California Vocational Agriculture Curriculum Guidelines Instructional Unit

AGRICULTURAL MECHANICS SHOP ORIENTATION AND SAFETY

TABLE OF CONTENTS

Introduction to Agriculture	
Agricultural Production	01.01
Agricultural Supplies/Services	01.02
Agricultural Mechanics	01.03
Agricultural Products/Processing	01.04
Ornamental Horticulture	01.05
Renewable Resources/ Rural Recreation	01.06
Forestry	01.07

	Suggested Learning Activities	Suggested Resource Materials
II.	1. Take the class on a tour of the shop to point out tools, equipment, and storage. Discuss shop procedures and grading, fire extinguisher location and use.	1. Local shop; local fire department for extinguisher demonstration.
	2. Demonstrate first aid to class.	2. School nurse; Red Cross First Aid Manual.
III.A.	3. Demonstrate safety instruction and administer test.	3. Class.
III.B-E.	4. Have students demonstrate safety precautions on each machine.	4. Class.

III. B. 7. Furnace (Crucible)

a. Safety instructions (TM - 15)
b. Safety test questions (TM - 16)

8. Grinder

a. Safety instructions (TM - 17)
b. Safety test questions (TM - 18)

9. Lathe (Metalworking)

a. Safety instructions (TM - 19)
b. Safety test questions (TM - 20)

10. Milling machine

a. Safety instructions (TM - 21)
b. Safety test questions (TM - 22)

11. Planer (Metalworking)

a. Safety instructions (TM - 23)
b. Safety test questions (TM - 24)

12. Portable electric drill

a. Safety instructions (TM - 25)
b. Safety test questions (TM - 26)

13. Shaper (Metalworking)

a. Safety instructions (TM - 27)
b. Safety test questions (TM - 28)

14. Shear

a. Safety instructions (TM - 29)
b. Safety test questions (TM - 30)

15. Welder (Oxygen-Acetylene)

a. Safety instructions (TM - 31)
b. Safety test questions (TM - 32)

16. Electric Welding
a. Safety instructions (TM - 33)
b. Safety test quesions (TM - 34)

C. Woodworking equipment

1. Band saw

a. Safety instructions (TM - 35)
b. Safety test questions (TM - 36)

2. Circular saw

a. Safety instructions (TM - 37)
b. Safety test questions (TM - 38)

3. Jointer

a. Safety instructions (TM - 39)
b. Safety test questions (TM - 40)

AGRICULTURAL MECHANICS SHOP ORIENTATION AND SAFETY

Unit Goal:

The goal of this unit is to provide the student with a basic understanding of shop procedures, rules of conduct, and general shop safety.

Unit Performance Objectives:

Upon completion of this unit the student will be able to:

1. Store tools, equipment, and materials properly.
2. Clean shop properly.
3. Recognize and report hazardous situations.
4. Use a fire extinguisher properly.
5. Practice all shop and equipment safety regulations.
6. Identify tools and equipment.

Special Acknowledgement

Much of the material in this unit is from Industrial Arts Safety Instruction compiled by California industrial arts teachers and published by the California State Department of Education. The safety tests and instructions are reprinted here in a form for duplication.

Teaching Outline

I. Introduction

Shop facilities vary considerably so the rules are written to allow an instructor to select what is applicable.

II. Orientation

A. Tools and equipment (TM - 80, 81, 83, 89)

B. Storage

C. Clean up (TM - 69, 89)

D. Grading procedures

E. Fire extinguishers and their use

F. Fire drill procedures

G. First aid (TM - 74, 90)

III. Safety

A. General safety (TM - 79, 84, 85, 88,)

1. Instructions (TM - 1)

2. Test (TM - 2)

B. Metalworking equipment

1. Bar folder

a. Safety instructions (TM - 3)
b. Safety test questions (TM - 4)

2. Brake

a. Safety instructions (TM - 5)
b. Safety test questions (TM - 6)

3. Buffer

a. Safety instructions (TM - 7)
b. Safety test questions (TM - 8)

4. Drill press

a. Safety instructions (TM - 9)
b. Safety test questions (TM - 10)

5. Forge

a. Safety instructions (TM - 11)
b. Safety test questions (TM - 12)

6. Furnace (Bench)

a. Safety instructions (TM - 13)
b. Safety test questions (TM- 14)

	Suggested Learning Activities	Suggested Resource Materials
III.B-E.	1. Have students who have completed safety tests administer tests to those who have not.	1. Class.

III. C. 4. Lathe (Woodworking)

a. Safety instructions (TM - 41)
b. Safety test questions (TM - 42)

5. Mortiser

a. Safety instructions (TM - 43)
b. Safety test questions (TM - 44)

6. Planer (Surfacer)

a. Safety instructions (TM - 45)
b. Safety test questions (TM - 46)

7. Radial-arm saw

a. Safety instructions (TM - 47)
b. Safety test questions (TM - 48)

8. Router

a. Safety instructions (TM - 49)
b. Safety test questions (TM - 50)

9. Sander

a. Safety instructions (TM - 51)
b. Safety test questions (TM - 52)

10. Scroll saw

a. Safety instructions (TM - 53)
b. Safety test questions (TM - 54)

11. Shaper (Woodworking)

a. Safety instructions (TM - 55)
b. Safety test questions (TM - 56)

D. Automotive and power mechanics equipment

1. Car lifts, hoists, and cranes

a. Safety instructions (TM - 57)
b. Safety test questions (TM - 58)

2. Engine

a. Safety instructions (TM - 59)
b. Safety test questions (TM - 60)

3. Storage battery

a. Safety instructions (TM - 61)
b. Safety test questions (TM - 62)

4. Use, storage, and disposal of flammable liquids

a. Safety instructions (TM - 63, 87, 88)
b. Safety test questions (TM - 64,)

Suggested Learning Activities	Suggested Resource Materials

III. E. Electrical and electronic equipment (TM - 82)

1. Circuits

a. Safety instructions (TM - 65)
b. Safety test questions (TM - 66)

2. Electrical equipment

a. Safety instructions (TM - 65)
b. Safety test questions (TM - 66)

F. Safety test answers (TM - 67)

G. OSHA

The California Occupational Safety and Health Act of 1973 and the Federal Occupational Safety and Health Act of 1970 was enacted for the purposes of: a) assuring safe and healthful working conditions for all working people by enforcement of effective standards, and b) helping employers maintain safe and healthy working conditions.

1. Jurisdiction and duties

a. All enforcement and rulemaking authority is made by the Department of Industrial Relations.
b. Department has the power, jurisdiction, and supervision over every place of employment in the state.
c. Enforcement may be any of the following:
   1) Declare and prescribe what safety devices are necessary
   2) Enforce standards and orders by the Standards Board
   3) Require the performance of any act
d. Inspections may be done with or without notice or hearing
e. Investigators have free access to any place of employment
f. Citations are issued for any violations of standards, rules, orders, or regulations
g. Citations must be in writing and describe the violation and references to the code
h. OSHA will investigate the cause of any accident which is fatal or which results in a serious injury to 5 or more
i. Department will investigate any complaint within 3 working days
j. Department may prohibit use or enry into any area determined an eminent hazard
k. State Department of Health works with Cal-OSHA, Federal OSHA, and NIOSH for impact on California

2. Education and research

a. Provide in-service training
b. Provide safety and health consulting services

3. Responsibilities of employers and employees

a. Employers will do everything reasonable to protect the safety and health of employees
b. Employers will provide all safety devices, safe methods, and protect the life safety and health of employees
c. Employees will not remove any safety devices, methods, or other protections

4. Penalties : Anyone who does the following will be guilty of a <u>misdemeanor</u>:

a. Knowingly or negligently violates any standard
b. Repeatedly violates any standard
c. Fails or refuses to comply

	Suggested Learning Activities	Suggested Resource Materials
III.G	1. Discuss the importance of following safety rules and OSHA regualtions.	1.
	2. Have students try to find unsafe conditions in the shop.	2. Local shop or local farmer's shop.

Student Evaluation

See appropriate Transparency Master.

General Safety Instructions for All Areas

Shop Practice

1. Ask your teacher to approve all work that you plan to do.
2. Report all injuries, even though slight, to your teacher immediately.
3. Wear suitable eye protection when engaged in any activity where eye hazards may exist.
4. Be sure clothes are safe and suitable for shop work. Remove or fasten any loose clothing. Roll loose sleeves above elbows. Keep hair away from equipment in operation. (Long hair must be confined.)
5. Observe rules concerning operators' zones.
6. Cooperate with your classmates in the student management program of your shop.
7. Caution any other student you see violating a safety rule.
8. Report to the teacher or shop foreman any equipment that does not seem to work properly.
9. Keep tools and materials from projecting over the edge of benches whenever possible.
10. Use a brush or piece of wood to clear away dry chips and use a rag to clean oily areas.
11. Keep the floor clear of scraps and litter.
12. Wipe up immediately any liquids spilled on the floor.
13. Keep bench and cabinet drawers and locker doors closed.
14. Place oily rags and other combustible materials in a covered metal container.
15. Exercise care in handling large, heavy, and long pieces of material.
16. Practice procedures to follow in case of earthquake, fire, or other disasters.

General Safety Instructions for All Areas (continued)

Hand Tools

1. Be sure your hands are as free as possible of dirt, grease, and oil when using tools.

2. Use proper type and size of hand tool.

3. Make sure that the tools you are going to use are sharp and in good condition.

4. Handle edged or pointed tools with care.

5. Make sure when using a sharp-edged tool to point the edge away from yourself and your classmates.

6. Clamp small work on bench or secure in vise when using gouge or wood chisel, driving screws, etc.

7. Control chisels, gouges, and carving tools with one hand while the other hand supplies the power.

8. Wear a face shield or safety glasses (goggles, spectacles) when chipping or cutting with a cold chisel. Arrange your work so that classmates are protected from flying chips.

9. Pass tools to classmates with the handles first.

Machine Tools

1. Qualify as a safe machine operator.

2. Obtain permission from your teacher before using any power equipment.

3. Check adjustments on machines before turning on the power. (Rotate machine one revolution by hand whenever possible without danger.)

4. Make sure that all other students are clear of the machines before turning on the power.

5. Keep all machine safety guards in correct position.

6. Start your own machine and remain with it until you have turned it off and it has come to a dead stop.

7. Stay clear of machines being operated by others.

8. Notify teacher or shop foreman when a machine does not seem to work properly.

9. Wait for machines to come to a dead stop before oiling, cleaning, or adjusting.

General Safety Test TM-2

I

( ) 1. You should report all injuries, even though slight, to: (a) an advanced student; (b) your principal; (c) your teacher; or (d) the office.

( ) 2. You should wear suitable eye protection: (a) to improve your vision; (b) when engaged in any activity where eye hazards may exist; (c) to avoid myopia; or (d) when you desire to improve your appearance.

( ) 3. It is best to fasten or remove loose clothing and roll sleeves above your elbows: (a) before operating any machine; (b) during the operation of the machine; (c) after operating a machine; or (d) only when you are assisting the teacher.

( ) 4. The designated area or operator's zone around a machine is to protect: (a) the power equipment; (b) all the students and the teacher working in the shop; (c) only the teacher; or (d) only the student operating the machine.

( ) 5. It is best that any liquid spilled on the floor should be wiped up immediately because it: (a) looks unsightly; (b) will stain the floor; (c) causes more work for the custodian; or (d) may cause someone to slip and injure himself.

( ) 6. Rags containing oil, gasoline, alcohol, shellac, paint, varnish, or lacquer must be: (a) kept in a covered metal container; (b) stored in a wastebasket; (c) folded neatly and placed on a shelf; or (d) stored in a cool, dry place.

( ) 7. Before using any power equipment, you should obtain permission from: (a) an advanced student; (b) your principal; (c) your teacher; or (d) the office.

( ) 8. If you notice any breakage or damage to a tool, instrument, or machine, you should: (a) ask an advanced student to repair it; (b) be careful when you use it; (c) say nothing because you might be blamed; or (d) notify your teacher.

( ) 9. When using a knife, you should: (a) pull the knife toward you; (b) strike the blade with a hammer to make large cuts; (c) use pointed end only; or (d) cut away from your body and hands.

( ) 10. You should grind off a mushroomed head on a chisel or punch so as to prevent: (a) inaccuracies in your work; (b) spoiling the looks of the tool; (c) making the tool difficult to hold; or (d) particles of metal from flying when you strike the head with a hammer.

II

..... 1. All work that you plan to do should be approved by the .....

..... 2. You should clear away dry chips with a piece of wood or a .....

..... 3. When using a wood chisel or gouge, you should point the sharp edge of the tool away from your classmates, teacher, and .....

..... 4. You should pass tools to classmates with the handles .....

..... 5. You should make sure that all students are clear of the machine before turning on the .....

..... 6. Before oiling, cleaning, or adjusting a machine, you should allow the machine to come to a complete .....

Bar Folder

TM-3

Safety Instructions

1. Obtain permission from your teacher before using the bar folder.
2. Remove sharp burrs and edges on sheet metal before folding.
3. Fold only single thickness of sheet metal within capacity of the bar folder. (Follow manufacturer's gauge limit specifications.)
4. Make sure that no one but you is inside the operator's zone.
5. Keep your hands clear of movable parts.
6. Hold handle firmly.
7. Let the bar down slowly after completing a bend.

Bar Folder

TM-4

Safety Test Questions

I

( ) 1. When folding metal in the bar folder, you should: (a) keep your fingers away from the folding bar; (b) let the folding bar drop; (c) always fold across a hem; or (d) feed the work as rapidly as possible.

( ) 2. When you are using the bar folder, the handle should be: (a) held by another person at all times; (b) let down slowly; (c) thrown back; or (d) rotated.

II

..... 1. You should always keep your hands clear of movable..... .....

..... 2. When using the bar folder, you should let the handle down .....

Brake

TM-5

Safety Instructions

1. Obtain permission from your teacher before using the brake.

2. Keep fingers clear of clamping bar and blade.

3. Make sure no one but you is inside the operator's safety zone (clear of counter balance).

4. Fold only single thickness of sheet metal within capacity of the brake (follow manufacturer's specifications as to gauge limits).

Brake

TM-6

Safety Test Questions

I

( ) 1. Before operating the brake, you should: (a) drop the leaf; (b) make sure that everyone is clear of the counter balance; (c) remove the counter balance; or (d) remove the bending leaf.

( ) 2. When using the brake, make sure you keep your fingers: (a) on the clamping bar; (b) on the bending leaf; (c) on the counter balance; or (d) clear of the clamping bar.

II

_____ 1. When using the brake, you should keep fingers clear of clamping _____.

_____ 2. Before operating the brake, you should make sure that everyone is clear of the counter _____.

Buffer

TM-7

Safety Instructions

1. Obtain permission from your teacher before using the buffer.
2. Hold work with both hands.
3. Ask your teacher for special instruction and permission to buff small pieces.
4. Make sure that no one but you is inside the operator's zone.
5. Wear face shield or safety glasses (goggles, spectacles).
6. Turn on power after permission is given.
7. Apply compound sparingly.
8. Keep hands away from the wheel while it is in motion.
9. Hold work below center (horizontal axis) as wheel revolves toward you.
10. Buff flat surfaces from center toward lower edge. Sharp edges should point downward.
11. Press material against wheel with correct amount of pressure.
12. Turn off power after using buffer.
13. Clean buffer and area with a brush.

Buffer

TM-8

Safety Test Questions

I

( ) 1. When buffing, you should hold your work: (a) on top of wheel; (b) below center (horizontal axis) of wheel; (c) above center (horizontal axis) of wheel; or (d) on bottom of wheel.

( ) 2. You must wear goggles or a face shield when using buffer because either of these will: (a) magnify your work; (b) remove glare; (c) help avoid distraction; or (d) protect your eyes from flying particles.

( ) 3. Special permission to buff small pieces must be obtained from: (a) foreman; (b) teacher; (c) student; or (d) monitor.

( ) 4. When using buffer, you should point sharp edges of your work: (a) upward; (b) sideways; (c) horizontal; or (d) downward.

II

..... 1. When using buffer, you should always keep your hands away from .....

..... 2. Work being buffed should be held against the wheel just below .....

..... 3. Be sure when using buffing wheel to wear face shield or .....

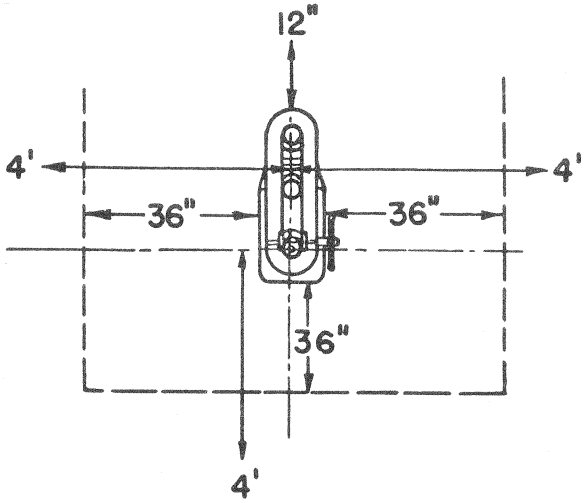
..... 4. Special permission to buff small pieces must be obtained from the .....

