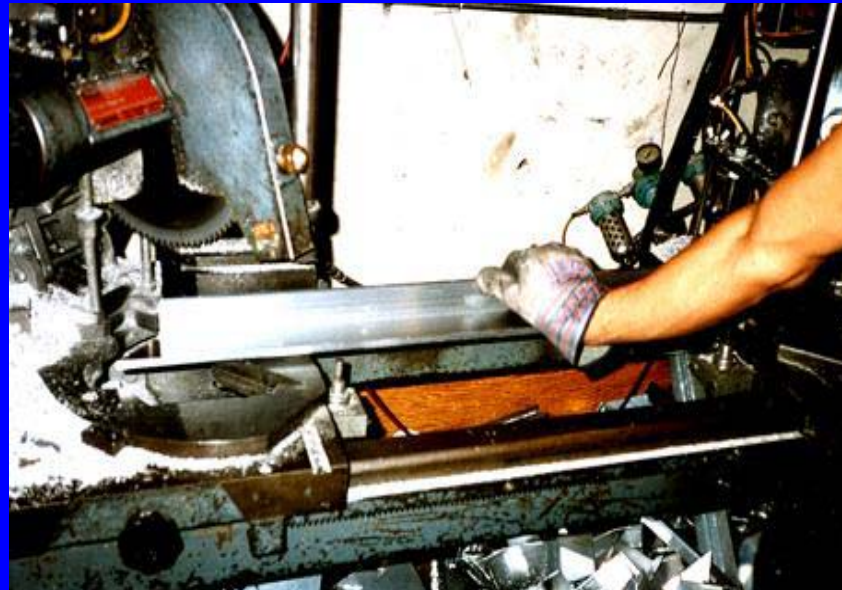
-  Reaching in to “clear” equipment
-  Not using Lockout/Tagout
-  Unauthorized persons doing maintenance or using the machines
-  Missing or loose machine guards

# Where Mechanical Hazards Occur

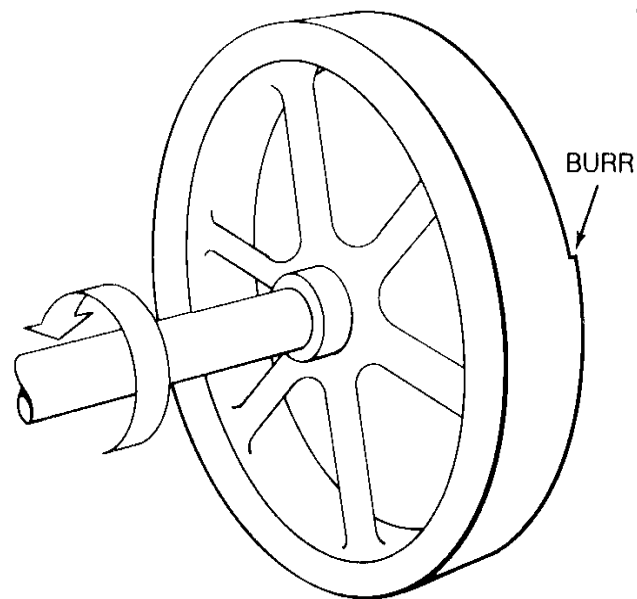
-  Point of operation
-  All parts of the machine which move, such as:
  -  flywheels, pulleys, belts, couplings, chains, cranks, gears, etc.
  -  feed mechanisms and auxiliary parts of the machine
-  In-running nip points

# Point of Operation

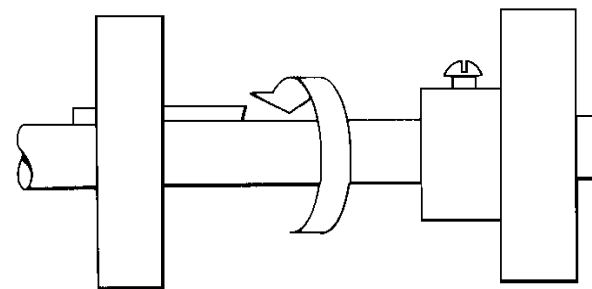
That point where work is performed on the material, such as cutting, shaping, boring, or forming of stock must be guarded.



