



Machine and Wood Shop Safety Program



Harvey Mudd College
Melonee Cruse
HMC Safety Coordinator



Agenda

- Responsibilities
- Types of Hazards
- Controls and Safeguarding Requirements
- Machinery/Wood Shops Guidelines
- Safe Work Practices
- General Lab Safety

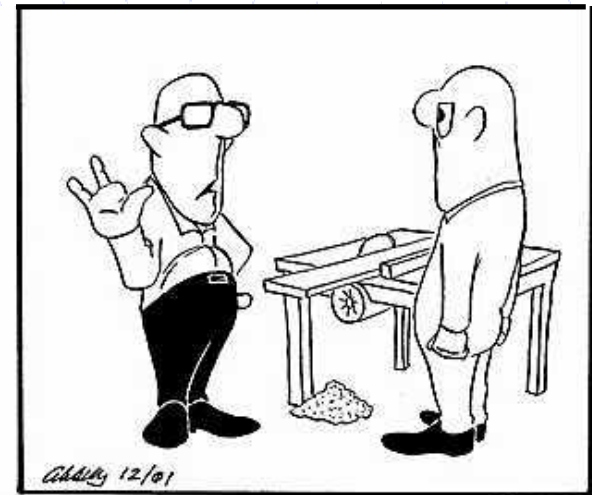
Purpose for Safety Training

- To assure Student (Machine/Wood) Shop users are provided information on how to protect themselves from shop and machine hazards
- To comply with the HMC guidelines and applicable Cal OSHA regulations

Case Study #1

A HMC employee is using a table saw to cut a small block of wood. With the guard removed, the worker used his hands to push the block of wood into the saw. The employees fingers are drawn towards the blade and the tips of his fingers are severely cut. The worker bandaged his fingers and sought help. The nearest person to assist was four floors above the shop.

How could this been avoided?



"Don't tell me how to work safely!
I've been at this job for over five
years!"

Responsibilities

- The HMC Safety Coordinator will
 - Monitor the overall effectiveness of the program
 - Coordinate Safety Training
 - Conduct an annual inspection of all shop areas
 - Provide or acquire technical assistance when needed
 - Maintain training records

Responsibilities (con't)

The HMC Machine Shop Manager will:

- Keep up with the manufacturer's maintenance schedule;
- Ensure that required safety features are installed and operating properly for all machines;
- Ensure that required PPE is used and operating procedures followed by Shop Users.;
- Take immediate action to correct any violation of safety rules observed or reported

Shop User Responsibilities

Access to Shops:

– All Faculty and Staff

- Complete the Machine/Wood Shop Safety Training class
- Always work with a buddy (can be a proctor or Paul Stovall)

– All Students MUST:

- Complete the Machine/Wood Shop Safety Training class
- Complete a Shop Tour with Shop Proctor
- Work in Shop **ONLY** when Shop Proctors are present
- Engineering Students MUST successfully pass E8 or E4/E8

All HMC students working in Machine/Wood shops must be supervised by appropriately trained staff (Proctors, Instructor or Paul) that have knowledge in both proper use of machinery and associated safety considerations.

Shop User Responsibilities, cont'd

- All Shop Users (employee, student, or other users) must:
 - Operate machinery or equipment only after attending safety training.
 - Follow SOPs for the machinery including use of safety features
 - Use prescribed PPE
 - Understand the tasks, hazards involved and proper protective measures
 - Report all injuries to the Machine Shop Manager, supervisor or department

Case Study #2

A HMC student is injured while polishing a tool attached to a drill press. The student watched others in the shop polish their tools using a strip of emery paper. Without obtaining assistance from the shop proctor, the student attached their tool to the press and attempted to polish it. During the first attempt the strip of emery paper wrapped around the tool nearly drawing his fingers into the drill. On the second polishing attempt, the student's hand drew closer to the tool as the strip of emery paper shortened. Again, the paper wrapped around the tool drawing his fingers towards the rotating tool. The student was able to quickly pull their left hand away from the drill. Unfortunately their right hand was pulled into drill. The student sustained an injury to his right index finger. The nail bed of his right index finger was removed.