Drill Press

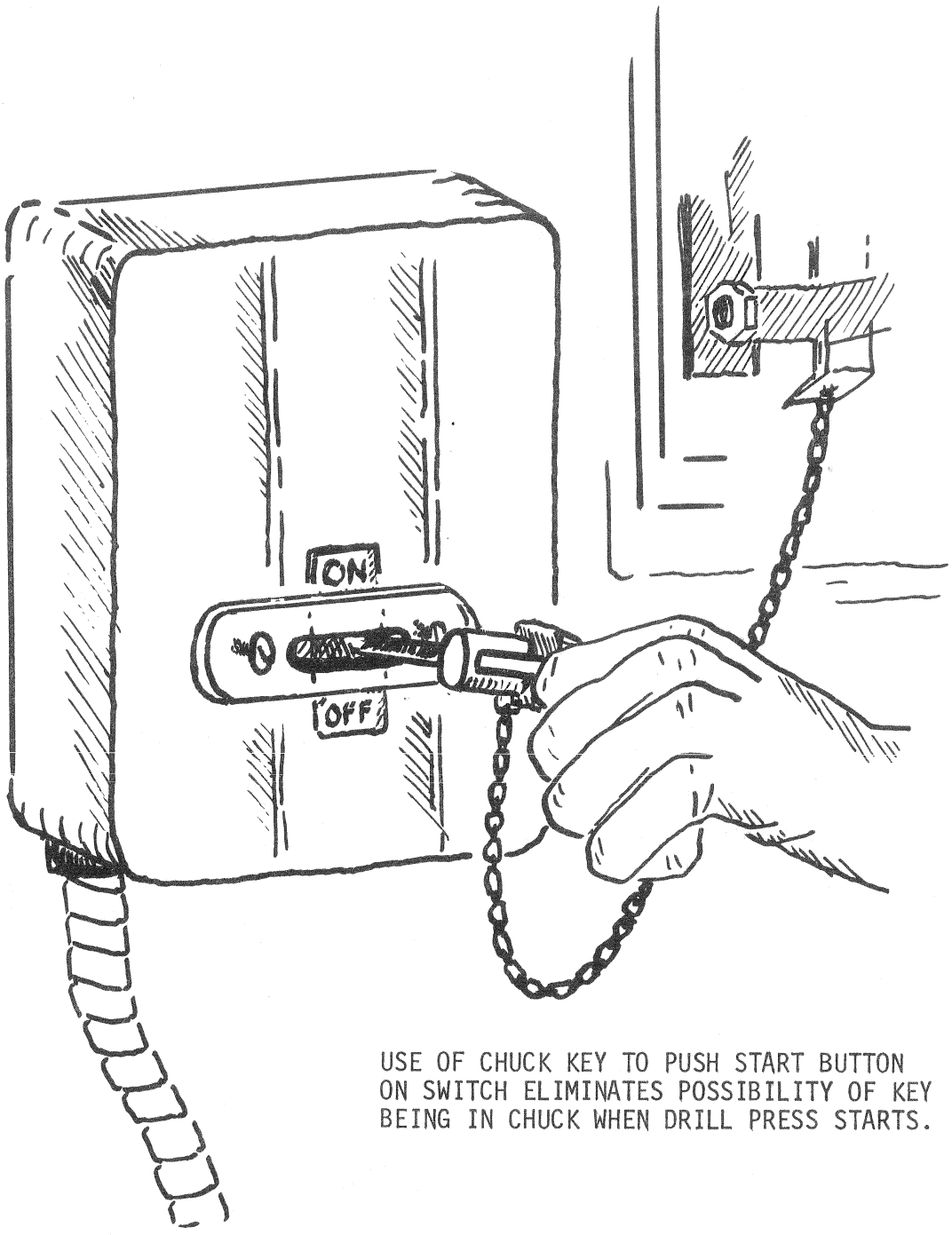
TM-9

Safety Instructions

1. Obtain permission from your teacher before using the drill press.
2. Shift belt and make other adjustments only when power switch is turned off.
3. See that belt guard is in place.
4. Be certain that the table and head of drill press are secure.
5. Select proper drill (be sure it is sharp) and coolant.
6. Remove chuck key immediately after using it.
7. Use drill press vise whenever possible. Clamp vise or work to drill press table.
8. Make sure that no one but you is inside the operator's zone.
9. Wear face shield or safety glasses (goggles, spectacles).
10. Turn on power after permission is given.
11. Keep hands away from revolving spindle, chuck, drill, and chips.
12. Operate feed handle so that drill cuts evenly into work.
13. Ease up on feed pressure when drill begins to break through material.
14. Back drill out as soon as hole is drilled.
15. Stop the drill press before attempting to remove work, chips, or cuttings.
16. Use a brush to remove chips or shavings.
17. Keep floor clean around drill press.
18. Step away immediately if work comes loose and is seized by drill; shut off power if possible without endangering self.
19. Turn off power after using drill press and stand by until the machine has stopped.
20. Clean off drill press table and surrounding area. Return cleaned drills, coolants, and clamping devices to designated place.



MINIMUM SPACE REQUIREMENTS FOR DRILL PRESS
Aisles, if necessary, should be outside this allocated space.



USE OF CHUCK KEY TO PUSH START BUTTON ON SWITCH ELIMINATES POSSIBILITY OF KEY BEING IN CHUCK WHEN DRILL PRESS STARTS.

California Vocational Agriculture Curriculum Guidelines Instructional Unit

ENGINE TUNE UP

TABLE OF CONTENTS

Introduction to Agriculture	
Agricultural Production	01.01
Agricultural Supplies/Services	01.02
Agricultural Mechanics	01.03
Agricultural Products/Processing	01.04
Ornamental Horticulture	01.05
Renewable Resources/ Rural Recreation	01.06
Forestry	01.07

T

Teaching Outline

I. Engine Tune Up

Engine tune up is probably the most important preventive maintenance that can be performed on a machine. However, most operators make the mistake of performing tune up only when the engine is not running satisfactorily. This is often a costly error because at this point the engine may be worn or damaged until it requires major repair or overhaul. Not only could these costly repairs be avoided by good maintenance, but operating costs could also be saved.

A. What is a Tune Up?

Tune up is the process of making checks and minor adjustments to improve the operation of the engine. Tune up is also preventative maintenance. Troubles can be caught early and prevented by checking out the engine before it actually fails.

B. When Should an Engine be Tuned?

Regularly. The intervals for tune up may vary from 500 to 1,000 hours or each spring and fall, depending upon the operating conditions. But regularity is the key to tuning the engine so that major problems are prevented. A badly worn engine cannot be tuned up. This is why the engine should first be checked to see if:

1. A tune up will restore it, or
2. Major overhaul is needed.

II. Visual Inspection, TM 1

By inspecting the engine before tuning it, you can learn a lot about its general condition.

A. Oil and Water Leakage:

Inspect the engine for any oil or water leaks. If the engine has been using too much oil, this often means an external oil leak. If the engine overheats, look for leaks in the cooling system.

B. Electrical System:

1. Inspect the battery for corrosion, cracked, case, or leaks at the cell covers. Remove the cell caps and examine the tops of the battery plates.

ENGINE TUNE UP

Unit Goal

The goal of this unit is to aid the students development of knowledge and skills related to engine tune up.

Unit Objectives

Upon completion of this unit the student will be able to:

1. Identify conditions that could lead to engine failure.
2. Perform the tune up procedures listed on the tune up chart in this unit.

SUGGESTED LEARNING ACTIVITIES	SUGGESTED RESOURCE MATERIALS
II. 1. Have students perform visual inspection of one or more tractors and record deficiencies.	1. Local dealer, John Deere FMO, Tractors and Preventive Maintenance.
2. Have students participate in farm power contest at Field Day.	2. CATA Curricular Code.

II. B. 2. If they are covered with a chalky deposit, this means one of three things:

a. Electrolyte level has been too low.
b. Battery charge has been too low, causing sulfation.
c. Battery was charged at too high a rate, boiling out water.

3. Any of these conditions can reduce the life of the battery. If they have gone too far, the battery must be replaced.

4. Check the battery cables and connections for damage and looseness.

5. Be sure the cables are the right size. Many complaints of poor starting can be traced to battery cables that are too small.

6. To check for this, operate the starter with the engine cold. If the battery cable gets hot, the cable is probably too small.

7. Inspect the wiring harnesses. If they are too oil-soaked, frayed, or corroded, replace them.

8. On spark-ignition engines, check the distributor for a cracked cap, excessive grease, or other damage.

9. Check the operation of the alternator or generator gauge or voltmeter. It should light or register when the starter switch is turned on.

10. Failure can be due to a burned-out bulb, an incomplete circuit, or the alternator or generator is not producing current. (Lack of current to the battery will show up a discharged battery).

11. If the oil pressure indicator light does not go out or register normal when the engine is running check for low or no oil pressure, or a short circuit.

12. Stop the engine at once and find the cause.

13. Lack of engine oil pressure can result in failure of expensive parts inside the engine due to lack of lubrication.

C. Cooling System

1. Wait until the engine has been idle for several hours and the crankcase oil is cold; then loosen the crankcase drain plug and carefully turn it out to see if any water seeps out. If water is present, locate the cause of the cooling system leak.

2. Inspect the cooling system for leaks, deteriorated hoses, bent or clogged radiator fins, slipping fan belt, or any other condition which could result

SUGGESTED LEARNING ACTIVITIES

SUGGESTED RESOURCE MATERIALS

II. C. in improper cooling.

D. Air Intake System

Inspect the air intake system for possible leaks or restrictions. If the proper amount of clean air does not reach the engine, performance and durability will be affected.

E. Fuel System

1. Check the fuel system for leaks and for bent or dented lines, which might cause a restriction.
2. Check the fuel transfer pump sediment bowl. On diesel engines, inspect the fuel filters for dirt, water, or other foreign matter.

F. Steam Cleaning

After checking for leaks, steam clean the engine. This cleans the engine, makes tune up easier and troubles easier to spot.

G. Dynamometer Tests

1. If possible, test the engine on a dynamometer both before and after it is tuned. Before tune up, this test gives you the horsepower output and fuel consumption of the engine as it is. Consider both hours of operation and the conditions under which the engine has been operated. It is far more economical in the long run to tune the engine before a lack of performance makes it mandatory.
2. Remember: Most manufacturers suggest a regular period of operation between tune ups, such as spring and fall, or every 500 or 1,000 hours of operation.

III. Engine Tune Up Chart -- TM 2

A. The chart gives a capsule of the steps necessary to tune your engine at the recommended intervals.

B. If, after performing these tune up steps, the engine fails to respond properly, have a service shop make further tests. The engine may require adjustments or repairs that you are not able to perform because of the special tools and knowledge required.

IV. Dynamometer Tests After Tune Up

The dynamometer test is the final check of overall engine performance after tune up.

SUGGESTED LEARNING ACTIVITIES	SUGGESTED RESOURCE MATERIALS
III. 1. Have students perform tune up steps.	1. School equipment or local farmer.

IV. It will tell you whether the tune up has been adequate. Compare it with the dynamometer test made before tune up.

A. Test for the following things:

1. Engine horsepower
2. Exhaust analysis, smoke analysis (diesel), and carburetor adjustment (spark ignition).
3. Fuel consumtion
4. Crankcase Blow-by

B. Most dynamometer manufacturers have instruments to be used with the dynamometer for checking the above items.

C. Use the engine Technical Manual for procedures and specifications.

D. Note: If the engine fails to produce the desired horsepower, and an air cleaner restriction test was not made at the beginning, make one now. It is possible that an air restriction is causing the loss of horsepower.

E. A completely tuned engine should pass the dynamometer test with no problems.

F. However, the engine should not put out more horsepower than it was designed for. Tampering with the engine to get extra horsepower will shorten engine life and raise operating costs. It may also void the engine warranty.

V. Summary: Engine Tune Up

Tune up of an engine may seem like a long ordeal. Actually, most of the items can be checked in a minute or two. But why check out so many items if the engine has not actually failed? The answer is that tune up is preventive maintenance. Before the engine fails, we keep it tuned up so that causes are corrected early, and possible causes are prevented. Tune up catches the problems early -- in the farm shop, not in the field.

Shop costs are much cheaper than field costs, and by scheduling the tune up during a lull in operation, costly downtime at peak periods can be prevented. Tune up means that the engine is ready to go and the operator can depend on it for some long and productive hours on the job.

SUGGESTED LEARNING ACTIVITIES	SUGGESTED RESOURCE MATERIALS
IV. 1. Field trip to local dealer to observe dynamometer tests.	1. Local dealer.

Student Evaluation

True-False:

_____ 1. A badly worn engine can be restored by a complete tune up.

Written:

2. Before tuning up an engine, what should be done?

3. When should dynamometer tests be made?

Practical:

4. Have students perform visual check of a tractor, record deficiencies and submit list.

5. Have students perform tune up according to tune up chart, TM 2.

VISUAL INSPECTION CHECKLIST

- ☐ OIL AND WATER LEAKAGE
- ☐ ELECTRICAL SYSTEM
  - Battery
  - Cables
  - Wiring
  - Indicator Lights
- ☐ COOLING SYSTEM
  - Water in Crankcase
  - External Leaks
  - Clogging
- ☐ AIR INTAKE SYSTEM
  - Air Leaks
  - Restrictions
- ☐ FUEL SYSTEM
  - Leaks
  - Restrictions
  - Clogged Filter
- ☐ STEAM CLEANING

ENGINE TUNE UP

Step No. *Operation*

1. AIR INTAKE AND EXHAUST SYSTEM

- ☐ Clean out pre-cleaner (if used)
- ☐ Remove and clean air cleaner
- ☐ Inspect exhaust system and muffler
- ☐ Check crankcase ventilating system for restrictions
- ☐ Check intake manifold for leaks
- ☐ Check air intake for leaks or restrictions
- ☐ Check radiator for air bubbles or oil indicating compression or oil leakage
- ☐ Check cylinder head gasket for leaks
- ☐ Retighten cylinder head cap screws
- ☐ Adjust valve tappet clearance
- ☐ Check engine compression

2. ELECTRICAL SYSTEM

☐ **Battery**

Check the following items:

- ☐ Clean battery, cables and terminals
- ☐ Tighten battery cables and battery hold-down clamps
- ☐ Coat battery posts and cable clamps with petroleum jelly
- ☐ Check specific gravity of electrolyte and add water to proper level

☐ **Generator or Alternator**

Check belt tension

Step No. *Operation*

3. IGNITION SYSTEM (Spark-Ignition Engines)

☐ **Spark Plugs**

Clean and adjust gap

☐ Check spark plug wires

☐ **Distributor**

Check the following items:

- ☐ Cap and rotor
- ☐ Breaker points
- ☐ Breaker point gap
- ☐ Cam lubrication
- ☐ Distributor timing

4. COOLING SYSTEM

- ☐ Check water pump for leaks and excessive shaft endplay
- ☐ Inspect radiator hoses
- ☐ Clean and flush cooling system
- ☐ Test thermostat operation
- ☐ Check radiator for leaks
- ☐ Check condition of fan belt

5. FUEL SYSTEMS

- ☐ Check fuel lines for leaks or restrictions
- ☐ Clean fuel pump sediment bowl
- ☐ Clean fuel strainer or filter
- ☐ Check radiator for LP-Gas leaking from converter into cooling system
- ☐ Drain sediment from gasoline or diesel fuel tank
- ☐ Bleed diesel fuel system
- ☐ Carburetor adjustments

6. LUBRICATING SYSTEM

- ☐ Check operation of pressure gauge or light
- ☐ Drain and refill crankcase
- ☐ Replace oil filter

7. CLUTCH PEDAL FREE TRAVEL

- ☐ Check free travel at clutch pedal

General References

Fundamentals of Machine Operation, Tractors, John Deere service publication.

F.M.O. Preventive Maintenance, John Deere Service publication.

Machines for Power Farming, Stone and Gulvan.

Principles of Farm Machinery, Bainer, Kepner, Borger.

Operation, Maintenance, and Repair of Farm Machinery, John Deere

Tractors and Crawlers, Frangee, Bedell.

Daily Operation and Maintenance, VEP

Operators Manuals.

Drill Press

TM-10

Safety Test Questions

I

( ) 1. Drill press work should be held: (a) with a pair of tongs; (b) by the hands; (c) in a vise or firmly clamped to the table; or (d) by an assistant at all times.

( ) 2. When the drill begins to break through the work, you should: (a) ease up on the feed pressure; (b) maintain the same feed pressure; (c) stop the drill press immediately; or (d) apply more pressure.

( ) 3. The best way to remove chips from the drill press is with: (a) your fingers; (b) a small drill; (c) a long ruler; or (d) a brush.

( ) 4. By removing the chuck key from the chuck before turning on the power, you will prevent: (a) the chuck from being damaged; (b) the drill from breaking; (c) the chuck key from being thrown out at a terrific speed; or (d) the chuck from becoming unbalanced.

( ) 5. If work is seized by the drill, you should (without endangering yourself): (a) exert more feed pressure; (b) stop the machine immediately; (c) grab it with your hands; or (d) decrease the feed pressure.