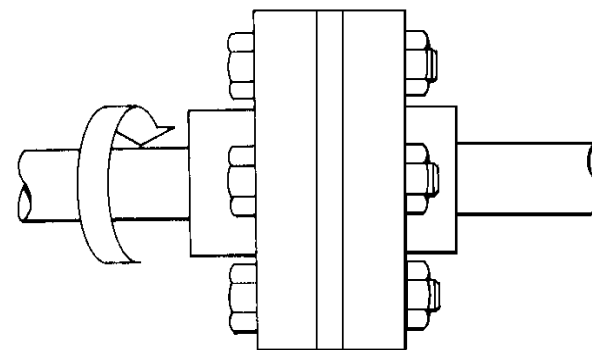
# Rotating Parts



ROTATING PULLEY WITH SPOKES AND PROJECTING BURR ON FACE OF PULLEY



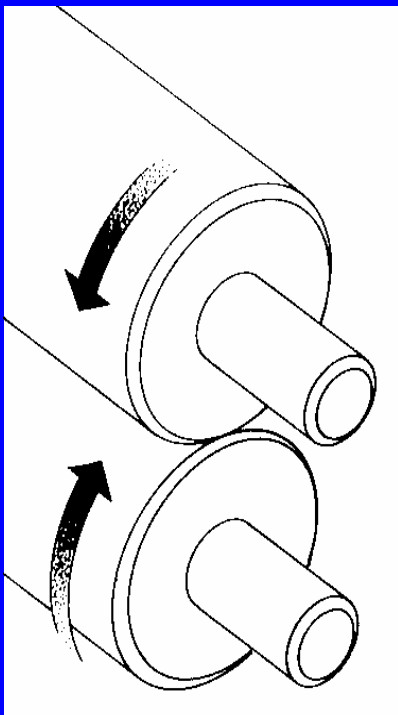
ROTATING SHAFT AND PULLEYS WITH PROJECTING KEY AND SET SCREW



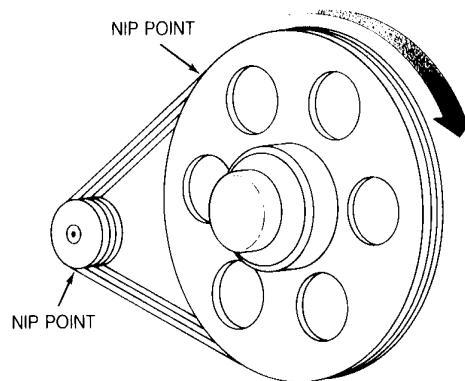
ROTATING COUPLING WITH PROJECTING BOLT HEADS

# In-Running Nip Points

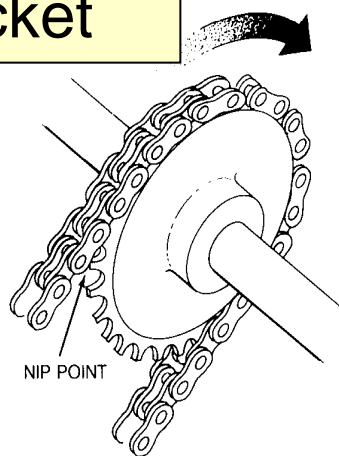
Rotating cylinders



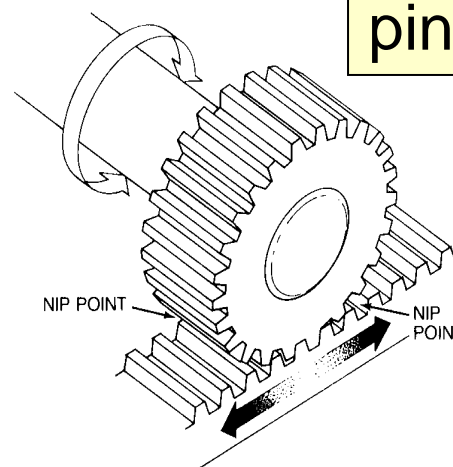
Belt and pulley









Chain and sprocket



Rack and pinion







# Requirements for Safeguards

-  Prevent contact - prevent worker's body or clothing from contacting hazardous moving parts
-  Secure - firmly secured to machine and not easily removed
-  Protect from falling objects - ensure that no objects can fall into moving parts
-  Create no new hazards - must not have shear points, jagged edges or unfinished surfaces
-  Create no interference - must not prevent worker from performing the job quickly and comfortably
-  Allow safe lubrication - if possible, be able to lubricate the machine without removing the safeguards