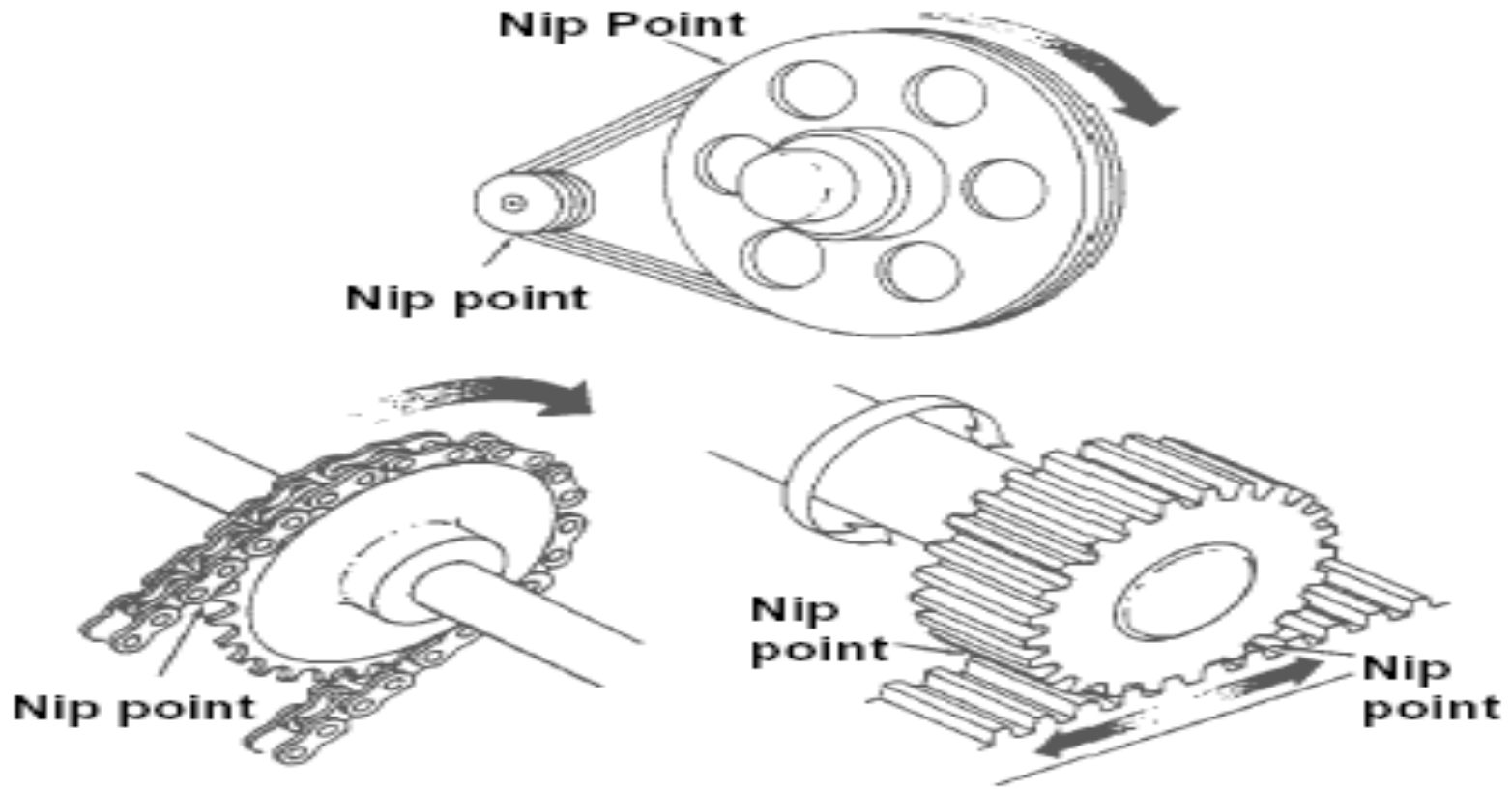
Machine Tool Hazards

- Moving parts
 - Any type of powered moving part that can cause injury
 - Belts, Pulleys
 - Links or driving rods
 - Chains, Cranks
 - Flywheels

Machine Tool Hazards (cont'd)

- Point of operation
 - The location where the material or a workpiece is positioned and work is performed
- Pinch point
 - An area, excluding the point-of-operation, that poses a hazard of exposure to moving parts of the bender, its related machines or equipment or the material or workpieces

Nip Points



Machine Tool Hazards (cont'd)

- Other hazards:
 - Swarf
 - Cuttings, especially the long, spiral-type cuttings with very sharp edges
 - Oil spray or splatter
 - Other pieces of metal
 - Broken pieces of metal or tool
 - Hot surfaces
 - Slippery surfaces (e.g., poor housekeeping)

Machine Tool Hazards (cont'd)

- Other hazards (cont'd)
 - Electrical
 - Internal shorting through the machine housing
 - Light bulb gets broken
 - Defective cords

Risks/Hazards to Users

- Exposure to machine hazards generally results in severe injuries:
 - Cuts or amputations from cutting blades
 - Entanglements from being trapped in rotating parts
 - Crushed members due to moving machine parts coming together
 - Amputations from fingers being pulled off
 - Scalping from hair entanglements in rotating parts