II

_____ 1. Work being drilled on the drill press should be securely clamped to the table or in a _____.

_____ 2. Be sure to remove chuck key from the drill press before turning the power _____.

_____ 3. You should remove chips from the drill press table with a _____.

_____ 4. When the drill begins to break through the work, you should ease up on the _____.

_____ 5. If work is seized by the drill, you should (without endangering yourself) immediately turn the power _____.

Forge

Safety Instructions

1. Obtain permission from your teacher before lighting gas forge.
2. Clear area of all flammable material.
3. Keep area well ventilated.
4. Make sure no one but you is in operator's zone.
5. Light gas forge by following this procedure:
   a. Wear face shield or safety glasses (goggles, spectacles).
   b. Run air for two minutes in unlighted forge.
   c. Turn air off.
   d. Place a lighted piece of paper in the forge.
   e. Create draft by turning on air slowly.
   f. Turn on the gas slowly.
   g. Adjust the flame so that all fire is confined within forge.
6. Handle long and heavy pieces of steel with great care.
7. Use tongs or pliers to handle hot metal.
8. Be careful when carrying hot metal. Warn students who may be in the way. Consider all metal around the furnace as being hot.
9. Mark hot metal with chalk or soapstone with the word "hot" if it is necessary for you to leave your work.
10. Use only tools with safe handles and properly dressed heads.
11. Keep anvil face clear of scraps and flakes of metal.
12. Hammer metal being forged only. *Striking hammer on face of anvil may cause chips of steel to fly.*
13. Stand so that your face is protected when quenching metal.
14. Shut off GAS first and then AIR when you have finished using the forge.
15. Quench hot tongs before putting them away.
16. Clean up working area.

Forge

TM-12

Safety Test Questions

I

( ) 1. Before leaving heated metal unattended, you should use chalk or soapstone to label it with the word "hot" because: (a) someone may be burned if he touches it; (b) other work may be placed on it; (c) you can tell to whom it belongs; or (d) chalk will help cool it.

( ) 2. You should only hammer the metal being forged because striking directly on the face of the anvil may: (a) cause a disturbing sound; (b) damage the hammer; (c) cause chips from the anvil and the hammer to fly and injure someone; or (d) damage the anvil.

( ) 3. You must wear a face shield or safety glasses (goggles, spectacles) when using the forge or hammering on metal because these: (a) are becoming to you; (b) magnify the work, thus making it easier for you to see; (c) protect your eyes from bright light; or (d) protect your eyes from flying particles.

( ) 4. When preparing to light the gas forge, you should *first:* (a) turn on the gas; (b) run air through the forge; (c) place a lighted piece of paper in the forge; or (d) close all vents.

( ) 5. You must cool tongs before placing them on the tool rack so as to prevent: (a) warping of the tongs; (b) burning someone; (c) heating the tool rack; or (d) disorganizing the tool rack.

II

..... 1. Before leaving heated metal unattended, you should use chalk or soapstone to label it with the word: .....

..... 2. You should hold hot metal with pliers or .....

..... 3. In preparing to light a gas forge, you should turn on the air before turning on the .....

..... 4. Before placing tongs on tool rack, you should make sure that they are .....

..... 5. When you finish using the gas forge, you should shut off the gas first and then the .....

Furnace (Bench)

Safety Instructions

1. Obtain permission from your teacher before lighting furnace for soldering.
2. Secure soldering copper in a vise when it is necessary to file tip.
3. See that area is properly ventilated.
4. Light furnace by following this procedure:
   a. Stand to one side of furnace.
   b. Place a lighted piece of paper in the furnace if furnace does not have a pilot light.
   c. Turn on the gas slowly.
   d. Adjust the flame so that all the fire is confined within furnace.
5. Place the soldering copper on the prescribed rest when not in use.
6. Determine heated readiness of a soldering copper by testing it with a piece of solder.
7. Use care in handling heated soldering copper.
8. Select correct flux for soldering job you are planning to do.
9. Stand so that you will be protected from any fumes while tinning a copper or soldering.
10. Use care when wiping off excess solder.
11. Wipe up immediately any spilled flux.
12. Shut off gas when you have finished using soldering furnace.
13. Clean area when you have completed your soldering.

Furnace (Bench)

Safety Test Questions

I

( ) 1. Before lighting the gas furnace, you should make sure: (a) all windows are closed; (b) electric lights are turned on; (c) there is a spare soldering copper; or (d) the area is properly ventilated.

( ) 2. When lighting the gas furnace, you should: (a) close all vents; (b) stand to one side; (c) immediately turn on gas full force; or (d) preheat furnace before turning on gas.

( ) 3. In passing a soldering copper to another person, you should: (a) hand it to him point first; (b) grasp it by the middle so that he can take hold of the handle; (c) place it on a rest or in the furnace so that he can pick it up; or (d) wrap a cloth around it so neither of you will be burned.

( ) 4. You should always pick up a soldering copper: (a) by its handle; (b) only when it it hot; (c) only when it is cold; or (d) by its shank.

( ) 5. To determine whether a soldering copper is hot enough to use, you should: (a) test with a piece of solder; (b) dip in water; (c) hold close to face; or (d) look at the flame.

II

_____ 1. When lighting the gas furnace, you should stand to one _____.

_____ 2. You should always pick up a soldering copper by its _____.

_____ 3. When the soldering copper is not in use, you should place it in the furnace or on the _____.

_____ 4. You should determine the heated readiness of a soldering copper by testing it with a piece of _____.

Furnace (Crucible)

TM-15

Safety Instructions

1. Use caution in handling tools, castings, or other metal in the foundry area, as they may be hot.
2. Obtain approval from your teacher before closing a mold.
3. Keep molds covered until ready for pouring.
4. Obtain permission from your teacher before lighting gas furnace.
5. Keep all flammable material away from the working area.
6. Light gas furnace by following this procedure:
   a. Wear face shield or safety glasses (goggles, spectacles).
   b. Run air for two minutes in unlighted furnace.
   c. Turn off air.
   d. Place a lighted piece of paper in the furnace.
   e. Create draft by turning on air slowly.
   f. Turn on the gas slowly.
   g. Adjust the flame so that all fire is confined within furnace.
7. Preheat metal to remove moisture before placing in a crucible containing any molten metal.
8. Preheat skimmer before using.
9. Keep moisture away from molten metal, because it might explode.
10. Shut off GAS first and then AIR when you have finished using the furnace.
11. Wear face shield or safety glasses (goggles, spectacles), gloves, and protective covering for the feet when handling ladles or crucibles of molten metal.
12. Move with care and carry molten metal close to the floor to reduce possible dangers.
13. Have mold on floor when pouring metal.
14. Stand so that your face is protected when pouring metal.
15. Allow casting to cool before breaking it out of mold.
16. Clean working area.

Furnace (Crucible) TM-16

Safety Test Questions

I

( ) 1. If water comes in contact with molten metal, it will: (a) discolor the material; (b) cause an offensive odor; (c) cause an explosion; or (d) make the material nonmetallic.

( ) 2. When preparing to light the gas furnace, you should *first:* (a) turn on the gas; (b) run air through the furnace; (c) place a lighted piece of paper in the furnace; or (d) close all vents.

( ) 3. You must wear a face shield or safety glasses (goggles, spectacles) when you handle ladles or crucibles of molten metal because these: (a) are becoming to you; (b) magnify the work, thus making it easier for you to see; (c) protect your eyes from bright light; or (d) protect your eyes from metal that may splatter.

( ) 4. When pouring metal, you should have the mold placed: (a) on the bench; (b) on the floor; (c) even with your waist; or (d) even with your shoulders.

( ) 5. You should preheat metal before placing it in a crucible containing any molten metal so as to remove: (a) moisture; (b) impurities; (c) oxides; or (d) carbon.

II

_____ 1. In preparing to light a gas furnace, you should turn on the air before turning on the _____.

_____ 2. When you have finished using the furnace, you should shut off the gas first and then the _____.

_____ 3. If water comes in contact with molten metal, it will cause an _____.

_____ 4. When pouring metal, you should have the mold placed on the _____.

_____ 5. You should preheat metal before placing it in a crucible containing any molten metal so as to remove _____.

Grinder

TM-17

Safety Instructions

1. Obtain permission from your teacher before using grinder.
2. Set tool rest 1/16 in. to 1/8 in. from the wheel.
3. Dress wheel when necessary.
4. See that guard is in place.
5. Make sure that no one but you is inside the operator's zone.
6. Wear face shield or safety glasses (goggles, spectacles) and use glass safety guard on grinder.
7. Stand to one side of wheel.
8. Turn on power after permission is given.
9. Keep hands away from the wheel while it is in motion.
10. Hold work with your hands. Ask your teacher for special instructions and permission to grind small pieces.
11. Use the face of the wheel only.
12. Press material against wheel with correct amount of pressure.
13. Keep work in motion across face of wheel.
14. Turn off power after using grinder.
15. Keep clothing, rags,hair, from moving wheel gloves.

Grinder

Safety Test Questions

I

( ) 1. You must wear a face shield or safety glasses (goggles, spectacles) when using grinder because these: (a) are becoming to you; (b) magnify the work, thus making it easier for you to see; (c) protect your eyes from bright light; or (d) protect your eyes from flying particles.

( ) 2. The grinder tool rest must be securely fastened: (a) immediately after grinder is turned on; (b) 1 in. away from wheel; (c) when wheel is not in motion; or (d) after power is turned off and the wheel is coasting.

( ) 3. You should set grinder tool rest: (a) ¼ in. away from wheel; (b) so wheel rubs lightly against tool rest; (c) ½ in. away from wheel; or (d) no more than ⅛ in. from wheel.

( ) 4. To grind small pieces of stock, you should: (a) hold them in your bare hands; (b) hold them with a rag; (c) use a very coarse wheel; or (d) receive special instruction and permission from your teacher.

( ) 5. You should stand to one side of grinding wheel while it is gathering speed because: (a) if it has a defect, the wheel may fly to pieces; (b) the air currents from wheel are unhealthful; (c) it will tempt you to use the wheel too soon and cause it to stop; or (d) you can see if the wheel is running true.

II

_____ 1. You must wear a face shield or safety glasses (goggles, spectacles) when using the grinder because these will protect your _____.

_____ 2. The grinder tool rest should be set away from grinding wheel no more than _____ inch.

_____ 3. When using the grinder, you should keep your hands away from the _____.

_____ 4. To grind small pieces of stock, you should obtain special permission from the _____.

_____ 5. When starting the grinder, you should stand to one _____.

Lathe (Metalworking)

TM-19

Safety Instructions

General Turning Instructions

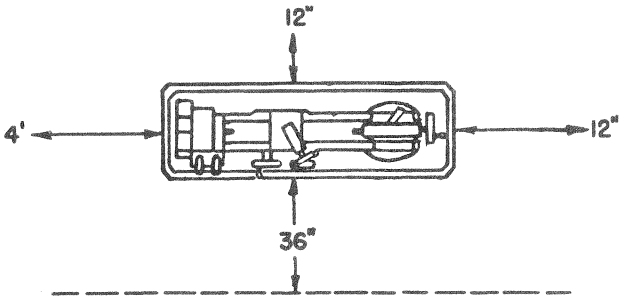
1. Obtain permission from your teacher before using the lathe.
2. Roll sleeves above elbows and remove or fasten any loose clothing.
3. Make all adjustments only when machine is at a dead stop.
4. Check to see that all guards are in place.
5. Be sure that all parts of the carriage will clear any rotating part during full length of cut.
6. *Remove chuck key or wrench immediately after using.*
7. Set tool on center of work to be turned.
8. Wear a face shield or safety glasses (goggles, spectacles).
9. Make sure that no one but you is inside the operator's zone.
10. Turn on power after permission is given.
11. Place your hands on the controls or at your sides except when filing or polishing.
12. Keep hands away from chips.
13. Finish your cuts that are close to chuck or against a shoulder by hand feed.
14. Bring lathe to a complete stop before reversing.
15. Remove toolholder and tool post before filing or polishing.
16. Shut off power after using lathe and stand by until the machine has stopped.
17. Clean machine and area.

Between-Centers Turning Instructions

1. Use safety dog to drive work.
2. Clamp tailstock securely.
3. Adjust and lubricate the tailstock center.
4. Regulate depth of cut according to size and type of metal.
5. Use tools that are properly ground for the particular job.

Chuck and Faceplate Turning Instructions

1. Place a board under chuck when threading it on or off spindle. Keep your fingers clear.
2. Secure work firmly in chuck.
3. *Remove chuck key or wrench immediately after using it.*
4. Counterbalance work on the faceplate if it is irregular in shape.
5. Turn chuck or faceplate by hand through one complete cycle to make sure work is clear.
6. Regulate depth of cut according to size and type of metal.
7. Stand to one side of revolving faceplate.
8. Stop power feed before tool reaches jaws of chuck.



MINIMUM SPACE REQUIREMENTS FOR METAL LATHE
Aisles, if necessary, should be outside this allocated space.

Lathe (Metalworking)

Safety Test Questions

I

( ) 1. Measurements should be made when the lathe is at a dead stop so as to: (a) avoid damaging measuring tool; (b) prevent measuring instrument from getting caught and flying out; (c) make faster measurements; or (d) keep chuck tight.

( ) 2. When the lathe chuck or faceplate has been removed from the lathe, you should place it: (a) on the ways; (b) in such a manner that it will not roll and fall onto the floor; (c) on the carriage; or (d) in the chip pan.

( ) 3. Before cleaning your work with a rag, be sure the lathe is: (a) operating slowly; (b) rotating in reverse; (c) at a dead stop; or (d) revolving at full speed.

( ) 4. To prevent the possibility of the chuck key or wrench from flying out of the lathe chuck, you should: (a) operate the lathe at low speed; (b) tighten the chuck; (c) remove the key or wrench immediately after using; or (d) use a key or wrench that fits securely.

( ) 5. Lathe chips are: (a) cool when the lathe is operating slowly; (b) cut from aluminum and brass only; (c) likely to burn and cut if you grasp them; or (d) safe to handle.

II

..... 1. Shifting gears and changing levers on the lathe should only be done when the machine is .....

..... 2. Before starting the lathe, you should see that it turns freely by rotating it by .....

..... 3. When making cuts where flying chips are a hazard, you must wear .....

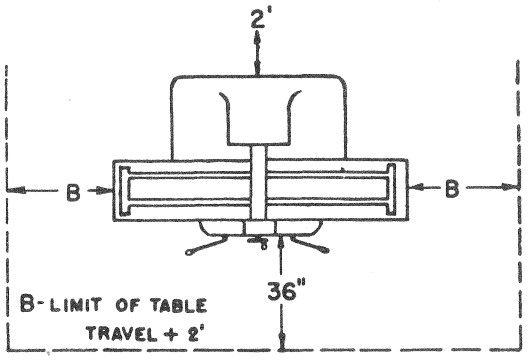
..... 4. Before filing or polishing, the toolholder and tool post should be .....

..... 5. You should remove the chuck key or wrench from the lathe chuck immediately after .....

Milling Machine

Safety Instructions

1. Obtain permission from your teacher before using milling machine.
2. Make adjustments or setup only when machine is at a dead stop. Check with the teacher.
3. Use correct fitting wrenches on machine parts.
4. Handle all cutters carefully.
5. Select proper cutter; be sure it is sharp.
6. Use only a soft hammer or mallet to seat work against the parallels or bottom of vise.
7. Be sure that job is securely fastened.
8. Make certain that work, milling machine table, and any holding device will clear arbor and support during cut.
9. Set machine for proper depth of cut.
10. Select correct feed.
11. Disengage handles when automatic feed is to be used or table is to be locked.
12. Make sure no one but you is inside the operator's zone.
13. Stand to one side of machine.
14. Turn on power after permission is given.
15. Be sure that cutter is turning in proper direction.
16. Feed against or opposite to direction of rotation of cutter.
17. Use a brush to remove chips from work when machine is at rest.
18. Keep floor clean around milling machine.
19. Turn off power after using milling machine and stand by until the machine has stopped.
20. Release all automatic feeds.
21. Clean machine and area with a brush.



MINIMUM SPACE REQUIREMENTS FOR HORIZONTAL MILLING MACHINE
Aisles, if necessary, should be outside this allocated space.

Milling Machine

TM-22

Safety Test Questions

I

( ) 1. You should check all attachments and clamps on the milling machine for tightness before: (a) turning on the power; (b) oiling the machine; (c) changing the spindle speeds; or (d) turning off the automatic feed.

( ) 2. When cutter of milling machine is revolving: (a) clean the table; (b) oil the bearings; (c) clean the arbor with a cloth; or (d) stand to one side of machine.

( ) 3. The best way to remove metal cuttings or chips from your work is to use: (a) your hand ;(b) a clean rag; (c) a brush; or (d) a tool.

( ) 4. Striking a mill cutter with a steel hammer may: (a) cause pieces of steel to fly; (b) break the cutter; (c) damage the arbor; or (d) damage the hammer.

( ) 5. When you have finished using the milling machine, you should: (a) speed up all clutches and feeds; (b) seat work against the parallels; (c) release all automatic feeds; or (d) select proper cutter.

II

..... 1. You should check all attachments and clamps on the milling machine before turning on the .....

..... 2. When milling machine cutter is revolving, you should stand to one .....

..... 3. The best way to remove metal cuttings or chips from your work is to use a .....

..... 4. When you have finished using the milling machine, all automatic feeds should be .....

..... 5. You should make adjustments or setup only when milling machine is .....

Planer (Metalworking)

Safety Instructions

1. Obtain permission from your teacher before using planer.
2. Make adjustments or setup only when machine is at a dead stop.
3. Secure work firmly in the machine.
4. Select proper tool for the job.
5. Set machine for proper depth of cut.
6. Make sure that work clears cross rail and sides of machine.
7. See that stops are set for controlling the movement of table.
8. Make sure no one but you is inside the operator's zone.
9. Protect your eyes with a face shield or safety glasses (goggles, spectacles).
10. Check to see that lever is in neutral position before starting the motor.
11. Turn on power after permission is given.
12. Keep your hands away from cutting tool and line of travel of moving parts of machine.
13. Turn off power after using planer and stand by until the machine has stopped.
14. Clean machine and area with a brush.