# Methods of Machine Safeguarding

## Guards



-  fixed
-  interlocked
-  adjustable
-  self-adjusting

## Devices




-  presence sensing
-  pullback
-  restraint
-  safety controls (tripwire cable, two-hand control, etc.)
-  gates

## Location/distance

## Feeding and ejection methods

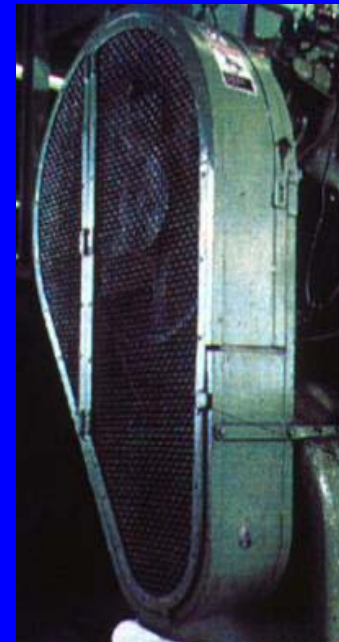
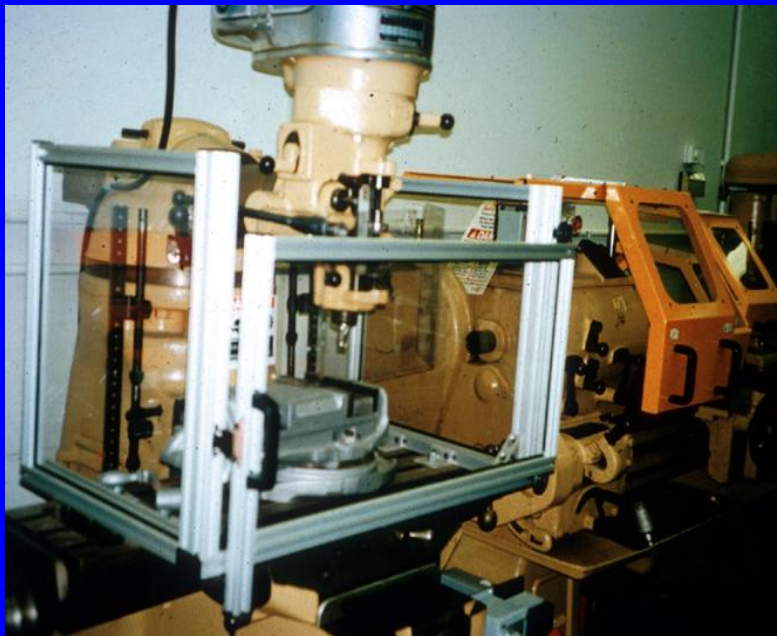
-  automatic and/or semi-automatic feed and ejection
-  robots

## Miscellaneous aids

-  awareness barriers
-  protective shields
-  hand-feeding tools

# Fixed Guard

Provides a barrier - a permanent part of the machine, preferable to all other types of guards.



# Interlocked Guard

When this type of guard is opened or removed, the tripping mechanism and/or power automatically shuts off or disengages, and the machine cannot cycle or be started until the guard is back in place.