Hierarchy of controls at HMC

- **ENGINEERING CONTROLS**
 - Wherever there is danger of injury from flying particles or substances, adequate shields, screens, chip guards, or enclosures shall be provided.... in a manner that will prevent injury to employees. (source:8 CCR 3303)
 - Dust collection systems remove sawdust and other particles
- **ADMINISTRATIVE CONTROLS**
 - Written policies and guidelines
 - Posted at entrances to the shop
- **PPE**
 - When it is not possible to provide such guards, employees subject to such hazards shall be protected by the use of personal protective equipment.
 - HMC requires safety glasses at all times as a matter of increased protection from flying particles

Safeguards:

Types of Machine Guarding

- Fundamental requirement – a person should not be able to reach over, under around, or through to reach the point of hazard
- Accomplished by:
 - **Hard or Fixed guards** - fixed or interlocked barriers to prevent contact—not dependent on machine movement, but can be manually set to the appropriate position
 - **Adjustable guard** – adjusts automatically to the thickness of the stock
 - **Point of operation guards** - e.g., light curtains, moveable barriers
 - **Shields** - may have to be used where guarding is not feasible

Safeguards: Appropriate Attire and PPE

- **Safety glasses (a MUST)**
 - Must meet requirements of 8 CCR 3382(d)
 - American National Standard, Practice for Occupational and Educational Eye and Face Protection, Z87.1-1989
 - Side shield protection is required whenever the hazard of flying objects.
- **No loose jewelry or clothing (Only use polishing cloths under supervision)**
- **No long unsecured long hair**
- **Closed toed shoes**
- **Gloves (can be a hazard)**

Safeguards: Posting of Warning Signs

- Recommend posting informational hazard warning signs at tools, e.g.:
 - Wear Safety Glasses
 - Do Not Remove Guards
 - Shop Rules

Safe Work Practices: Machines

- Use hand tools to hold parts (e.g., vice grips while grinding small parts)
- Know how to safely load the unload parts and stock
- Use extension tools to clean machine parts
- Always focus on the point of operation before starting any motion

Safe Work Practices: Machines (cont'd)

- Pre-inspect machine before use
 - Common-use machines
 - Out of adjustment, alignment
 - Dull cutters, blades
 - Poor housekeeping
 - Defective electrical cords, lights
- Always insure that cutting tools are sharp
 - Problems with common-use type tools - persons do not change dull blades, bits or cutters
- Don't use an unsafe tool or machine

Safe Work Practices: Machinery (cont'd)

- Should have adequate guarding
- Should have readily accessible shut off for emergencies
- Should have adequate lighting
- Should have safe electrical wiring
 - No exposed electrical wiring or energized components
- Should have appropriate warning signs posted.

Drill Press



Drill Press

- **Use the right speed for the work**
 - High speed for drilling
 - Use lubricant/coolant
- **Insure bit is tight in chuck**
- **Don't leave the chuck key in the chuck**
- **Use a clamp or work vice to hold the work in place**
- **No guards**

Drill Presses

- All moving parts need to be guarded except the area around the chuck and bit (point of operation)
- Point of operation guarding is not easily achieved
- Have to watch out for exposed belt/pulley drives