Planer (Metalworking) TM-24

Safety Test Questions

I

( ) 1. When setting up a job on the planer, be certain: (a) there are no chips on the table; (b) your work is securely fastened on the table; (c) the platen travels at least 6 in.; or (d) the machine is in gear.

( ) 2. Before starting the planer, you should make sure the work will clear the: (a) starting lever; (b) operator; (c) table; or (d) cross rails and sides of machine.

( ) 3. When operating the planer, you should: (a) oil the machine; (b) sweep the chips from the floor immediately; (c) wear a face shield or safety glasses; or (d) increase the cutting speed.

( ) 4. You should use a file to remove sharp burrs and corners from your work so as to: (a) prevent work from being marred; (b) avoid tearing your clothes; (c) prevent your fingers from being cut; or (d) speed up production.

( ) 5. When the planer is in motion, you should: (a) lean on the cross rail; (b) sit nearby and watch; (c) stop the table each time it returns; or (d) keep your hands away from the work.

II

_____ 1. In setting up a job on the planer, you should be certain that your work is securely _____.

_____ 2. Before starting the planer, you should make sure the work clears the sides of machine and the cross _____.

_____ 3. When operating the planer, you should wear a face shield or _____.

_____ 4. When the planer is in motion, you should stand to one _____.

_____ 5. Sharp burrs and corners should be removed from your work with a _____.

Portable Electric Drill

Safety Instructions

1. Obtain permission from your teacher before using portable electric drill.
2. Select proper drill (be sure it is sharp) and coolant.
3. Make sure switch is in an "off" position.
4. Remove chuck key immediately after using it.
5. See that a grounded wire is connected to the portable electric drill.
6. Keep drill, electric cord, and plug dry at all times.
7. Plug in electric cord.
8. Hold the machine firmly.
9. Turn on power after permission is given.
10. Keep hands away from revolving spindle and drill.
11. Apply straight and steady pressure on the drill.
12. Ease up on pressure just before drill begins to break through material.
13. Back drill out as soon as hole is drilled.
14. Turn off power and hold machine firmly until it comes to a dead stop—then rest machine on its side.
15. Disconnect electric cord. Clean and return machine to designated place.

Portable Electric Drill

Safety Test Questions

I

( ) 1. You should select a location that is dry and not grounded for using a portable electric tool or appliance so as to avoid: (a) soiling the equipment; (b) serious electric shock; (c) motor bearings deterioration; or (d) discoloring the electric cord.

( ) 2. By removing the chuck key from the drill chuck before turning on the power, you will prevent the: (a) chuck from being damaged; (b) drill from breaking; (c) chuck key from being thrown out at a terrific speed; or (d) chuck from becoming unbalanced.

( ) 3. Before plugging in the portable electric drill, you should: (a) remove the drill; (b) check the armature; (c) make sure the switch is off; or (d) disconnect the ground wire.

( ) 4. When you turn off the switch on the portable electric drill, you should: (a) disconnect electric cord; (b) inspect rotor; (c) blow the sawdust out of the armature opening; or (d) hold the machine firmly until it comes to a dead stop.

II

..... 1. You should select a location that is dry and not grounded for using a portable electric tool or appliance so as to avoid serious electric .....

.....

..... 2. Be sure to remove the chuck key from the drill chuck before you turn the power .....

..... 3. Before plugging in the electric drill, you should make certain the switch is .....

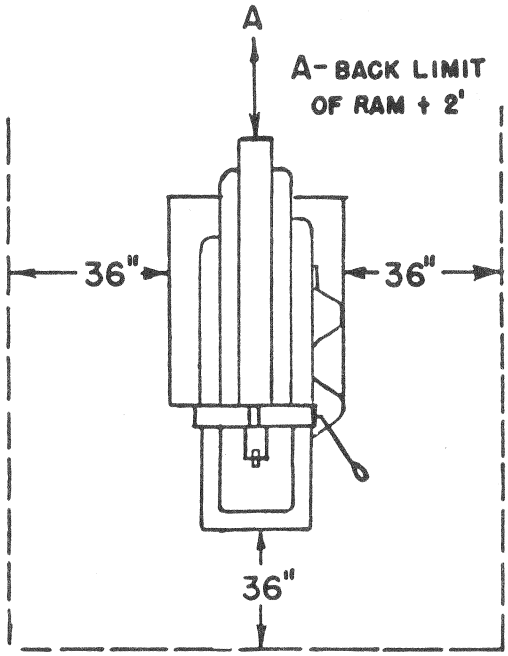
..... 4. When you turn off the switch on the portable electric drill, you should hold the machine firmly until it comes to a .....

Shaper (Metalworking)

TM-27

Safety Instructions

1. Obtain permission from your teacher before using shaper.
2. Make adjustments or setup only when machine is at a dead stop.
3. Use soft hammer or mallet to set work on the parallels.
4. Secure work firmly in the machine.
5. Select proper tool for the job.
6. Set machine for proper depth of cut.
7. Be sure that ram and head will clear your work and any holding device.
8. Make sure no one but you is inside the operator's zone.
9. Protect your eyes with a face shield or safety glasses (goggles, spectacles).
10. Check to see that lever is in neutral position before starting the motor.
11. Stand to one side of machine.
12. Turn on power after permission is given.
13. Keep your hands away from cutting tool and line of travel of all moving parts.
14. Turn off power after using shaper, and stand by until the machine has stopped.
15. Clean machine and area with a brush.



MINIMUM SPACE REQUIREMENTS FOR METAL SHAPER

Aisles, if necessary, should be outside this allocated space.

TM-28

Shaper (Metalworking)

Safety Test Questions

I

( ) 1. When setting up a job on the shaper, be certain: (a) there are no chips on the vise; (b) your work is securely fastened in the machine; (c) the stroke of the ram is at least 3 in. long; or (d) the machine is in gear.

( ) 2. Before starting the shaper, you should make sure the ram and head will clear the: (a) starting lever; (b) ram clamp; (c) operator; or (d) work and holding device.

( ) 3. When operating a shaper, you should: (a) oil the machine; (b) sweep the chips from the floor immediately; (c) wear a face shield or safety glasses; or (d) increase the cutting speed.

( ) 4. You should use a file to remove sharp burrs and corners from your work so as to: (a) prevent work from being marred; (b) avoid tearing your clothes; (c) prevent your fingers from being cut; or (d) speed up production.

( ) 5. When the shaper is in motion, you should: (a) lean on the ram; (b) sit nearby and watch; (c) raise the tool holder on each back stroke; or (d) keep your hands away from the work.

II

_____ 1. In setting up a job on the shaper, you should be certain that your work is securely _____.

_____ 2. Before starting the shaper, you should make sure the ram and head clear your _____.

_____ 3. When operating a shaper, you should wear a face shield or _____.

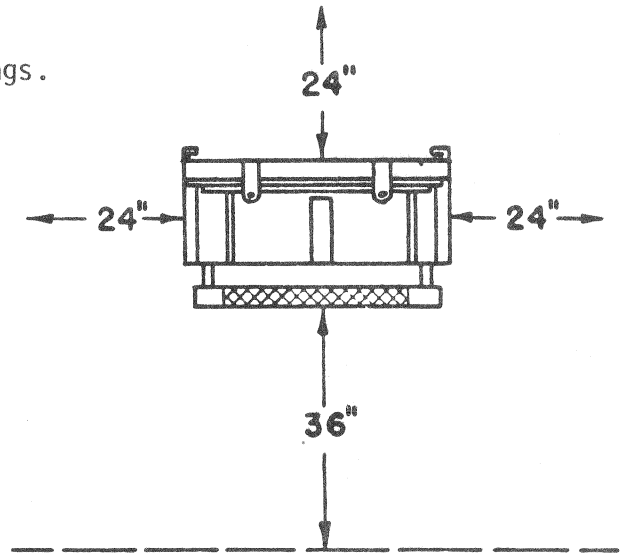
_____ 4. When the shaper is in motion, you should stand to one _____.

_____ 5. Sharp burrs and corners should be removed from your work with a _____.

Shear

Safety Instructions

1. Obtain permission from your teacher before using the shear.
2. See that guards are in place.
3. Follow manufacturer's specifications as to gauge of sheet metal that can be safely cut.
4. Cut narrow strips of metal crosswise only.
5. Make sure that no one but you is inside the operator's zone.
6. Stand directly in front of machine.
7. Feed pieces of metal into shear from front (operator's position).
8. Keep your fingers away from clamp and blade.
9. Hold stock securely against guide.
10. Make sure the foot that is not being used to operate treadle is clear before pushing down on treadle.
11. Regulate pressure on treadle according to gauge and type of stock. Keep foot on treadle to ease its return to normal position.
12. Allow small pieces of metal being cut to drop to the floor or into a container.
13. Use care when picking up trimmings.
14. Cut only single pieces of metal.



MINIMUM SPACE REQUIREMENTS FOR SQUARING SHEAR
Aisles, if necessary, should be outside this allocated space.

Shear

Safety Test Questions

I

( ) 1. The shear must be operated by: (a) several students at once; (b) an advanced student and the shop foreman; (c) one student and a helper; or (d) only one person at a time.

( ) 2. You should make sure that the foot that is *not* being used to operate the foot treadle of the shear is kept: (a) on the treadle; (b) under the treadle; (c) clear of the treadle; or (d) away from the floor.

( ) 3. When using a shear, you should keep your fingers: (a) near the clamp and blade; (b) under the clamp and blade; (c) away from the clamp and blade; or (d) between the clamp and blade.

( ) 4. After pushing down on the shear's treadle for a cut, you should allow the treadle to: (a) stay down; (b) return to its normal position as fast as possible; (c) return only part way; or (d) return slowly to its normal position.

II

..... 1. The shear must be operated by only one .....

..... 2. You should make sure that the foot that is *not* being used to operate the foot treadle is clear of the .....

..... 3. When using the shear, you should keep your fingers away from the clamp and .....

..... 4. After pushing down on the shear's treadle for a cut, you should allow the treadle to return to its normal position .....

Welder Oxygen-Acetylene

TM-31

Safety Instructions

1. Obtain permission from your teacher before using welding equipment.
2. Fasten cylinders with a chain or other suitable device as a protection against falling or rolling.
3. Close cylinder valve and replace protective cover before moving cylinder.
4. Keep welding equipment free of oil and grease. Use only clean rags for wiping off welding equipment.
5. Inspect hose before using.
6. Make sure that hose is properly connected and that all connections are tight.
7. Report any leaking of cylinders or connections to teacher immediately.
8. Make sure you have ample ventilation.
9. Keep all flammable material away from working area.
10. Be sure that you wear welding goggles. All assistants and observers must also wear welding goggles.
11. Release regulator pressure screw. Open cylinder valves gradually.
12. Open acetylene cylinder valve one-fourth turns. Keep wrench in place so that valve may be shut off quickly if necessary.
13. Keep acetylene pressure in the hose below 15 pounds per square inch.
14. Use a friction torch lighter to ignite torch.
15. Close acetylene valve first if torch backfires.
16. Make certain lighted torch always points away from yourself and other students.
17. Keep sparks and flame away from cylinders.
18. Close cylinder valves when you have finished your welding job.
19. Quench section of metal that has been welded or mark with chalk or soapstone the word "hot" on the metal if it is necessary for you to leave your work.
20. Open oxygen cylinder valve all the way.

TM-32

Welder Oxygen-Acetylene

Safety Test Questions

Oxygen-Acetylene Welding

I

( ) 1. You should make sure welding equipment is: (a) lubricated with oil; (b) tightened by hand; (c) kept free of oil and grease; or (d) lubricated weekly.

( ) 2. Welding goggles are worn because they: (a) magnify your work; (b) protect your eyes from dust; (c) help you concentrate on your work; or (d) protect your eyes against heat, rays, and sparks.

( ) 3. The valve on a cylinder of acetylene should be opened: (a) with a pair of pliers; (b) three full turns; (c) one-fourth turn or (d) as many turns as possible.

( ) 4. When you light a welding torch, you should use a: (a) friction torch lighter; (b) match; (c) fluid lighter; or (d) piece of lighted paper.

( ) 5. If a welding torch backfires, you should: (a) dip the torch in water; (b) inspect the hose; (c) hang an out-of-order sign on equipment; or (d) close the acetylene valve first.

II

_____ 1. Before moving a cylinder, you should close the valve and replace _____.

_____ 2. You should report any leaking of cylinders or connections immediately to the _____.

_____ 3. You should keep the acetylene pressure in the hose below _____ pounds per square inch.

_____ 4. The valve on a cylinder of acetylene should be opened not more than _____ turns.

_____ 5. Anyone watching a welding flame must wear welding _____.

Electric Welder

Safety Instructions

1. Obtain permission from your teacher before using welding equipment.

2. Wear a helmet with proper observation window, treated gauntlet gloves, and treated leather apron. All assistants and observers must also wear this equipment.

3. Keep your sleeves and pants cuffs rolled down. Wear leather jacket.

4. Make sure electric welding is done only in a correctly constructed booth or room or behind proper screens.

5. Be sure there is ample ventilation.

6. Keep all flammable material away from working area.

7. See that floor area is clear of all obstructions.

8. Report to your teacher at once if electrode holder, holder cable connection, cable or cable terminals at the welding machine, ground clamp, lugs, or cable get hot.

9. Turn off welder and hang up electric holder when work is being changed or when work has been completed.

10. Welding helmet lense should be shade number 10 or 11, and in good condition.

11. Electric are rays;will burn the skin and damage the eyes, so you must wear protective clothing and helmet.

Electric Welder

Safety Test Questions

Electric Welding

I

( ) 1. If observation window in your welding helmet is cracked, it will: (a) allow dust to pass through it; (b) obstruct your view; (c) transmit infrared and ultraviolet rays; or (d) rattle every time the helmet is flipped up.

( ) 2. When you are through using the electrode holder, you should: (a) place it on a metal workbench; (b) clamp it on the metal frame of the workbench; (c) rest it on the floor; or (d) suspend it so that it will not touch any metal.

( ) 3. If a cable or the electrode holder overheats, you should: (a) notify your teacher; (b) turn the voltage down; (c) stop welding and wait until it cools; or (d) change the electrode holder.

( ) 4. You should always draw the curtains on the welding booth before you strike an arc so as to: (a) protect your eyes from the infrared and ultraviolet rays; (b) keep the work from getting cool; (c) prevent anyone from noticing any mistakes; or (d) protect anyone nearby from the infrared and ultraviolet rays.

( ) 5. Before leaving heated metal unattended, you should use chalk or soapstone to label it with the word "hot" because: (a) someone may be burned if he touches it; (b) other work may be placed on it; (c) you can tell to whom it belongs; or (d) chalk will help cool it.

II

..... 1. For eye protection against infrared and ultraviolet rays, you must wear a welding .....

..... 2. If a cable or the electrode holder overheats, you should notify the .....

..... 3. When chipping slag, you must wear .....

..... 4. Arc welding should be done only behind proper screens or in a .....

..... 5. If your skin is exposed to electric arc rays, you will be .....

Band Saw

TM-35

Safety Instructions

1. Obtain permission from your teacher before using the band saw.
2. Plan sawing procedure so there may be a maximum forward feed with a minimum of backing out of cuts.
3. Cut only stock with a flat surface.
4. Make sure the proper width saw is on the machine for your particular job.
5. Check to see that all guards are in place.
6. Make adjustments only when machine is at a dead stop.
7. Set upper saw guide ¼ in. or less above the stock to be cut; check with teacher if stock is rough or warped.
8. Ask your teacher to approve all special setups.
9. Make sure that no one but you is inside the operator's zone.
10. Wear face shield or safety glasses (goggles, spectacles).
11. Turn on power after permission is given.
12. Hold material firmly.
13. Keep fingers a safe distance from saw blade.
14. Feed material into machine at a moderate rate of speed.
15. Keep saw blade from twisting or binding when cutting curves.
16. Allow machine to come to a dead stop before backing saw out of a long cut.
17. Keep waste from accumulating on the saw table.
18. Step away immediately if the saw breaks or comes off. Shut off power if possible without endangering self. Notify your teacher.
19. Turn off power after using band saw (use brake if provided) and stand by until machine has stopped.
20. Clear away scraps of wood on the table only after saw stops running.
21. Make sure the proper blade is in the machine for cutting metal or cutting wood.

Band Saw

Safety Test Questions

I

( ) 1. You should make all adjustments on the band saw: (a) only when the machine is at a dead stop; (b) more than ½ in. above the stock; (c) while the machine is coasting; or (d) only when the power is on.

( ) 2. It is best to set upper saw guide of the band saw: (a) when the power is off and the saw is coasting; (b) ¼ in. or less above the stock; (c) tight against the stock; or (d) ½ in. or more above stock.

( ) 3. You should plan your sawing procedure on the band saw so that: (a) small curves can be cut easily with wide blades; (b) there will be a maximum forward feed with a minimum of backing out of cuts; (c) there will be little scrap left on the table; or (d) back-outs can be made after each ½ in. of forward feed.

( ) 4. When it becomes necessary to back out stock from a long cut on the band saw, you should: (a) carefully back the stock away while the blade is in motion; (b) stop the machine, then back out the stock; (c) try to turn the stock on the table; or (d) continue to saw forward.

( ) 5. If the band saw blade breaks or comes off, you should: (a) call another student to shut off the power; (b) back your stock away from the blade immediately so as to avoid damage to your work; (c) continue cutting until the blade comes to a stop; or (d) step away immediately, shut off power (without endangering yourself), and then notify your teacher.