Interlocked  
guard on  
revolving drum

# Adjustable Guard

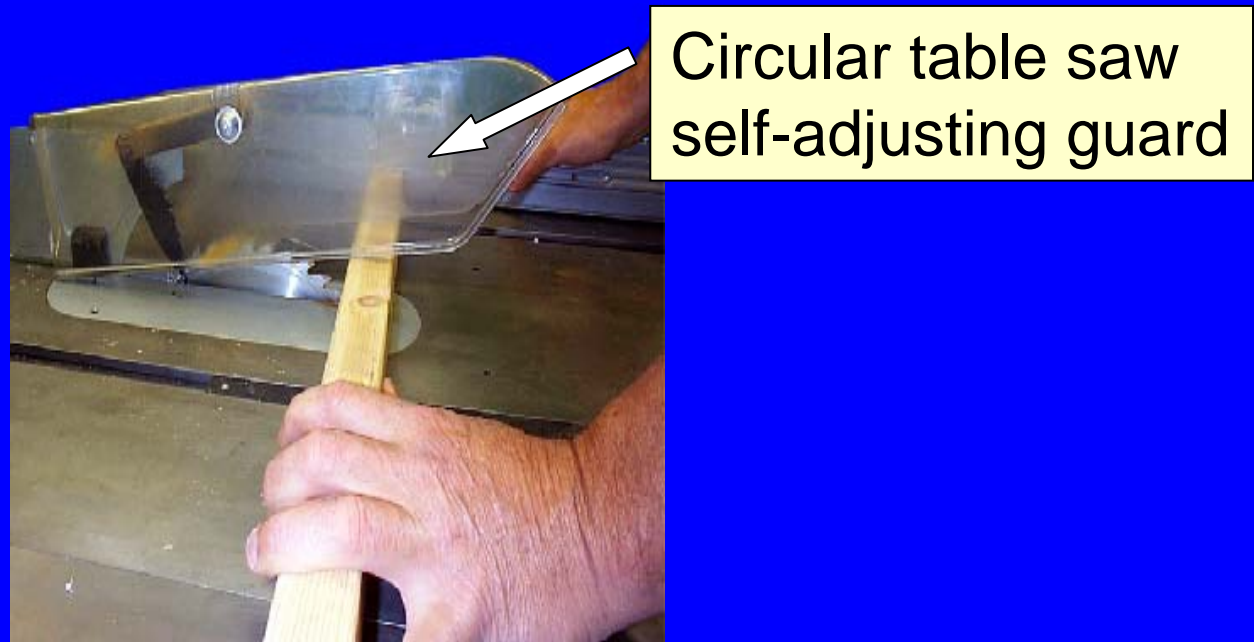
Provides a barrier which may be adjusted to facilitate a variety of production operations.



Bandsaw blade  
adjustable guard

# Self-Adjusting Guard

Provides a barrier which moves according to the size of the stock entering the danger area.



# Pullback Device

- ✎ Utilizes a series of cables attached to the operator's hands, wrists, and/or arms
- ✎ Primarily used on machines with stroking action
- ✎ Allows access to the point of operation when the slide/ram is up
- ✎ Withdraws hands when the slide/ram begins to descend



# Pullback Device (cont'd)



- ✎ Hands in die, feeding
- ✎ Point of operation exposed
- ✎ Pullback device attached and properly adjusted



- ✎ Die closed
- ✎ Hands withdrawn from point of operation by pullback device

# Restraint Device

- ✎ Uses cables or straps attached to the operator's hands and a fixed point
- ✎ Must be adjusted to let the operator's hands travel within a predetermined safe area
- ✎ Hand-feeding tools are often necessary if the operation involves placing material into the danger area





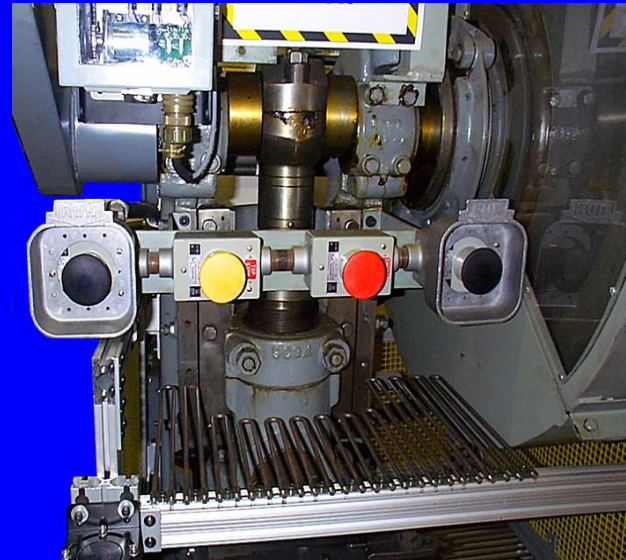
# Safety Tripwire Cables

- ✎ Device located around the perimeter of or near the danger area
- ✎ Operator must be able to reach the cable to stop the machine



# Two-Hand Control

- ✎ Requires constant, concurrent pressure to activate the machine
- ✎ The operator's hands are required to be at a safe location (on control buttons) and at a safe distance from the danger area while the machine completes its closing cycle



# Gate

- ✎ Movable barrier device which protects the operator at the point of operation before the machine cycle can be started
- ✎ If the gate does not fully close, machine will not function