Mill



Milling Machines

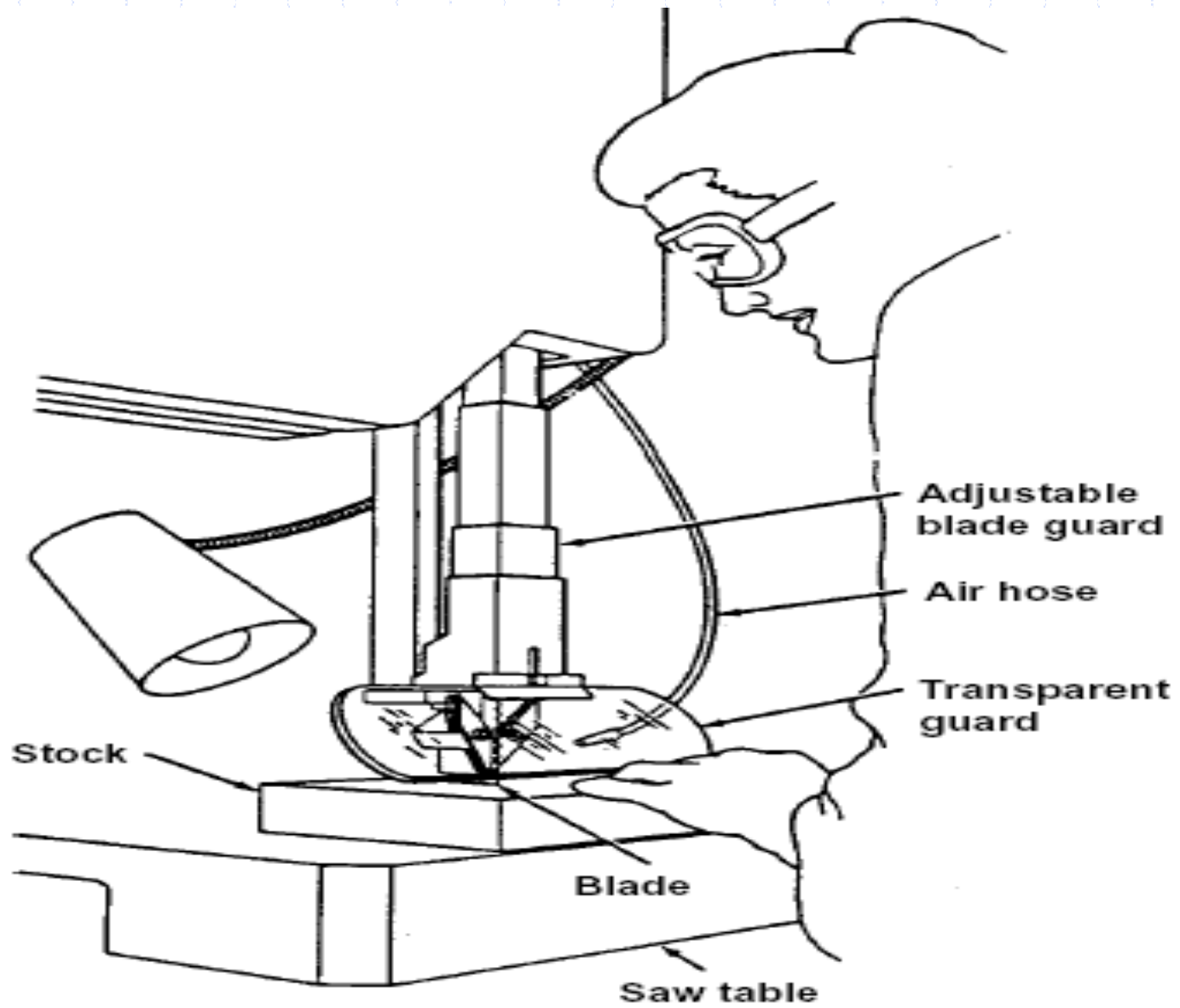
- **The cutter must be clamped tightly in the collet**
- **The part must be tightly clamped onto the bed**
- **Feed the bit slowly into the part**
- **Keep the free hand away from the point of cutting**
- **Use a chip shield when the material is ejected from the cutting area and watch out for long sharp swarf**

Band Saw



Band Saw

- **Need to keep upper blade guide adjusted down as close to the work as possible - prevents blade from wandering**
- **Should use a push block at the end of the cut to avoid running your fingers into the blade on small parts**
- **Need to check the blade before you start:**
 - Proper tension and is it sharp?
 - Proper blade – wood cutting, fiberglass cutting or metal cutting blade?
- **Need to check that there is only a very small space between the blade and guides**



Source: *Concepts and Techniques of Machine Safeguarding*, OSHA

Using Compressed Air For Cleaning

- Compressed air must be used at the lowest workable pressure
- Use safety air nozzles which restrict air pressure at tip to less than 30 psig
- Use a vacuum when possible
- Use compressed air so that it minimizes the hazardous noise generation

Other Issues

- **Housekeeping - the work areas and especially floors must be frequently cleaned of metal chips and oils**
 - Cutting oils—spill kit is located in Paul Stovall's office
- **Sweep tables and beds rather than use compressed air for blowing chips off**
- **Some machinery may be very noisy and ear protection should be considered**
- **Adequate safety signage is needed to remind persons to work safely such as wearing safety glasses or cleanup**

Emergency Information

- Proctor must be present at all times!
- Call 72000 for medical and other emergencies (Please note: The black and red phones do not call outside numbers!)
- 911 will not identify where on campus you are located
- In the cases where ambulance services are not needed, call the dorm proctors- "The Proctor On-Call".



Summary

- Machine tools are highly hazardous pieces of equipment
 - Serious cuts, crushed and amputated limbs, entanglements and scalping are the common injuries with machine tools
- Machine tools must be used safely at all times
 - Safe machinery
 - Guarded mechanical and electrical parts
 - Sharp cutting implements

Summary (cont'd)

- Machine tool safety (cont'd)
 - Safe persons are:
 - Trained
 - Experienced
 - Know where/when to get assistance
 - Safe procedures and work practices
 - Disciplined work practices, e.g.,
 - Work with guards in place
 - Practice good housekeeping
 - Remember: Work on only those machines they have been trained on. Get training before attempting a new procedure

Remember!

- You are ONLY trained for the tasks the class requires, and may only work in the shop during your lab sections. A shop proctor must be present at all times.
- Want to be able to use all machines in the shop, and use the machines outside of class time? Contact Professor Orwin at orwin@hmc.edu; training will be scheduled later in the semester.