II

..... 1. You should make adjustments on the band saw only when the machine is .....

..... 2. The proper height at which to set the band saw's upper guide above the stock being cut is ..... inch or less.

..... 3. You should plan your sawing procedure on the band saw so that you will have a maximum of forward .....

..... 4. Before backing out stock from a long cut on band saw, you should allow the machine to come to a complete .....

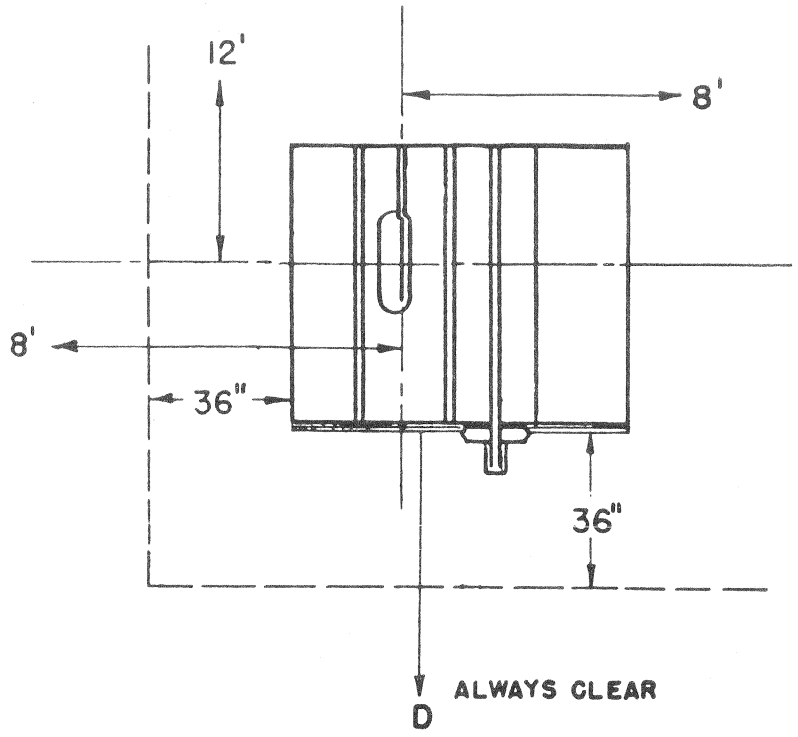
..... 5. If the blade breaks or comes off while you are operating the band saw, you should, without endangering yourself, turn the power .....

Circular Saw

TM-37

Safety Instructions

1. Obtain permission from your teacher before using the circular saw.
2. Be sure that all lumber is free from loose knots, nails, sand, or paint.
3. Select and install proper saw blade for ripping material or cutting across the grain. Make sure blade is sharp and free of cracks or other defects.
4. Make adjustments only when the machine is at a dead stop.
5. Limit saw blade extension to ⅛ in. or less above the stock being cut.
6. See that all guards and other safety devices are in their proper position.
7. Ask your teacher to approve all special setups and dado heads.
8. Use ripping fence or cutoff gauge when cutting material. See that a cutoff board is properly mounted on cutoff gauge.
9. Fasten a clearance block to ripping fence when multiple cutting stock to length—when ripping fence is used as gauge.
10. Use a holding jig or a method of clamping for cutting cylindrical stock. Check with your teacher.
11. Be certain there is an adequate number of proper push sticks immediately available.
12. Make sure that no one but you is inside the operator's zone.
13. Stand to one side of the line of the saw.
14. Wear face shield or safety glasses (goggles, spectacles).
15. Turn on power after permission is given.
16. Keep fingers clear of path to the saw blade.
17. Stop saw and move out of operating zone before responding to anyone trying to attract your attention.
18. Use approved push stick when ripping narrow pieces of stock.
19. Feed stock only as fast as the saw will freely cut.
20. Push the stock by yourself.
21. Make certain that a helper tailing off only supports the material.
22. Turn off power after using circular saw and stand by until the machine has stopped.
23. Clear away scraps of wood on the table only after saw stops running.
24. Reset saw adjustments to a normal position when completing an operation requiring a special setup.



MINIMUM SPACE REQUIREMENTS FOR CIRCULAR SAW

Aisles, if necessary, should be outside this allocated space. Area (following arrow "D") should be clear all the way to a wall or protective shield.

Circular Saw

Safety Test Questions

I

( ) 1. The guard must always be in place over the saw blade of the circular saw except when: (a) cutting stock with a thickness of more than 1 in.; (b) short pieces tend to catch under the guard; (c) using a thick blade; or (d) your teacher has authorized its removal for special setups.

( ) 2. All adjustments on the circular saw are made: (a) while the machine is coasting; (b) by the shop foreman; (c) while the machine is at a dead stop; or (d) while the power is on.

( ) 3. You should limit the extension of the circular saw blade above the stock being cut to: (a) 1 in.; (b) ¼ in.; (c) ⅛ in.; or (d) ½ in.

( ) 4. When tailing off on the circular saw, the helper must: (a) support stock from underneath but not grasp it; (b) pick up all tailings that might cause an accident; (c) use a brush when cleaning up tailings; or (d) hold the stock and pull gently.

( ) 5. You should use a push stick when operating the circular saw to: (a) rip short and narrow pieces of stock; (b) adjust the saw; (c) turn on the power; or (d) remove scraps.

II

_____ 1. Adjustments on the circular saw are made only when the saw blade has _____.

_____ 2. Dadoing and tilting the arbor are special setups; therefore, you must obtain the approval of your _____.

_____ 3. To avoid being hit by flying material, you should stand to one side of the line of the saw _____.

_____ 4. You should limit the extension of the circular saw blade above your work to _____ inch.

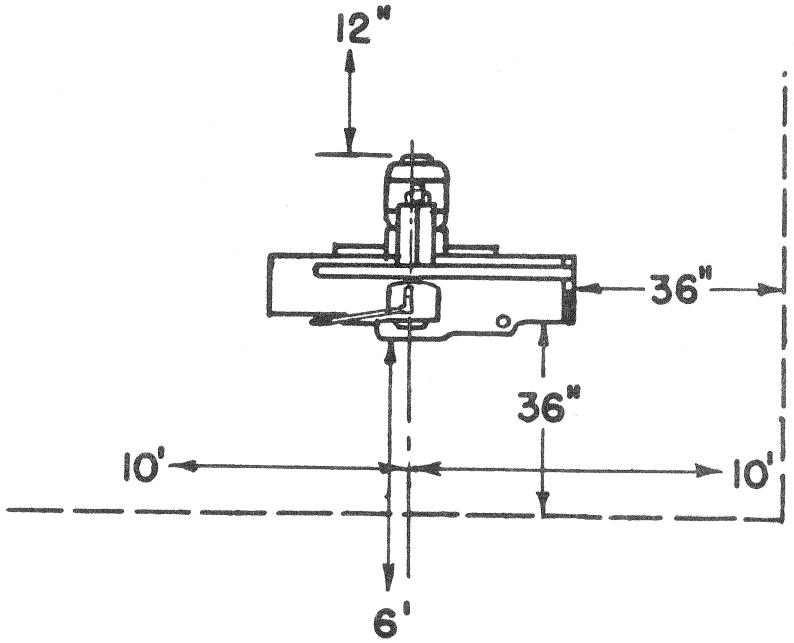
_____ 5. It is best to use a push stick when ripping pieces of stock on the circular saw if they are short or _____.

Jointer

TM-39

Safety Instructions

1. Obtain permission from your teacher before using jointer.
2. Use only clean lumber.
3. Inspect all wood for checks, loose knots, nails, or other defects.
4. Make sure that only stock 12 in. or longer is used on the jointer.
5. Clamp fence firmly.
6. See that guard is in place over the knives.
7. Make adjustments only when machine is at a dead stop.
8. Limit cuts to 1/8 in. or less.
9. Ask your teacher to approve all setups involving stop-cuts, beveling, tapering, or rabbeting.
10. Make sure that no one but you is inside the operator's zone.
11. Wear face shield or safety glasses (goggles, spectacles).
12. Turn on power after permission is given.
13. Keep hands at a safe distance from the revolving head.
14. Use an approved push stick whenever possible.
15. Whenever possible, allow two fingers of the right hand to ride along top of fence when push stick is not being used.
16. Feed the stock slowly; consider the grain.
17. Push the stock far enough past the knives so that the guard will return before picking up the stock.
18. Turn off power after using jointer and stand by until the machine has stopped.
19. Do not adjust the rear or outfeed table, only adjust the front table.



MINIMUM SPACE REQUIREMENTS FOR JOINTER
Aisles, if necessary, should be outside this allocated space.

Jointer

TM-40

Safety Test Questions

I

( ) 1. The jointer is used for smoothing: (a) painted stock; (b) lumber containing knots or cracks; (c) warped stock; or (d) clean lumber.

( ) 2. In adjusting the depth of cut on the jointer, you should limit cut to: (a) 1/16 in.; (b) 1/8 in.; (c) 1/4 in.; or (d) 3/16 in.

( ) 3. The shortest length of stock that can be safely cut on the jointer is: (a) 6 in.; (b) 4 in.; (c) 18 in.; or (d) 12 in.

( ) 4. When facing stock on the jointer, you should: (a) use an approved push stick whenever possible; (b) remove the guard from over knives; (c) limit depth of cut to 1/2 in.; or (d) feed stock as fast as possible.

( ) 5. Before picking up stock that has been surfaced on the jointer, you should make sure you have pushed the stock far enough past the knives so that the: (a) stock drops clear of the table; (b) outfeed table raises the material above the level of the knives; (c) fence will cover the work; or (d) guard will return over the cutter knives.

II

..... 1. You should make sure the jointer cutter knives are covered by the ..... .

..... 2. In adjusting the depth of cut on the jointer, you should limit cut to ..... inch.

..... 3. The shortest length of stock that can be safely cut on the jointer is ..... inches.

..... 4. The rear or outfeed table of the jointer is preset and needs no further ..... .

Lathe (Woodworking) TM-41

Safety Instructions

1. Obtain permission from your teacher before using lathe.
2. Roll loose sleeves above elbows and remove or fasten any loose clothing.
3. Make sure the stock is free from checks, loose knots, or other defects.
4. Make certain that all glued work is properly glued and dry.
5. Be sure stock is correctly mounted in lathe.
6. Clamp tool rest holder firmly.
7. Be certain tool rest is adjusted correctly.
8. Make adjustments of tool rest only when lathe is at a dead stop.
9. Shift belt on belt-driven lathes (for changes of speed) only when lathe is at a dead stop. Some machines must be in operation; check with teacher.
10. Check sharpness of turning tools and condition of handles.
11. Wear face shield or safety glasses (goggles, spectacles).
12. Start lathe at lowest speed when beginning operation.
13. Stand to one side when power is first turned on.
14. Grasp turning tool firmly with both hands while cutting stock.
15. Hold turning tool firmly against the rest.
16. Keep hands away from stock while it is revolving.
17. Use correct amount of tool pressure against stock.
18. Stop lathe when using inside or outside calipers.
19. Maintain tool rest as close as reasonably possible to the stock by making frequent adjustments.
20. Remove tool rest when sanding and finishing.
21. Use for polishing only a small rag folded into a pad.
22. Shut off power after using lathe and stand by until the machine has stopped.
23. Clean machine.

Spindle Turning Instructions

1. See that centers are properly embedded in the stock.
2. Use oil or beeswax on the dead center.
3. Clamp tailstock firmly in place and tighten screw.
4. Turn spindle (rough stock) one revolution by hand.
5. Start lathe at lowest speed when beginning operation.
6. Rough stock down to cylindrical form before using a higher speed. Maintain correct tool rest adjustment.
7. Govern speed according to the diameter of the work.

Lathe (Woodworking)

TM-41A

Faceplate Turning Instructions

1. Cut stock circular on band saw or scroll saw.
2. Select proper size and style of faceplate.
3. Choose the correct size and number of screws according to design of work.
4. Fasten stock or subbase glued to stock (through paper) to faceplate with screws.
5. Be sure screws are tight.
6. Have teacher check fastenings and adjustments.
7. Keep an accurate check on depth of cut in work to avoid striking screws.
8. Be certain that tool rest adjustment is correct and is correcly maintained.
9. Revolve work once by hand.
10. Use the *lowest* speed when beginning operation.
11. Use correct speed in relation to diameter of stock.
12. Make frequent inspection of screws to be sure they do not loosen.

Lathe (Woodworking)

Safety Test Questions

I

( ) 1. As soon as stock is located between centers for spindle turning, you should: (a) clamp tailstock firmly in place and tighten screw; (b) remove tailstock and mount steady rest on the ways; (c) rotate stock counterclockwise to avoid burning; or (d) have it inspected by another student.

( ) 2. You should make all adjustments of the lathe tool rest: (a) while machine is rotating slowly; (b) after initial cuts are made; (c) when lathe is at a dead stop; or (d) 2 in. below center of stock.

( ) 3. It is best to set lathe tool rest so it is: (a) in slight contact with the stock, thus reducing chatter; (b) below and to right of center; (c) the same width as the lathe tool being used; or (d) ¼ in. or less from the rough stock.

( ) 4. When starting lathe for a beginning operation, you should use: (a) the highest speed; (b) the lowest speed; (c) any belt or gear ratio; or (d) a tool rest with a 3:1 ratio.

( ) 5. You should hold lathe turning tool: (a) to the right of the tool rest; (b) flat on the tailstock; (c) firmly against the tool rest; (d) just above the tailstock.

II

..... 1. Before using the lathe, you should roll loose sleeves above elbows and remove or fasten any loose .....

..... 2. When starting the lathe, you should stand to one .....

..... 3. Tool rest adjustments on the lathe must be made when the machine is .....

..... 4. Prior to starting lathe, you should turn rough stock one revolution by .....

..... 5. Before sanding and finishing on the lathe, you should remove tool .....

Mortiser

TM-43

Safety Instructions

1. Obtain permission from your teacher before using mortiser.
2. Clamp all stock securely on table.
3. Make adjustments only when machine is at a dead stop.
4. Check with your teacher for correct method of installing mortiser bit and chisel.
5. Make adjustments for depth stops and lateral travel.
6. Make sure that no one but you is inside the operator's zone.
7. Wear face shield or safety glasses (goggles, spectacles).
8. Turn on power after permission is given.
9. Keep hands away from chisel when the machine is turned on.
10. Feed chisel only as fast as machine will easily cut.
11. Turn off power immediately if cutting is difficult or the chisel burns. Check with your teacher.
12. Lift bit clear of the mortise before moving table.
13. Turn off power after using mortiser and stand by until machine has stopped.
14. Clean off mortiser table.

Mortiser

TM-44

Safety Test Questions

I

( ) 1. You should make sure the chisel and bit of the mortiser are: (a) sharpened before and after each use; (b) properly aligned; (c) adjusted so that the chisel leads the bit; or (d) cooled after each cut.

( ) 2. It is best that all stock used on the mortiser is: (a) free of warps and checks; (b) big enough to hold with both hands; (c) at least 1 in. thick and 1 ft. long; or (d) securely clamped on the table.

( ) 3. If cutting on the mortiser becomes difficult or the chisel starts to burn, you should: (a) turn off machine and notify the teacher; (b) wax or grease chisel; (c) press harder on the pedal; or (d) release depth stop.

( ) 4. When the mortiser is turned on, you should: (a) adjust for depth of cut; (b) change alignment of chisel and bit; (c) keep away from table; or (d) keep your hands away from bit and chisel.

II

1. You should make sure mortiser bit and chisel are properly _____.

2. Before cutting on the mortiser, you should make sure your work is securely clamped on the _____.

3. If cutting on the mortiser becomes difficult or the chisel starts to burn, you should turn off machine and notify _____.

4. When mortiser is turned on, you should keep your hands away from chisel and _____.

TM-45

Planer (Surfacer)

Safety Instructions

1. Obtain permission from your teacher before using planer.
2. Use only clean lumber.
3. Be sure that all wood is free from loose knots or other defects.
4. See that length of stock is longer than the distance between centers of feed rolls.
5. Make adjustments only when machine is at a dead stop.
6. Adjust cut to measurements taken on thickest part of the board.
7. Limit cuts to $\frac{1}{8}$ in. or less on narrow stock.
8. Limit cuts on wide stock to $\frac{1}{16}$ in. or less.
9. Run thin stock through planer on top of a thick surfaced board.
10. Make sure that no one but you is inside the operators' zone.
11. Wear face shield or safety glasses (goggles, spectacles).
12. Turn on power after permission is given.
13. Stand to one side of planer when machine is in operation.
14. Keep hands away from feed rolls and away from board(s) already gripped by the feed rolls.
15. Turn off power and call your teacher if machine does not seem to operate correctly.
16. Allow material to travel completely through planer before making any additional depth of cut adjustment.
17. Turn off power after using planer and stand by until the machine has stopped.

TM-46

Planer (Surfacer)

Safety Test Questions

I

( ) 1. Stock to be run through the planer must have a minimum length which is: (a) longer than the distance between centers of the feed rolls; (b) determined by the width of the lumber; (c) left up to the decision of the operator; or (d) determined by depth of cut.

( ) 2. When operating the planer, you should stand: (a) behind the machine; (b) in the area marked off for the machine; (c) in front of the machine, provided you have someone to tail off; or (d) in an upright position and to one side of the machine.

( ) 3. You should limit your cuts on the planer to: (a) the amount specified on the depth gauge; (b) 1/8 in. on narrow and medium width stock; (c) three turns of the depth adjustment wheel; or (d) half the width of the board.