Gate Open



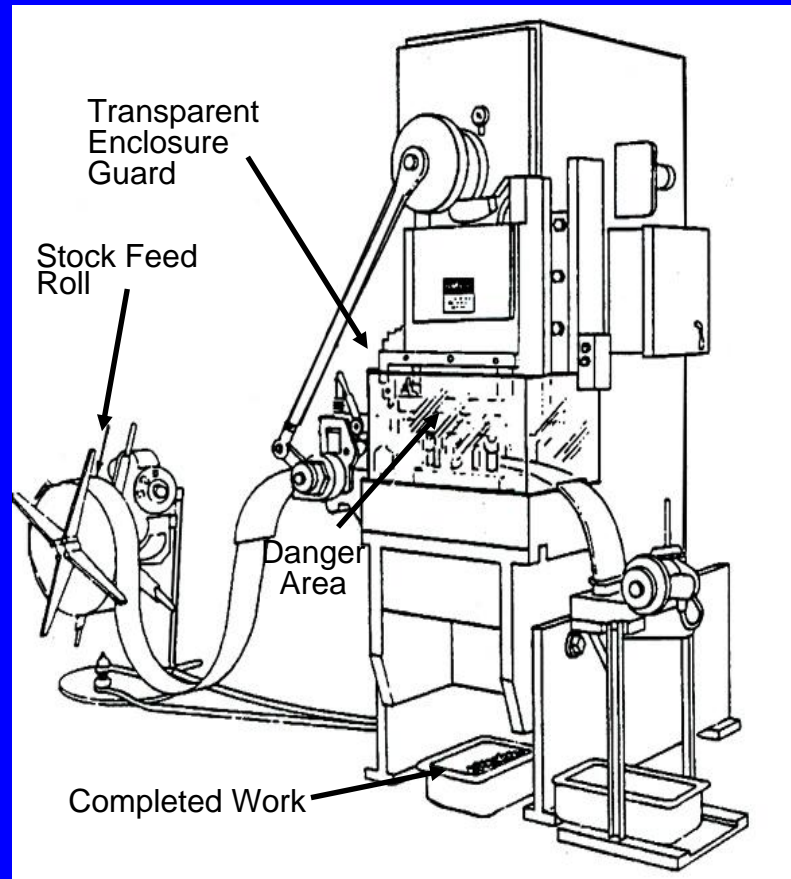
Gate Closed

# Safeguarding by Location/Distance

- ✎ Locate the machine or its dangerous moving parts so that they are not accessible or do not present a hazard to a worker during normal operation
- ✎ Maintain a safe distance from the danger area