Clinic Safety

What types of Hazards do you encounter working in Clinic?

- Chemical
 - Physical Hazards
 - Fire, explosion, slip/trips/falls,
 - Health Hazards
 - Toxins that are inhaled, ingested, absorbed, or injected.
- Electrical
 - Exposed wires, faulty equipment, source of ignition
- Ergonomic
 - Improper lifting, strains, repetitive motion
- Other Operations:
 - Welding
 - Sunburn, other burns, inhalation hazards

Clinic Safety-

How to stay Safe

- Proper Understanding of the Hazard Involved
 - MSDS, Consumer Warnings, Labels,
- Proper Use of PPE
 - Protect: Eyes, Hands, Head, Feet, Ears, Breathing
- Are other safeguards needed?
 - Chemical fume hood, LEL meters, Fire extinguisher, First Aid, other tools or instruments.
- Ask for Help

QUIZ

- Q1- f
- Q2- f
- Q3- False (minor exception: Drill Press)
- Q4- B, A, C
- Q5- False (Below if guard is available)
- Q6- 1/4in and 1/8in
- Q7-True
- Q8- False
- Q9- False, False, False, True
- Q10- Report to ? Call ? Get help from?

Questions???

Getting Started

In one to two days you will be given access. Follow rules regarding appropriate shop hours.