( ) 4. When board is gripped by the feed rolls of the planer, you should: (a) push the stock through; (b) readjust depth of cut; (c) increase cutting speed; or (d) keep your hands away from the feed rolls.

( ) 5. If stock jams in the planer or fails to feed, you should: (a) apply more pressure on feed rolls; (b) push the stock through; (c) adjust depth of cut; or (d) turn off power and call your teacher.

II

..... 1. Stock to be run through the planer must be longer than the distance between the centers of the feed .....

..... 2. When operating the planer, you should stand to one .....

..... 3. On narrow or medium width boards, you should limit planer cut to ..... inch.

..... 4. On wide boards, you should limit planer cut to ..... inch.

..... 5. If planer does not seem to operate correctly, you should turn off the power and call the .....

Radial-Arm Saw

Safety Instructions

1. Obtain permission from your teacher before using radial-arm saw.
2. Ask your teacher to approve all special setups.
3. Make sure that no one but you is inside the operator's zone.
4. Wear face shield or safety glasses (goggles, spectacles).
5. Hold stock firmly against fence.
6. Stand to one side and keep hands away from the direction of travel of saw.
7. Feed saw into material only as fast as it will easily cut.
8. Cut only one piece of stock at a time.
9. Use a piece of wood to remove scraps from path of saw blade only when saw is at a dead stop.
10. Turn off power after using radial-arm saw, return saw to beginning position carefully, and stand by until the machine has stopped.
11. Clean working area.

Radial-Arm Saw

TM-48

Safety Test Questions

I

( ) 1. The radial-arm saw is used primarily for: (a) cutting short stock; (b) ripping lumber into smaller strips; (c) crosscutting stock too long for a table saw; or (d) curved cuts that cannot be done on band saw.

( ) 2. In operating the radial-arm saw, you must take great care: (a) not to take too deep a cut, especially with a combination blade; (b) to cut on the line you have intended to follow so as to avoid burning the blade; (c) in feeding material only as fast as it will easily cut; or (d) when ripping lumber into short lengths.

( ) 3. You should remove scraps from the path of the radial-arm saw blade with: (a) your fingers; (b) a tool, such as a rule; (c) an air hose; or (d) a piece of wood only while saw is at a dead stop.

( ) 4. At the completion of each cut, the radial-arm saw blade must be: (a) returned to its position behind the guide fence; (b) removed and placed in its proper place; (c) rotated below guide fence; or (d) left at a point nearest to the operator.

II

..... 1. The type of cutting done on the radial-arm saw is .....

..... 2. You should hold stock firmly against the radial-arm saw .....

..... 3. You should stand to one side and keep your hands away from the direction of travel of the radial-arm saw .....

..... 4. It is best to remove scraps from the path of the radial-arm saw blade with a piece of wood while the saw is .....

Router

Safety Instructions

1. Obtain permission from your teacher before using the router.
2. Fasten stock firmly with vise or clamp.
3. Make adjustments only when electric cord is disconnected from power source.
4. Tighten all bits and cutters with proper wrenches.
5. Ask your teacher to approve setup and adjustments.
6. Be sure that the switch is in an off position and machine is on its side before plugging in electric cord.
7. Wear face shield or safety glasses (goggles, spectacles).
8. Hold the machine firmly.
9. Turn on power after permission is given.
10. Keep hands clear of revolving cutters.
11. Feed the cutter slowly into the material.
12. Turn off power and rest machine on its side when a desired cut has been finished.
13. Disconnect electric cord. Clean and return machine and its parts to designated place.

Router

Safety Test Questions

I

( ) 1. You should select a location that is dry and grounded for using a portable electric tool or appliance so as to avoid: (a) soiling the equipment; (b) serious electric shock; (c) motor bearing deterioration; or (d) discoloring the electric cord.

( ) 2. Prior to using the router, you should: (a) request other students to stay at least ten feet from the area of operation; (b) turn blades by hand; (c) have machine turned on before connecting electric cord; or (d) obtain permission from teacher.

( ) 3. Before changing bits or cutters or making adjustments on the router, you should make sure: (a) the electric cord is disconnected from the power source; (b) other students are at a safe distance; (c) to turn blades by hand; or (d) one hand is free.

( ) 4. When turning on the power to the router, you should: (a) attempt to make as deep a cut as possible; (b) hold the machine firmly with both hands; (c) readjust bits and cutters; or (d) reverse motor rotation.

( ) 5. When cutting with the router, you should: (a) feed the cutter as fast as possible; (b) hold electric cord with one hand; (c) keep hands clear of the revolving cutters; or (d) rest machine on its side.

II

..... 1. You should select a location that is dry and grounded for using a portable electric tool or appliance so as to avoid serious electric .....

..... 2. You should make adjustments on the router only when the electric cord is .....

..... 3. While using the router, you should hold it firmly with both .....

..... 4. It is best to feed the cutter of the router into the material .....

..... 5. When cutting with the router, you should keep your hands clear of the revolving .....

Sander

Safety Instructions

1. Obtain permission from your teacher before using sanding machine.
2. Hold work securely.
3. Make adjustments only when sander is at a dead stop. Portable sander electric cord should be disconnected.
4. Check belt or disc for breaks or tears.
5. Be sure that the switch is in an off position and machine is on its side before plugging in electric cord on a portable sander.
6. Wear face shield or safety glasses (goggles, spectacles).
7. Turn on power after permission is given.
8. Keep fingers away from the abrasive surface on the sander.
9. Sand on downward motion side of disc sander.
10. Use special care in sanding small or irregular pieces. Check with your teacher.
11. Feed stock into the abrasive material at a moderate rate of speed and pressure.
12. Turn off power and rest portable sander on its side while changing position of board.
13. Turn off power after using sander and stand by until the machine has stopped.
14. Disconnect electric cord of portable sander and return cleaned machine to designated place.

Sander

TM-52

Safety Test Questions

I

( ) 1. You should make all adjustments on the portable sander: (a) while the electric cord is disconnected; (b) only when other students are at a safe distance; (c) with one hand; or (d) while it is in gear.

( ) 2. Before you plug in the electric cord of the portable sander, you should be certain: (a) machine is free of sawdust; (b) machine is resting on its abrasive surface; (c) sanding belt or disc has been removed; or (d) switch is turned off and machine is on its side.

( ) 3. When operating a disc sander, you should hold your work against the disc: (a) rim; (b) center; (c) upward motion side; or (d) downward motion side.

( ) 4. While sander is in motion, you should: (a) blow away the sawdust; (b) remove abrasive surface; (c) use extreme feed pressure; or (d) keep your fingers away from abrasive surface.

( ) 5. You should feed stock into the abrasive material of the sander: (a) as fast as possible; (b) at a moderate rate of speed and pressure; (c) both upward and downward; or (d) both forward and backward.

II

_____ 1. You should make adjustments on the portable sander while the electric cord is _____.

_____ 2. When operating a disc sander, you should hold your work on the side where the motion is _____.

_____ 3. While sander is in motion, you should keep your fingers away from the abrasive _____.

_____ 4. You should feed stock into the sanding machine at a moderate rate of speed and _____.

_____ 5. Before plugging in the portable sander, you should make sure the switch is _____.

Scroll Saw

Safety Instructions

1. Obtain permission from your teacher before using the scroll saw.
2. Cut only stock with a flat surface on bottom.
3. Make adjustments only when machine is at a dead stop.
4. Make sure the saw blade is the proper size for the job.
5. Check blade for correct tension.
6. Adjust hold-down so it will be as close as possible to the work.
7. Turn machine by hand to make sure all parts are clear.
8. Make sure that no one but you is inside the operator's zone.
9. Select correct machine speed.
10. Wear face shield or safety glasses (goggles, spectacles).
11. Turn on power after permission is given.
12. Hold material firmly.
13. Feed the material into the machine at a moderate rate of speed.
14. Keep fingers away from saw and hands out of the path of saw.
15. Report mechanical defects or a broken blade to your teacher.
16. Turn off power after using scroll saw and stand by until the machine has stopped.
17. Clear away scraps of wood on the table only after saw stops running.

Scroll Saw

TM-54

Safety Test Questions

I

( ) 1. You should install the scroll saw blade to cut: (a) on the down stroke of the saw; (b) at minimum speed; (c) on the up stroke of the saw; or (d) on both the up and down stroke of the saw.

( ) 2. Before you start the scroll saw, you should check the hold-down adjustment to make certain: (a) there is a half-inch clearance between it and the stock; (b) it is as close as possible to the work; (c) the correct size of blade is installed; or (d) it is against the table.

( ) 3. Prior to starting the scroll saw, you should turn machine by hand to be sure: (a) saw blade teeth point upward; (b) hold-down moves up and down; (c) the beginning cut is on the line marked on stock; or (d) all moving parts are clear.

( ) 4. Stock to be cut on the scroll saw should be: (a) soft; (b) hard; (c) flat on the bottom; or (d) round on the bottom.

( ) 5. You should feed stock into scroll saw: (a) in rhythm with motion of hold-down; (b) at a rate dependent upon pulley speed; (c) as fast as possible; or (d) at a moderate rate of speed.

II

_____ 1. You should install scroll saw blade so it will cut on the _____ stroke.

_____ 2. After installing scroll saw blade, you should check blade for correct _____.

_____ 3. To ensure that all moving parts are clear after making adjustments on the scroll saw, you should turn machine by _____.

_____ 4. Stock to be cut on the scroll saw should have a flat surface on the _____.

Shaper (Woodworking)

Safety Instructions

1. Obtain permission from your teacher before using the shaper.
2. Make sure the stock is free from loose knots, cracks, or other defects.
3. See that knives are correctly seated before tightening the lock nut.
4. Use fence whenever possible.
5. Employ fixed collar whenever possible.
6. Ask your teacher to approve all setups.
7. Remove all loose articles from the bed of the shaper before starting operations.
8. Make sure that no one but you is inside the operator's zone.
9. Wear face shield or safety glasses (goggles, spectacles).
10. Turn on power after permission is given.
11. Keep hands well away from revolving cutters; use spring guard whenever possible.
12. Use push stick whenever possible.
13. Enter all work opposite to the direction of the rotation of the cutter.
14. Test setup on sample piece of safe size.
15. Turn off power after using shaper and stand by until the machine has stopped.
16. Clean shavings from the table.

Shaper (Woodworking)

TM-56

Safety Test Questions

I

( ) 1. In selecting stock for use on the shaper, you should make sure the stock is: (a) at least 2 in. by 4 in. by 18 in.; (b) correctly seated under lock nut; (c) grained; or (d) free from loose knots, cracks, or other defects.

( ) 2. You should make sure the shaper knives are: (a) correctly seated before tightening lock nut; (b) all of the tang type; (c) tightened with a fixed collar; or (d) flush with the table top.

( ) 3. Prior to starting shaper, you should: (a) request the assistance of another student, especially on long stock; (b) check the hold-down attachment for rigidity; (c) remove all loose articles from the shaper bed; or (d) loosen the lock nut.

( ) 4. In operating the shaper, it is best to: (a) enter all work in the direction the knives are rotating; (b) use fence or fixed collar whenever possible; (c) back up work, especially in corners of small radii; or (d) enter all work above fixed collar level.

II

---------- 1. Before a shaper is started, all setups must be examined by the ----------.

---------- 2. Make adjustments on the shaper only when the machine is at a dead ----------.

---------- 3. In shaper operation, whenever possible, you should use a push ----------.

---------- 4. Prior to starting shaper, you should remove all loose articles from the shaper ----------.

Car Lifts, Hoists, and Cranes

Safety Instructions

1. Obtain permission from your teacher before using a car lift, hoist, or crane.
2. Ask your teacher to inspect blocking of car before it is raised.
3. Place crane or hoist directly over the object to be lifted.
4. Determine that chain, cable, or rope to be used in lifting is in good condition.
5. Double-check fastening of chain, cable, or rope to the object to make sure it is secure before lifting with crane or hoist. Balance object before lifting.
6. Make sure all persons and obstructions are clear before raising or lowering an engine or car.
7. Support car with stands or blocks before doing work under the car or removing wheels.
8. Obtain permission from your teacher before getting under a raised car.
9. Wear face shield or safety glasses (goggles, spectacles) when working under a car.

Car Lifts, Hoists, and Cranes

Safety Test Questions

I

( ) 1. Before doing work under a car that has been raised, or removing wheels, you should make sure the: (a) transmission is in neutral; (b) car is adequately supported; (c) car is raised enough for the use of a creeper; or (d) hand brake is applied.

( ) 2. When you are about to raise an engine or car by hoist or crane, you should be certain the: (a) battery is disconnected; (b) transmission is in neutral; (c) hand brake is set; or (d) object to be lifted is securely tied and balanced.

( ) 3. You should place crane or hoist directly over the object to be lifted so: (a) weight may be raised faster; (b) crane, hoist, or object will not tip over; (c) there will be less wear on the chain; or (d) less room will be needed.

( ) 4. After you have raised a car by crane or hoist, you should place sufficient support under the car so you will be sure the: (a) car will not roll away; (b) strain will be eliminated on the springs and shock absorbers; (c) hoist will last longer; or (d) car will remain in the raised position.

II

_____ 1. When you are about to raise an engine or car by hoist or crane, you should be certain the object to be lifted is securely _____.

_____ 2. After raising a car by hoist or crane, you should support the car with blocks or _____.

_____ 3. When lifting an engine with a chain sling, you should be sure the sling is securely _____.

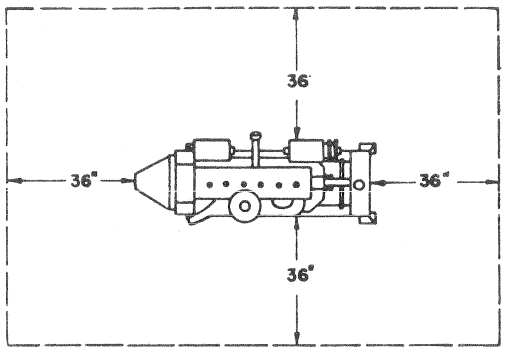
_____ 4. Before getting under a raised car, you must obtain permission from the _____.

Engine

TM-59

Safety Instructions

1. Obtain permission from your teacher before starting an engine whether engine is in a test stand or in a car.
2. Check fuel line for possible leaks.
3. Vent exhaust to the outside of building and provide adequate ventilation whenever running an engine whether engine is in a test stand or in a car.
4. Keep your head and hands away from revolving fan.
5. Be sure to block wheels of any mobile engine test stand you may use.
6. Use, when necessary, a carbon dioxide (CO_2) extinguisher for flammable liquid fires.



MINIMUM SPACE REQUIREMENTS FOR ENGINE STANDS
(Exercise and Running)
Exhaust fumes must be vented to outside of building.

Engine

Safety Test Questions

I

( ) 1. You should vent exhaust to the outside of building and provide adequate ventilation whenever running an engine because: (a) an engine needs this air to produce a proper mixture; (b) the noise of the exhaust will be reduced; (c) back pressure on the manifold will be lessened; or (d) it will prevent the release of exhaust gas in the shop.

( ) 2. When working on an engine that is running, you should: (a) remove blocks from the wheels; (b) keep the car in low gear; (c) make sure tank is full of gasoline; or (d) keep head and hands away from revolving fan.

( ) 3. It is best to use a carbon dioxide (CO_2) extinguisher because: (a) it will extinguish flammable liquid fires; (b) carbon dioxide can be mixed with the exhaust to reduce carbon monoxide; (c) carbon dioxide can be used to make the fuel richer; or (d) it can be used to cool muffler.

II

---------- 1. Before starting an engine, you should obtain permission from ----------.

---------- 2. When running an engine, you should vent exhaust to the outside of building and provide adequate ----------.

---------- 3. When working on an engine that is running, you should keep your head and hands away from the revolving ----------.

Storage Battery

Safety Instructions

Servicing

1. Obtain permission from your teacher before servicing or charging a storage battery.
2. Use proper instruments for testing a storage battery.
3. Avoid overfilling a battery, especially if it is to be charged.
4. Use water and baking soda (a neutralizer) to clean off the top of a battery.
5. Remove and transport a battery with a battery lifter.
6. Handle battery or acid with care. Wash immediately any part of your body or clothing that comes in contact with acid.
7. Wash hands immediately after handling a battery.

Charging

1. Wear goggles when using a charger.
2. Provide ample ventilation when using a charger.
3. Remove cell covers before charging a battery (unless the covers have other instructions upon them).
4. Keep open flames and sparks away from a battery being charged.
5. Turn off charger before disconnecting leads (wires) from charger to battery.
6. Replace cell covers before moving battery.

Storage Battery TM-62

Safety Test Questions

I

( ) 1. You should test a storage battery with: (a) a pair of pliers; (b) a screw driver; (c) an analyzer or tester; or (d) a piece of wire.

( ) 2. A good neutralizer for cleaning off the top of a storage battery is water and: (a) borax; (b) baking soda; (c) lye; or (d) lime.

( ) 3. It is best to charge storage batteries in a well-ventilated room because the gas given off during charging is: (a) explosive; (b) not dangerous; (c) nonexplosive; or (d) carbon monoxide.

( ) 4. Before disconnecting leads (wires) from charger to storage battery, you should: (a) replace cell covers; (b) check with tester; (c) close windows; or (d) turn off charger.

II

..... 1. It is best to clean top of storage battery with water and baking .....

..... 2. After handling a storage battery, you should wash your .....

..... 3. An open flame near a storage battery may cause an .....