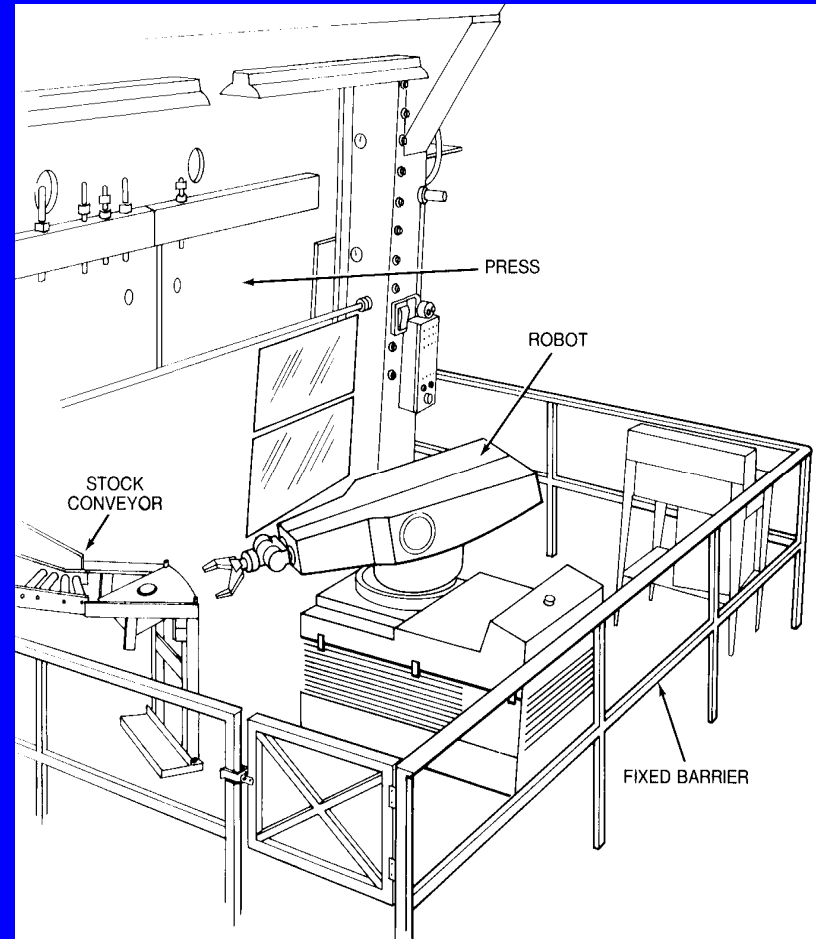


# Automatic Feed (shown on power press)



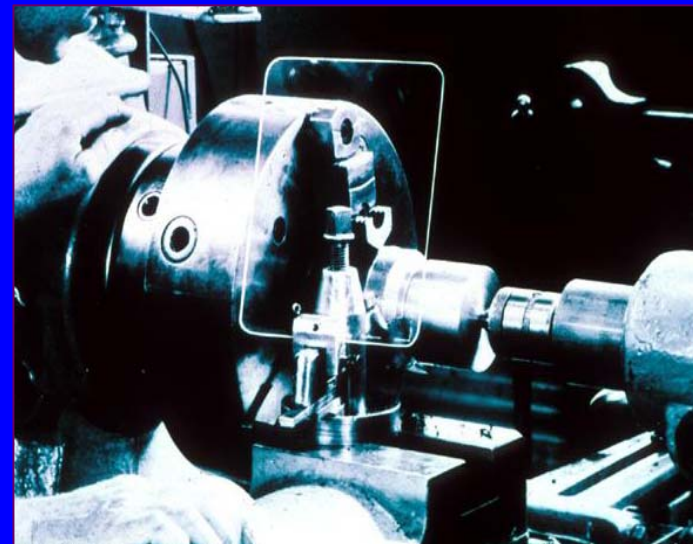
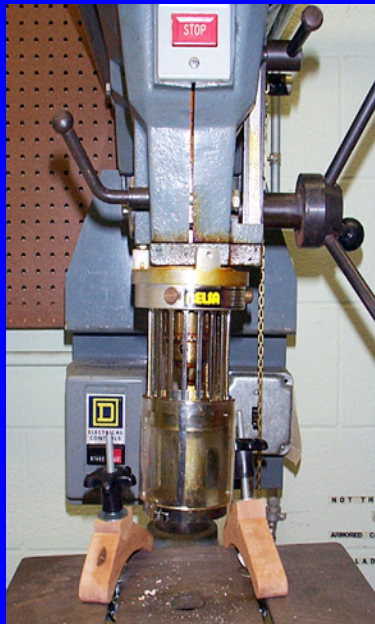
# Robots

- ✎ Machines that load and unload stock, assemble parts, transfer objects, or perform other tasks
- ✎ Best used in high-production processes requiring repeated routines where they prevent other hazards to employees



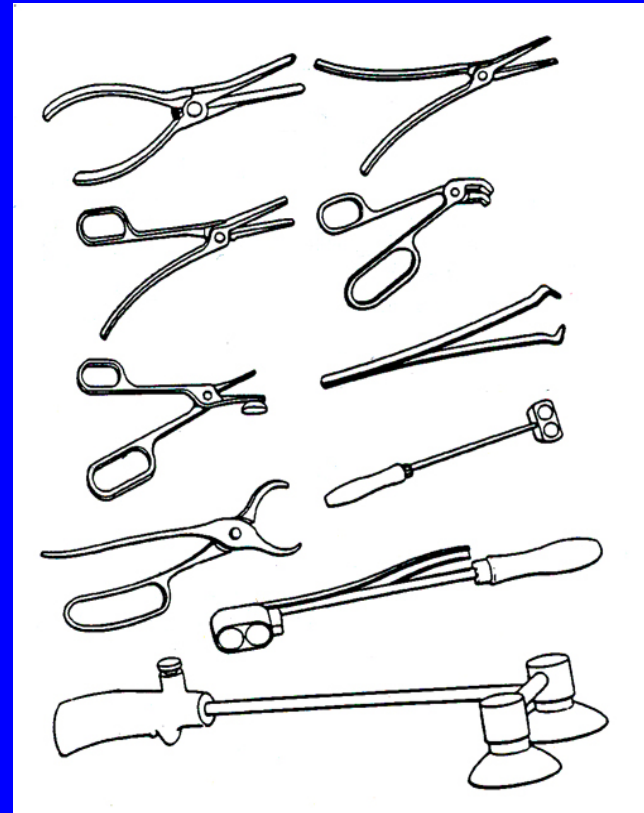
# Protective Shields

These do not give complete protection from machine hazards, but do provide some protection from flying particles, splashing cutting oils, or coolants.