ALWAYS USE THE BUDDY SYSTEM

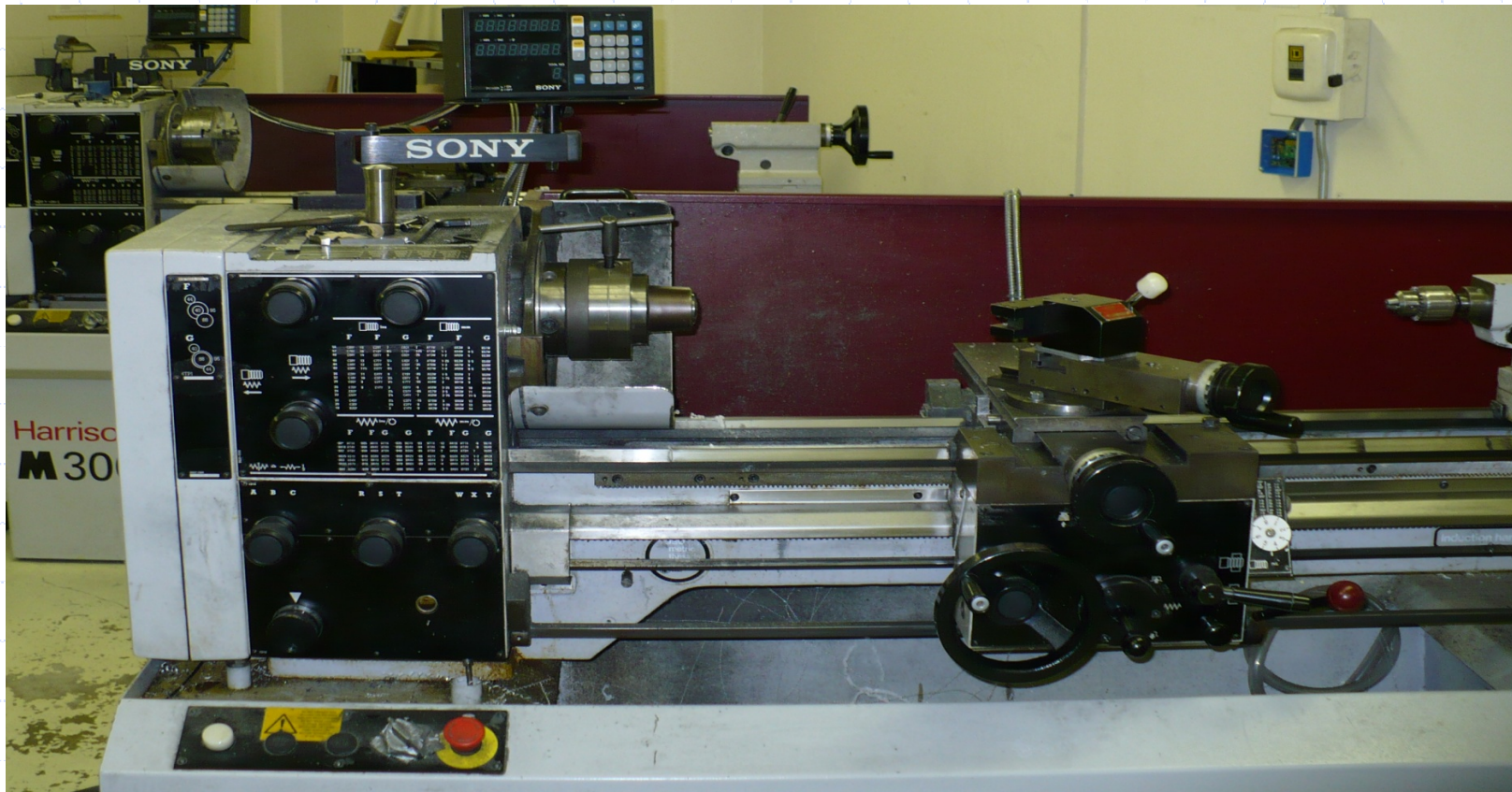
Lathe



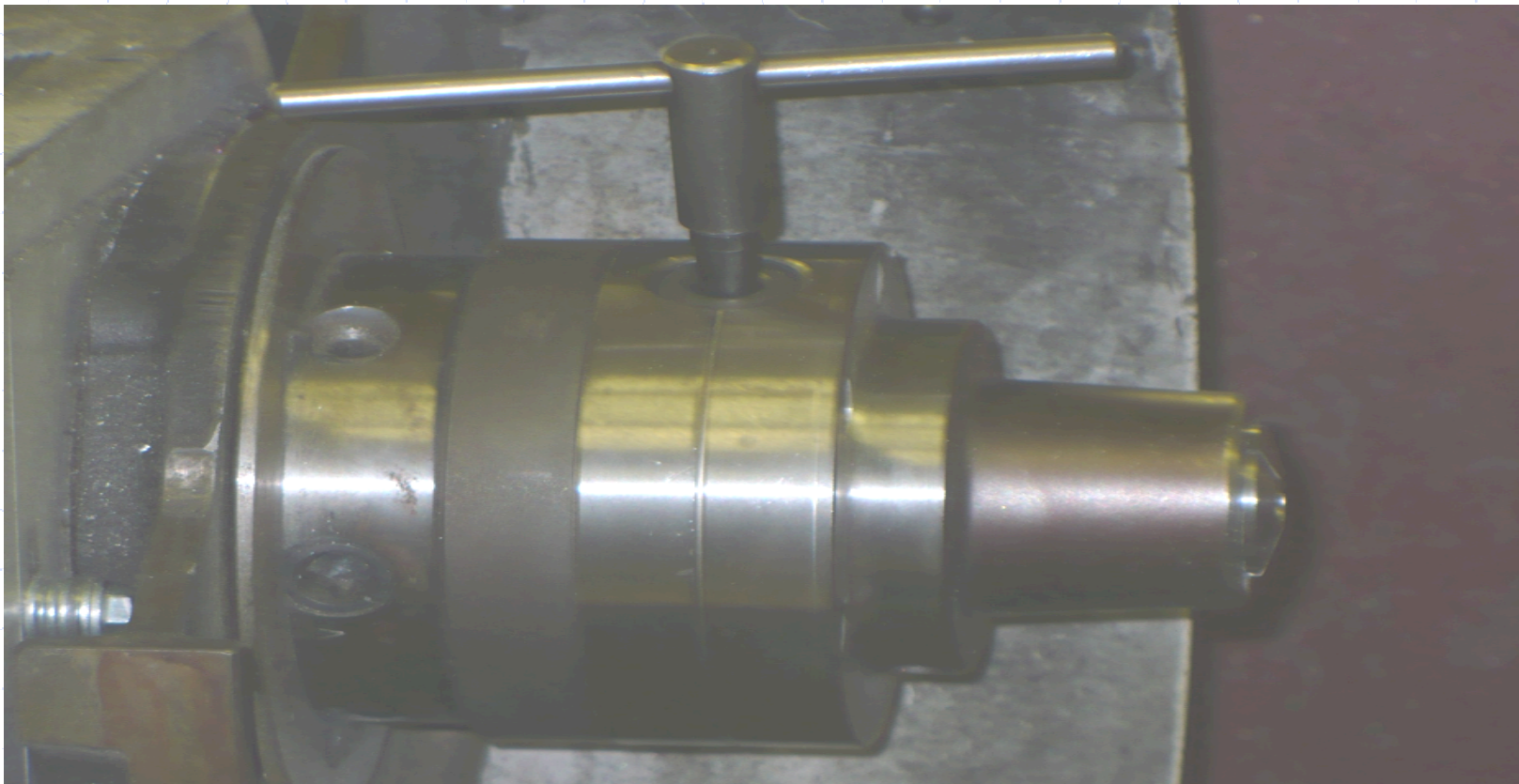
Lathes

- Large rotating chuck is the primary hazard of this machine
- A chuck guard is required to be used over the chuck during operation
- High frequency of accidents related to leaving chuck wrench in the chuck when the lathe is started
- Watch out for persons walking behind the lathe as this material can harm them also.