..... 4. Before disconnecting leads (wires) from charger to storage battery, you should turn off .....

Use, Storage, and Disposal of Flammable Liquids

TM-63

Safety Instructions

1. Store flammable liquids in a fireproof room or cabinet.
2. Bring into the shop only sufficient flammable liquid for immediate use. Keep only in a safety container approved by the Underwriters' Laboratory. Label container with name of contents.
3. Use only approved cleaning solutions.
4. Avoid contact of carbon-removing or paint-stripping compounds with your skin.
5. Place rags containing oil, gasoline, paint, solvents, and other combustibles in designated (approved) metal containers.
6. Keep the top of oil drums and the surrounding area clean and free of combustible materials.
7. Dispose of unwanted flammable liquids and combustible materials daily.

Use, Storage, and Disposal of Flammable Liquids TM-64

Safety Test Questions

I

( ) 1. Gasoline should be kept in a safety container approved by the Underwriters' Laboratory because: (a) the odor of gasoline makes some people ill; (b) gasoline vapor is highly combustible; (c) it will not evaporate; or (d) the container is difficult to tip over.

( ) 2. You should use approved cleaning solutions instead of gasoline because: (a) gasoline does not clean as well as solvent; (b) gasoline is too expensive to use for cleaning purposes; (c) parts will be tinted by the red dye in leaded gasoline; or (d) there is danger of an explosion when using gasoline.

( ) 3. Rags containing oil, gasoline, paint, solvents, and other combustibles should be: (a) folded neatly and placed on a shelf; (b) left on the workbench; (c) thrown on the floor; or (d) placed in an approved metal container.

II

---------- 1. You should store flammable liquids in a room or cabinet that is ----------.

---------- 2. When using carbon-removing or paint-stripping compounds, you should avoid contacting material with your ----------.

---------- 3. You should place rags containing oil, gasoline, paint, solvents, and other combustibles in a designated (approved) metal ----------.

Electrical Circuits TM-65

Safety Instructions

1. Consider all wires and other conductors in a circuit live until proved dead by a safe method of testing.
2. Use test lamp or suitable meter for testing a circuit.
3. Turn on switch only when you know what it operates.
4. Turn off power before replacing a fuse.
5. Locate and correct fault that caused circuit breaker to open or fuse to blow before turning on power.
6. Be sure circuit is protected against overload by a fuse or circuit breaker of correct current-carrying capacity.
7. Make changes in the wiring of a circuit only when power is turned off.
8. Select and use wire of correct current-carrying capacity.

Electrical Equipment

Safety Instructions

1. Disconnect portable, electrically powered equipment from power source before servicing or repairing the equipment.
2. Examine electric cord for possible defects and correct any defects found before using.
3. Make certain frame or housing of portable, electrically powered equipment is properly grounded before operating it.
4. Connect with power source and turn on your own equipment.

Electrical Circuits TM-66

Safety Test Questions

I

( ) 1. When replacing a fuse in a switchboard, always: (a) turn off power; (b) replace with a fuse of lower rating; (c) check the lights; or (d) check the voltmeter.

( ) 2. All electrical circuits must be protected from overload damage through the use of: (a) fuses or circuit breakers; (b) jumpers; (c) a penny; or (d) other metal objects.

( ) 3. When testing for live wires, a suitable device to use would be a: (a) pencil; (b) wire; (c) test lamp; or (d) screwdriver.

( ) 4. All wires in a circuit must be considered to be: (a) dead; (b) live; (c) safe; or (d) harmless.

II

_____ 1. Before working on a circuit, you should make sure it is dead by using a suitable meter or a test _____.

_____ 2. When replacing a fuse, you should be certain that the power is turned _____.

_____ 3. A fuse or circuit breaker protects a circuit against _____.

Electrical Equipment

Safety Test Questions

I

( ) 1. You should make certain that the frame or housing of portable, electrically operated equipment is: (a) painted green; (b) polished; (c) undergrounded; or (d) grounded.

( ) 2. Before servicing or repairing electrical equipment, be sure that: (a) electric cord has been disconnected from power source; (b) batteries are discharged; (c) fuse has been replaced; or (d) gas has been shut off.

II

_____ 1. Frame or housing of a portable, electrically operated piece of equipment must be _____.

_____ 2. Only an electric cord free from defects should be _____.

Safety Test Answers

General Safety (TM-2)

I:	II:
1. c	1. teacher
2. b	2. brush
3. a	3. self (yourself)
4. b	4. first
5. d	5. power (switch)
6. a	6. stop
7. c	
8. d	
9. d	
10. d	

Bar Folder (TM-4)

I:	II:
1. a	1. parts
2. b	2. slowly

Brake (TM-6)

I:	II:
1. b	1. bar
2. d	2. balance

Buffer (TM-8)

I:	II:
1. b	1. wheel
2. d	2. center
3. b	3. goggles
4. d	4. teacher

Drill Press (TM-10)

I:	II:
1. c	1. vise
2. a	2. on
3. d	3. brush
4. c	4. feed (pressure)
5. b	5. off

Forge (TM-12)

I:	II:
1. a	1. hot
2. c	2. tongs
3. d	3. gas
4. b	4. cool (cold)
5. b	5. air

Furnace (Bench) (TM-14)

I:	II:
1. d	1. side
2. b	2. handle
3. c	3. rest
4. a	4. solder
5. a	

Furnace (Crucible) (TM-16)

I:	II:
1. c	1. gas
2. b	2. air
3. d	3. explosion
4. b	4. floor
5. a	5. moisture

Grinder (TM-18)

I:	II:
1. d	1. eyes
2. c	2. 1/8
3. d	3. wheel
4. d	4. teacher
5. a	5. side

Lathe (Metalworking) (TM-20)

I:	II:
1. b	1. stopped
2. b	2. hand
3. c	3. face shield (safety glasses)
4. c	4. removed
5. c	5. using

Milling Machine (TM-22)

I:	II:
1. a	1. power (switch, machine)
2. d	2. side
3. c	3. brush
4. a	4. released
5. c	5. stopped

Planer (Metalworking) (TM-24)

I:	II:
1. b	1. fastened (held)
2. d	2. rail
3. c	3. safety glasses (goggles, spectacles)
4. c	4. side
5. d	5. file

Portable Electric Drill (TM-26)

I:	II:
1. b	1. shock
2. c	2. on
3. c	3. off
4. d	4. stop

Shaper (Metalworking) (TM-28)

I:	II:
1. b	1. fastened (held)
2. d	2. work
3. c	3. safety glasses (goggles, spectacles)
4. c	4. side
5. d	5. file

Safety Test Answers (continued)

Shear (TM-30)

I:	II:
1. d	1. person (student)
2. c	2. treadle
3. c	3. blade
4. d	4. slowly

Oxy-Acetylene Welding (TM-32)

I:	II:
1. c	1. cover(cap)
2. d	2. teacher
3. c	3. 15
4. a	4. 1 1/4
5. d	5. goggles

Electric Welding (TM-34)

I:	II:
1. c	1. helmet
2. d	2. teacher
3. a	3. goggles
4. d	4. booth
5. a	5. burned

Band Saw (TM-36)

I:	II:
1. a	1. stopped
2. b	2. 1/4
3. b	3. feed
4. b	4. stop
5. d	5. off

Circular Saw (TM-38)

I:	II:
1. d	1. stopped
2. c	2. teacher
3. c	3. blade
4. a	4. 1/8
5. a	5. narrow

Jointer (TM-40)

I:	II:
1. d	1. guard
2. b	2. 1/8
3. d	3. 12
4. a	4. adjustment
5. d	5. plane

Lathe (Woodworking) (TM-42)

I:	II:
1. a	1. clothing
2. c	2. side
3. d	3. stopped
4. b	4. hand
5. c	5. rest

Mortiser (TM-44)

I:	II:
1. b	1. aligned (lined up)
2. d	2. table
3. a	3. teacher
4. d	4. bit

Planer (Surfacer) (TM-46)

I:	II:
1. a	1. rolls
2. d	2. side
3. b	3. 1/8
4. d	4. 1/16
5. d	5. teacher

Radial Arm Saw (TM-48)

I:	II:
1. c	1. crosscutting
2. c	2. fence
3. d	3. blade
4. a	4. stopped

Router (TM-50)

I:	II:
1. b	1. shock
2. d	2. disconnected
3. a	3. hands
4. b	4. slowly
5. c	5. cutters

Sander (TM-52)

I:	II:
1. a	1. disconnected
2. d	2. downward (down)
3. d	3. surface (face)
4. d	4. pressure
5. b	5. off

Scroll Saw (TM-54)

I:	II:
1. a	1. downward (down)
2. b	2. tension
3. d	3. hand
4. c	4. bottom
5. d	

Shaper (Woodworking) (TM-56)

I:	II:
1. d	1. teacher
2. a	2. stop
3. c	3. stick
4. b	4. bed

Safety Test Answers (continued)

Car Lifts, Hoists, and Cranes (TM-58)

I:
1. b
2. d
3. b
4. d

II:
1. fastened (tied)
2. stands
3. fastened (tied)
4. teacher.

Engine (TM-60)

I:
1. d
2. d
3. a

II:
1. teacher
2. ventilation
3. fan

Storage Battery (TM-62)

I:
1. c
2. b
3. a
4. d

II:
1. soda
2. hands
3. explosion
4. charger (power)

Use, Storage, and Disposal of Flammable Liquids (TM-64)

I:
1. b
2. d
3. d

II:
1. fireproof
2. skin (hands)
3. container

Electrical Circuits (TM-66)

I:
1. a
2. a
3. c
4. b

II:
1. lamp
2. off
3. overload

Electrical Equipment (TM-66)

I:
1. d
2. a

II:
1. grounded
2. used

TOOL DESCRIPTIONS

Portable Hand Drill - These tools are made in various sizes and can drill holes from the very smallest to quite large. They also vary in power from light to heavy and in speeds from slow to fast including reversible.

Portable Grinder and Disc Sander - These portable machines can be very useful tools to remove excess materials when the piece is too awkward or heavy to get it on the pedestal or bench machines. They must be used with great care.

Sanding Machine - There are many types of power sanders: disc, belt, drum, spindle, and sheet. All use abrasive paper or cloth and set it into motion in such a manner as to make light work of sanding.

Milling Machine - With the exception of the lathe, the milling machine is the most versatile machine tool used in the machining of metal. Metal is removed by a rotating multi-tooth cutter that is fed into the work.

Lathe (Metalworking) - An engine lathe is a machine tool in which the work is held and rotated, while being shaped by a cutting tool that is fed against the work.

Oxygen-acetylene Welding - Welding can be a very useful method of joining metals. The equipment though can be very dangerous if used incorrectly. Be very careful and know the safe welding procedures. Wear proper eye protection.

Spot Welder - Spot welding is known as resistance welding. The weld is produced by heat obtained from the resistance of the work to a flow of electric current and by application of pressure.

Band Saw - The band saw is a most versatile machine. It has an endless blade traveling around two wheels. The band saw cuts so fast and so easily that the operator must constantly watch his fingers.

Circular Saw - The circular saw is the most useful of all woodworking machines. On it, the following processes may be performed: crosscutting, ripping, mitering, beveling, chamfering, rabbeting, and with attachments, cove cutting, tapering, dadoing, shaping, and molding cutting. This machine, although very commonplace, demands the complete respect of anyone who operates it.

Portable Electric Saw - The portable electric saw is a power hand saw and a circular saw combined. This saw requires close attention for safe and accurate control.

Jointer - The jointer is one of the most useful machines in the woodshop. This machine is made to take the place of the hand plane. When used right, it will smooth a surface, square an edge, cut a rabbet taper, bevel or chamfer.

Wood Turning Lathe - The wood lathe is the machine on which wood is shaped into round and cylindrical shapes, such as bowls, lamps, and table legs. Wood turning is fascinating; don't spoil the fun be being careless. The wood is held and rotated, while being shaped by a cutting tool, that is fed into it.

Mortiser - The mortiser is a single-purpose machine, for the making of mortises only. It operates similar to the attachment for the drill press except that the chisel is pressed into the wood by a foot lever.

TOOL DESCRIPTIONS (continued)

Drill Press - A stationary machine used to drill holes. They are made in various sizes, and drill holes from small to quite large. The speed of the drill is allowed to be changed for the size of the drill. All materials must be properly held.

Planer or Surfacer - The planer or surfacer is a machine which will plane boards smooth and to an even thickness. Most high school shops have a single surfacer which has a single cutter head and will plane only one side at a time. Usually the only adjustments to make in the operation of this machine is for depth of cut and speed of travel.

Cut-off or Radial Saw - The cut-off saw is used to cut long pieces of wood to a more usable size. This machine can also be used to do some of the operations done on the circular saw.

Router-Shaper - The router is a portable shaper that is moved over the work instead of the work being moved through the cutter, as to the regular shaper. This machine, like the shaper, turns at a high speed and demands serious attention.

Portable Electric Sanders - The Oscillating Sander: The oscillating and orbital sanders are light in weight and easy to control. They use a flat sheet of abrasive, moving it in short, rapid strokes. This machine is suitable for finish sanding.

- The Portable Belt Sander: The weight of the machine provides the necessary pressure on the belt; it is only necessary to maneuver the machine uniformly over the surface. They use a belt abrasive moving around very fast.

Scroll Saw - The scroll saw resembles a power-driven coping saw. The short blade moves up and down, cutting only on the down stroke. The saw is designed especially for cutting fine curves and details in stock up to approximately an inch in thickness.

Saber Saw - The saber saw, also called a bayonet saw, is a portable electric scroll saw that can be used for a wide range of light work.

Shaper - The work of the shaper is specialized cutting shaped edges, moldings, picture frame stock, and the like. It operates at a very high rate of speed. Shaper safety cannot be over-emphasized. It is a machine to be used only by the serious-minded, advanced student. The wood is fed into a moving router or shaper blade.

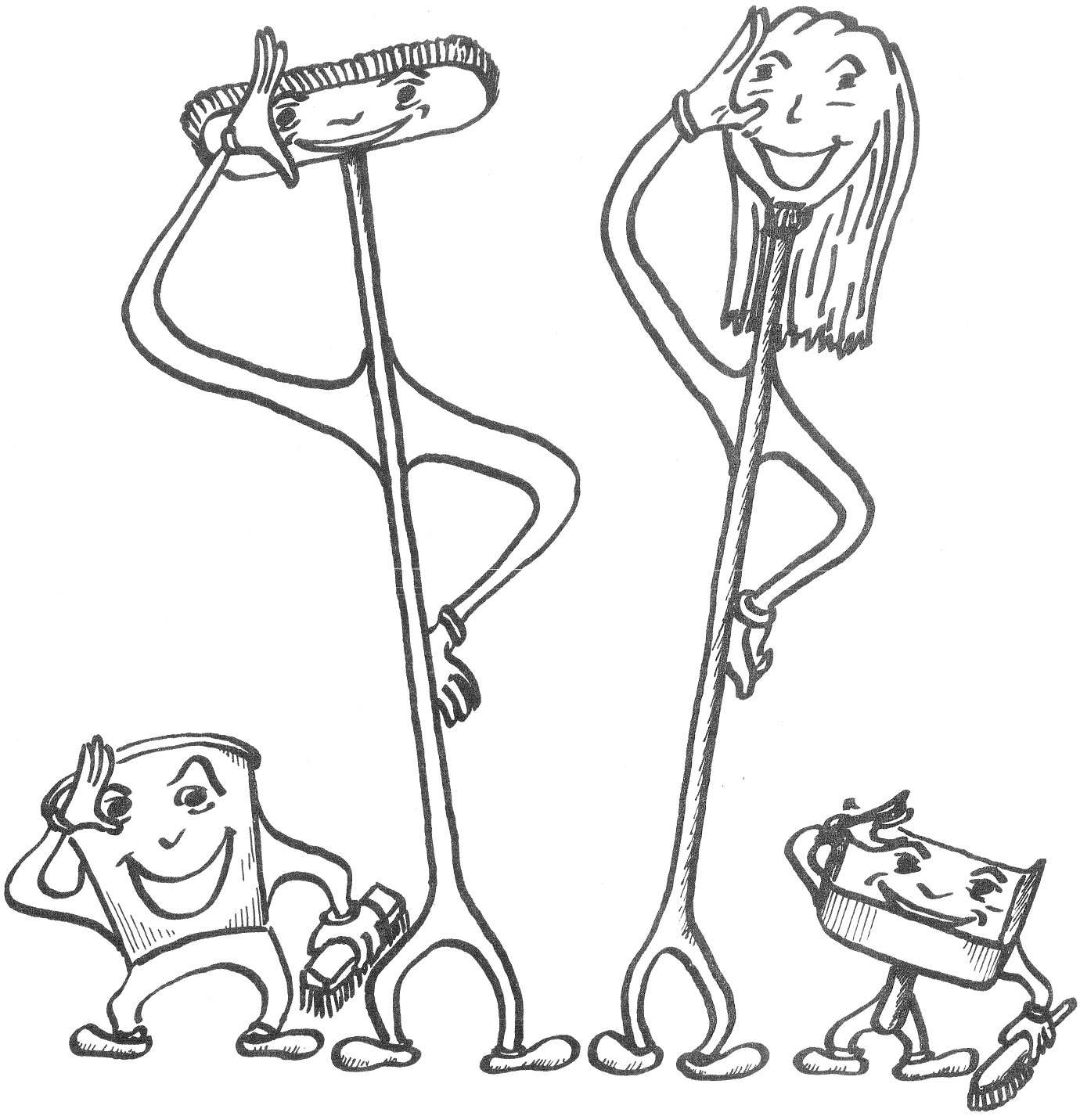
Electric Arc Welding Machine - This machine uses electric current to weld metal together. Proper safety clothing, eye and face protection must be worn.