# Holding Tools

- ✎ Used to place and remove stock in the danger area
- ✎ Not to be used instead of other machine safeguards, but as a supplement





# ***Some Examples of OSHA Machine Guarding Requirements . . . .***

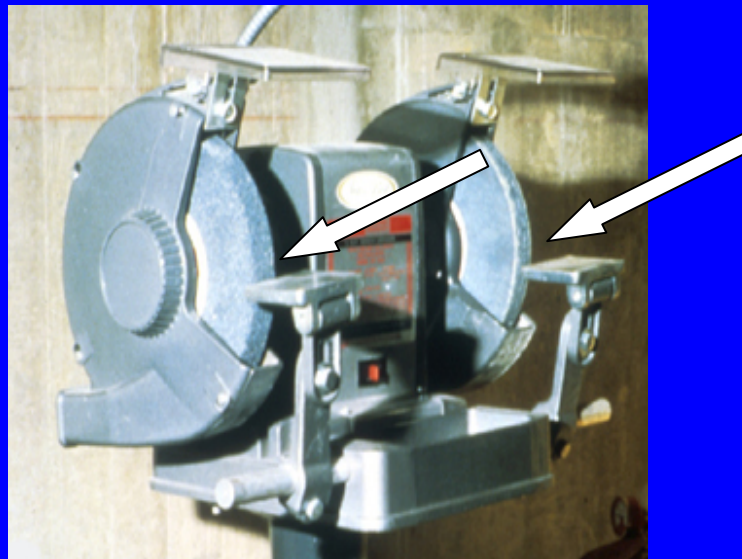
# Guarding Fan Blades

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.



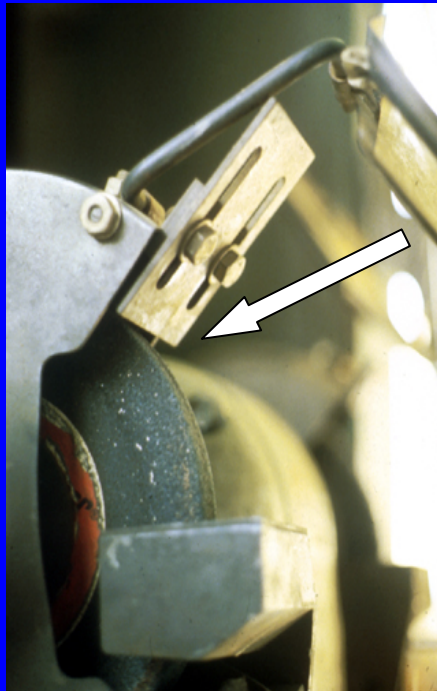
# Abrasive Wheel Machinery

Work rests on offhand grinding machines must be kept adjusted closely to the wheel with a maximum opening of 1/8-inch to prevent the work from being jammed between the wheel and the rest, which may result in wheel breakage.



# Abrasive Wheel Machinery

The distance between the wheel periphery and the adjustable tongue must never exceed 1/4-inch.



# Power-Transmission Apparatus

Power-transmission apparatus (shafting, flywheels, pulleys, belts, chain drives, etc.) less than 7 feet from the floor or working platform must be guarded.

Unguarded belt and pulley






# Machine Safety Responsibilities




## Management

-  ensure all machinery is properly guarded

## Supervisors

-  train employees on specific guard rules in their areas
-  ensure machine guards remain in place and are functional
-  immediately correct machine guard deficiencies

## Employees

-  do not remove guards unless machine is locked and tagged
-  report machine guard problems to supervisors immediately
-  do not operate equipment unless guards are in place

# Training

Operators should receive training on the following:

- ✎ Hazards associated with particular machines
- ✎ How the safeguards provide protection and the hazards for which they are intended
- ✎ How and why to use the safeguards
- ✎ How and when safeguards can be removed and by whom
- ✎ What to do if a safeguard is damaged, missing, or unable to provide adequate protection

# Summary

- ✎ Safeguards are essential for protecting workers from needless and preventable machinery-related injuries
- ✎ The point of operation, as well as all parts of the machine that move while the machine is working, must be safeguarded
- ✎ A good rule to remember is: *Any machine part, function, or process which may cause injury must be safeguarded*