What's wrong with this Picture?



Key in the Chuck



SHEARS



Shears

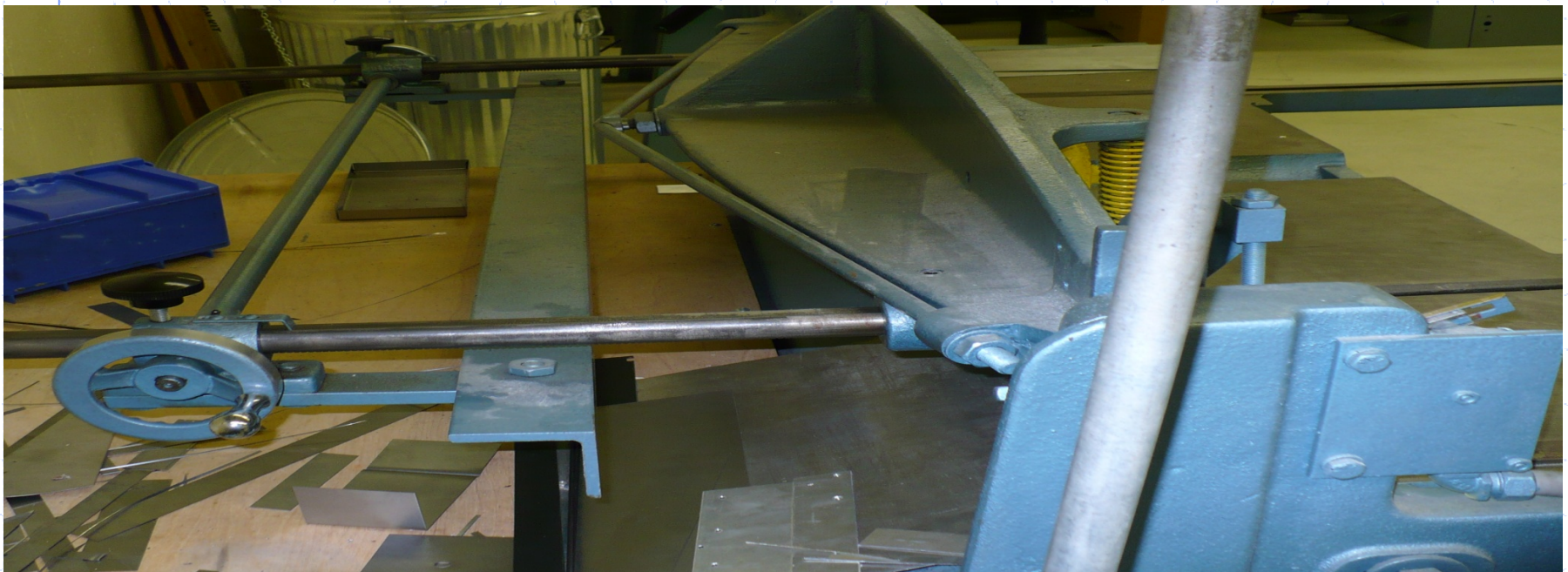
- Manual (foot-operated) shears
 - Insure blade guard is in place
 - Don't cut metal thicker or harder (ex Titanium) than capability of shear unit
 - Keep fingers back away from the guard
 - Keep persons way from backside of shear when using

Shears (cont'd)

- Cut edges of metal can be very sharp
 - Wear gloves when handling metal pieces
- Insure that the work hold-downs securely clamp the work to the table
- Foot bars must be guarded from the top to prevent accidental activation of the equipment due to something being dropped on the bar

Shear

- Area behind shear must be secured with some means to prevent persons accessing the equipment from behind



GRINDER



Grinders

- Wheels are made up of bonded abrasives
 - Wheels are fragile - easily cracked
 - Can't drop them
 - Don't grind on the side of the wheel
 - Unless it is designed for it
 - Don't grind soft materials as it plugs the wheel
 - Brass
 - Aluminum
 - Soft metals clog the wheel which leads to uneven wear

Grinders (cont'd)

- **Uneven grinding surface needs to be dressed or wheel replaced**
- **Tongue guard (attached to the top of the guard) must be within 1/4" of the wheel or closer**
 - Designed to stop pieces of the wheel if it shatters
- **Tool rest must be within 1/8" of the wheel**
 - To prevent work from jamming between wheel and tool rest

Grinders (cont'd)

- Need to wear safety glasses with side shields to protect your eyes as a minimum, plus a faceshield would be prudent

Pan & Box Brakes



Pan & Box Brakes

- **Units must be guarded to keep persons from reaching into the finger area**
- **Guarding must also account for reaching into finger area from sides and back**
- **Foot switches must be guarded on top**

Sander



Belt Sander

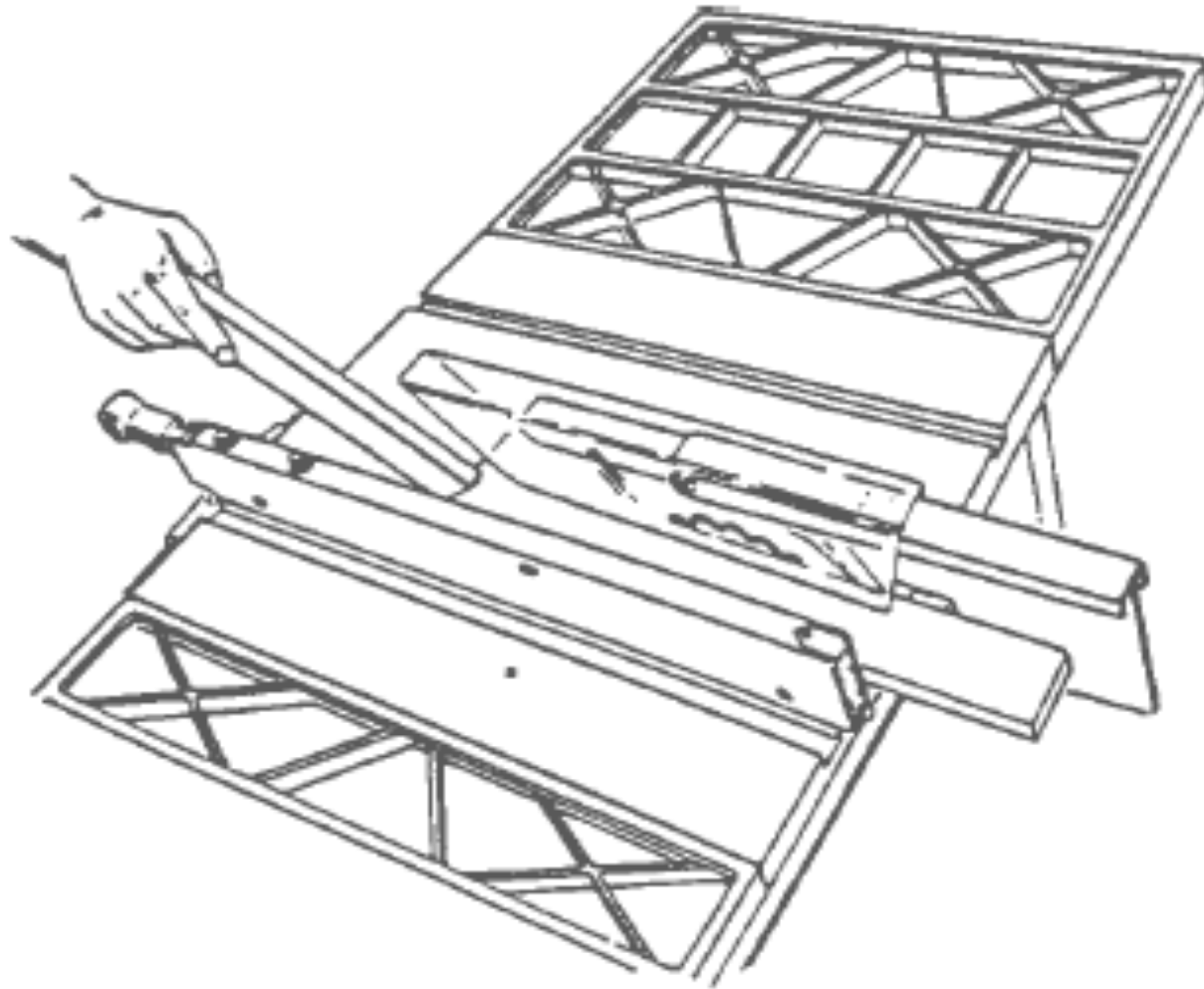
- Work table must always be within 1/8" of the belt
 - Needed to keep part from flipping up & from jamming in between table and belt
- Watch where you put your hands
 - Easy to run your knuckles into the moving belt

Table Saw



Table Saw

- The guarded hood must completely enclose that portion of the saw blade **above the table** and that portion of the blade **above the material being cut**
- The hood must automatically **adjust itself to the thickness** of and **remain in contact with the material being cut** at the point where the stock encounters the saw blade
- The hood or other guard must be so designed as **to prevent a "kickback,"** or a separate attachment that will prevent a "kickback" shall be provided. "Anti-kickback" devices must be designed to be effective for all thicknesses of material
- Do **not cross cut** narrow pieces of wood between the fence and saw blade



Source: *Accident Prevention Manual for Industrial Operations*, National Safety Council