Bench Grinder Buffer - These machines may vary in size and speed. An abrasive or wire sheel is rotated and the work is fed against it, to remove, or to polish the metal. Safety goggles must be worn.

Metal Shear - This machine is used to cut large pieces of sheet metal. A blade is pushed down through the metal, so watch fingers and clothing.

Bar Folder/ Brake - This machine is used fold or bend thin pieces of metal.

TIME FOR CLEAN UP



A CLEAN SHOP
IS A HEALTHY SHOP

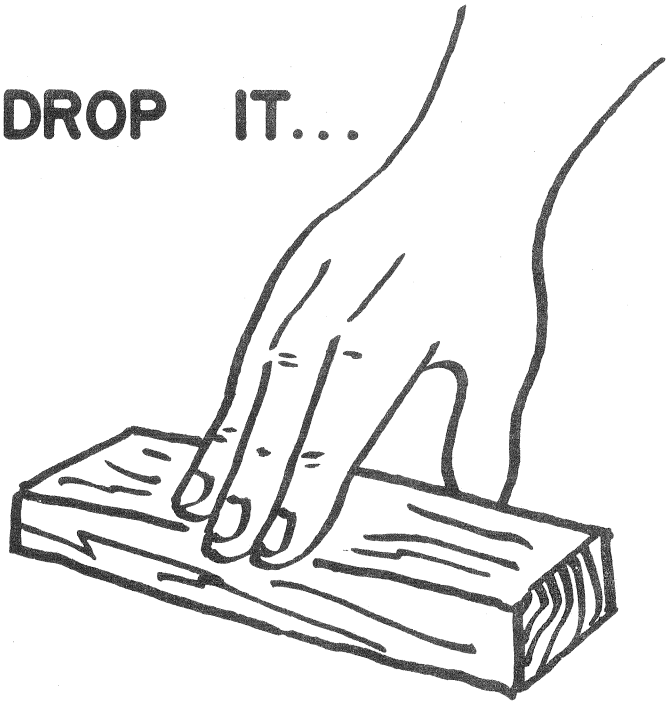
PREVENT A FALL

TM-70

IF YOU SPILL IT...

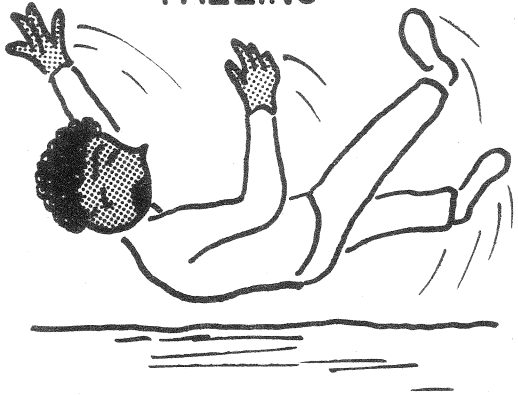
WIPE IT UP.

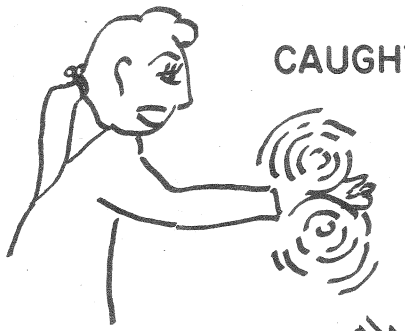
IF YOU DROP IT...

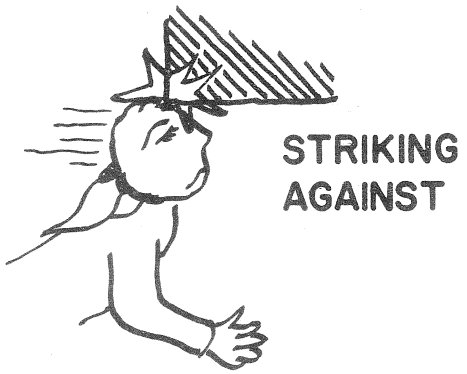


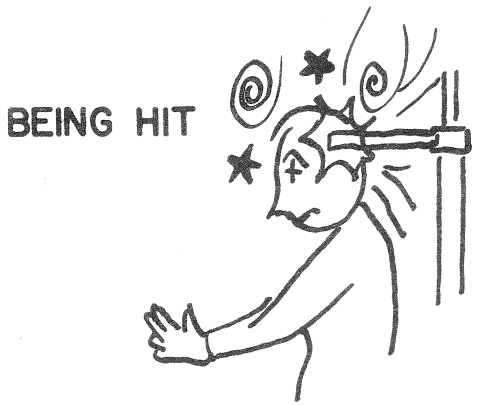
PICK IT UP.

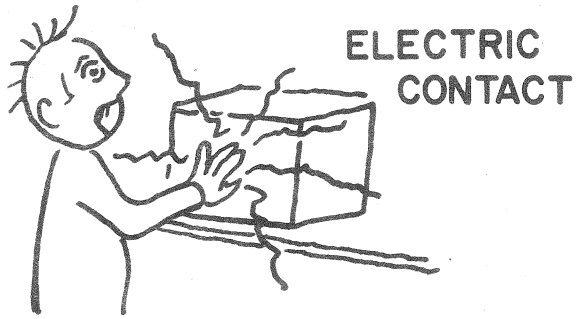
ONE ACCIDENT IS TOO MANY!
SO BEWARE OF...







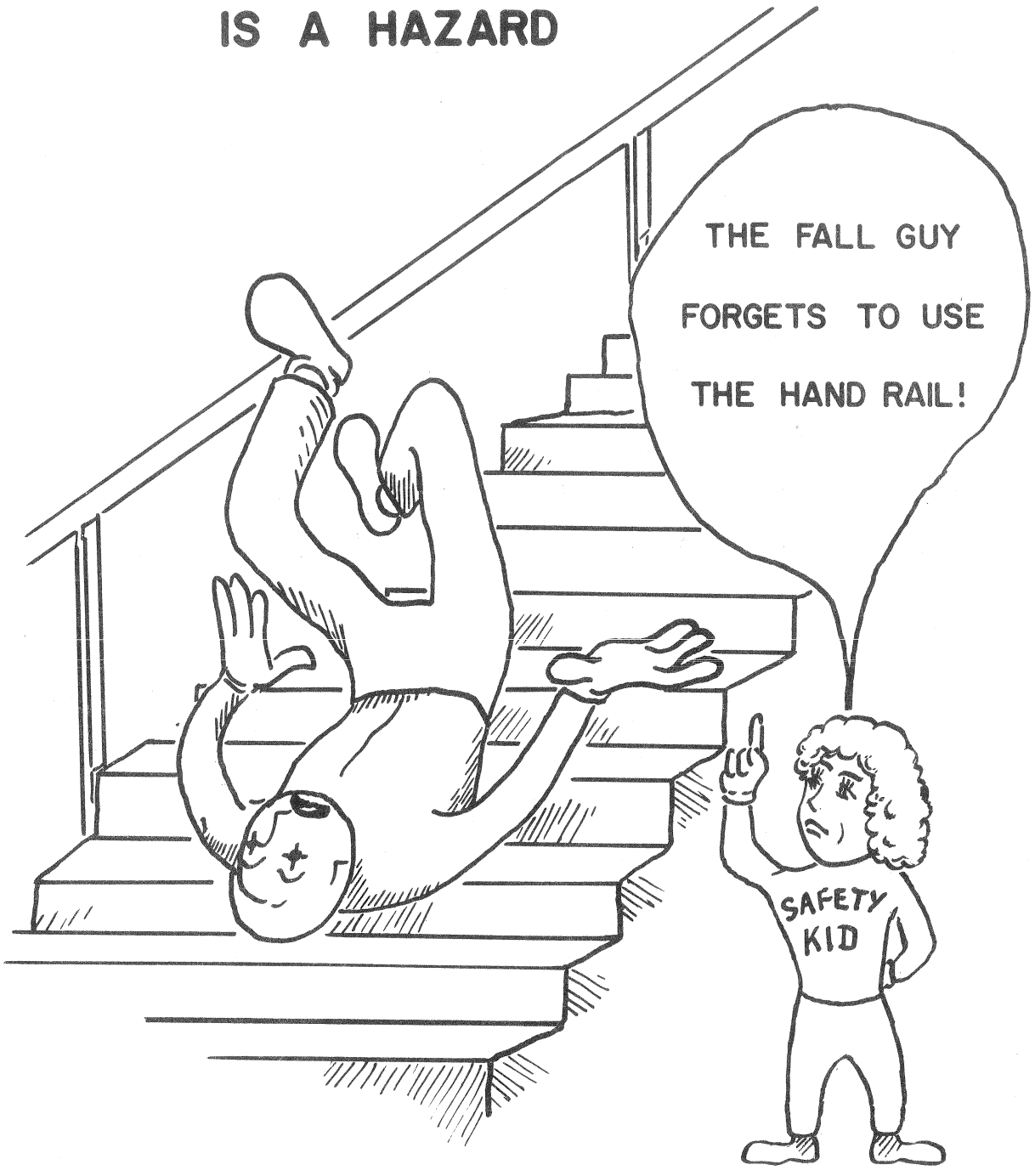




STATE OF MIND – CAUSES ACCIDENTS

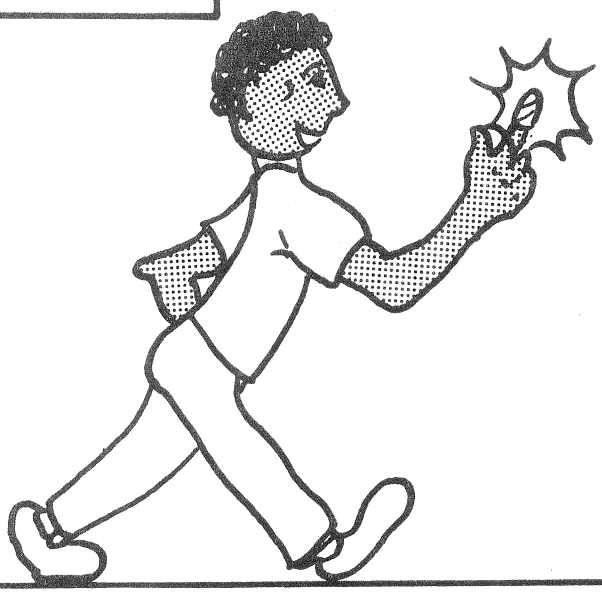
TM-72

CARELESSNESS IS A HAZARD



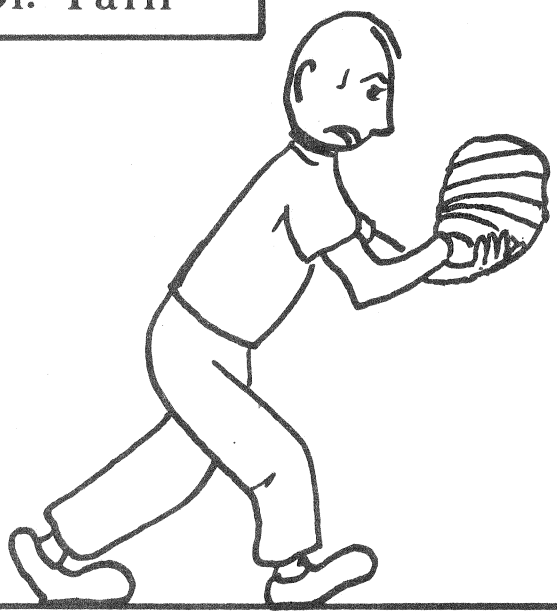
THINK AHEAD FOR SAFETY!

FIRST AID



AN OUNCE OF PREVENTION...

Dr. Pain



IS BETTER THAN A POUND OF CURE.

GET FIRST AID FAST

DON'T TAKE CHANCES ON "LITTLE HURTS" LIKE

BLISTERS

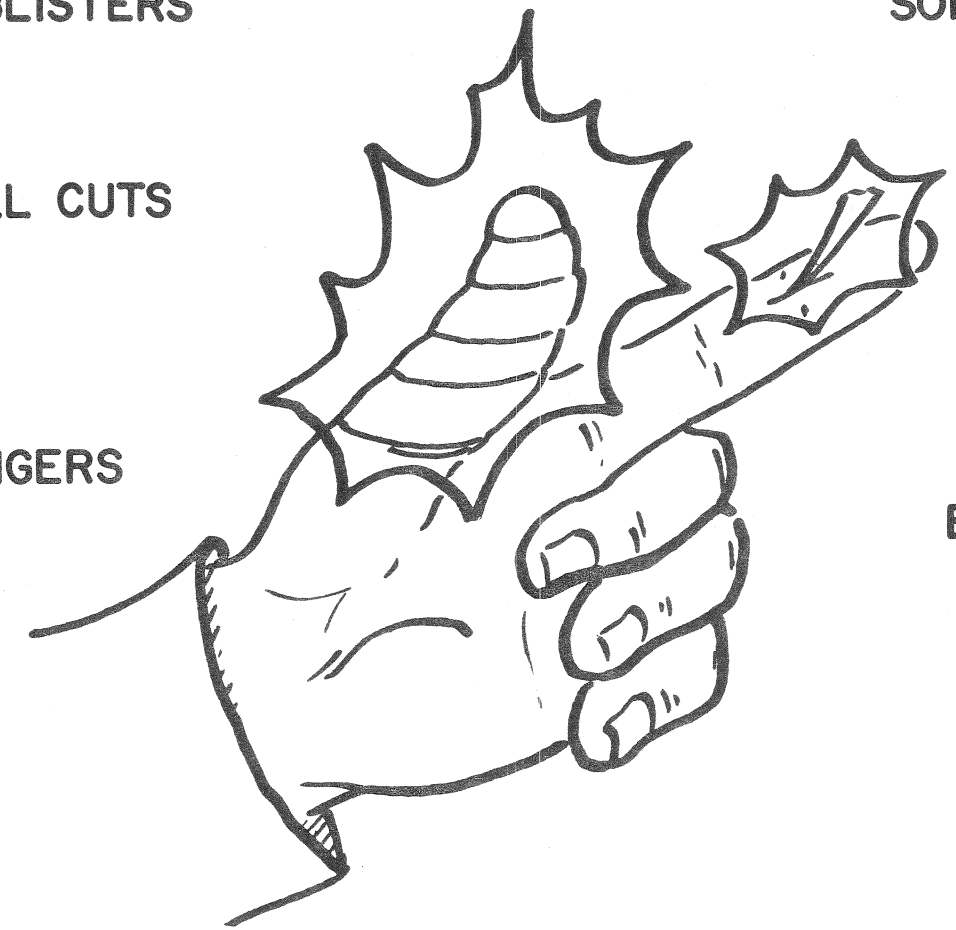
SOMETHING IN EYE

SMALL CUTS

SPLINTERS

JAMMED FINGERS

BURNS



GET TREATMENT IMMEDIATELY

IF INJURED... where will you hurt?

TM-76

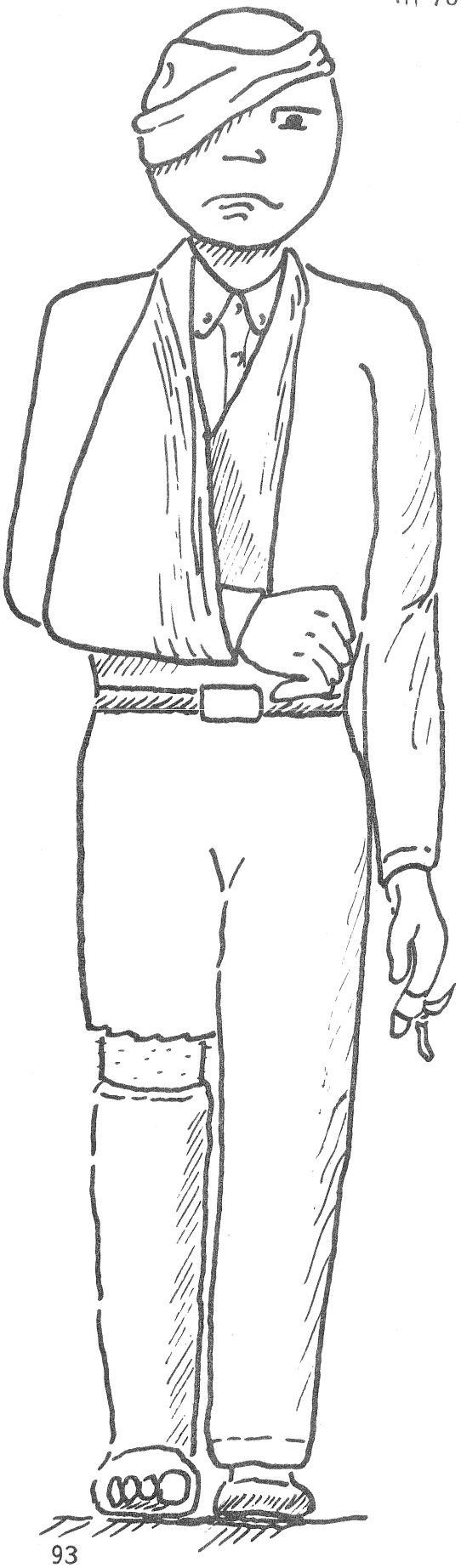
10% HEAD

25% BODY

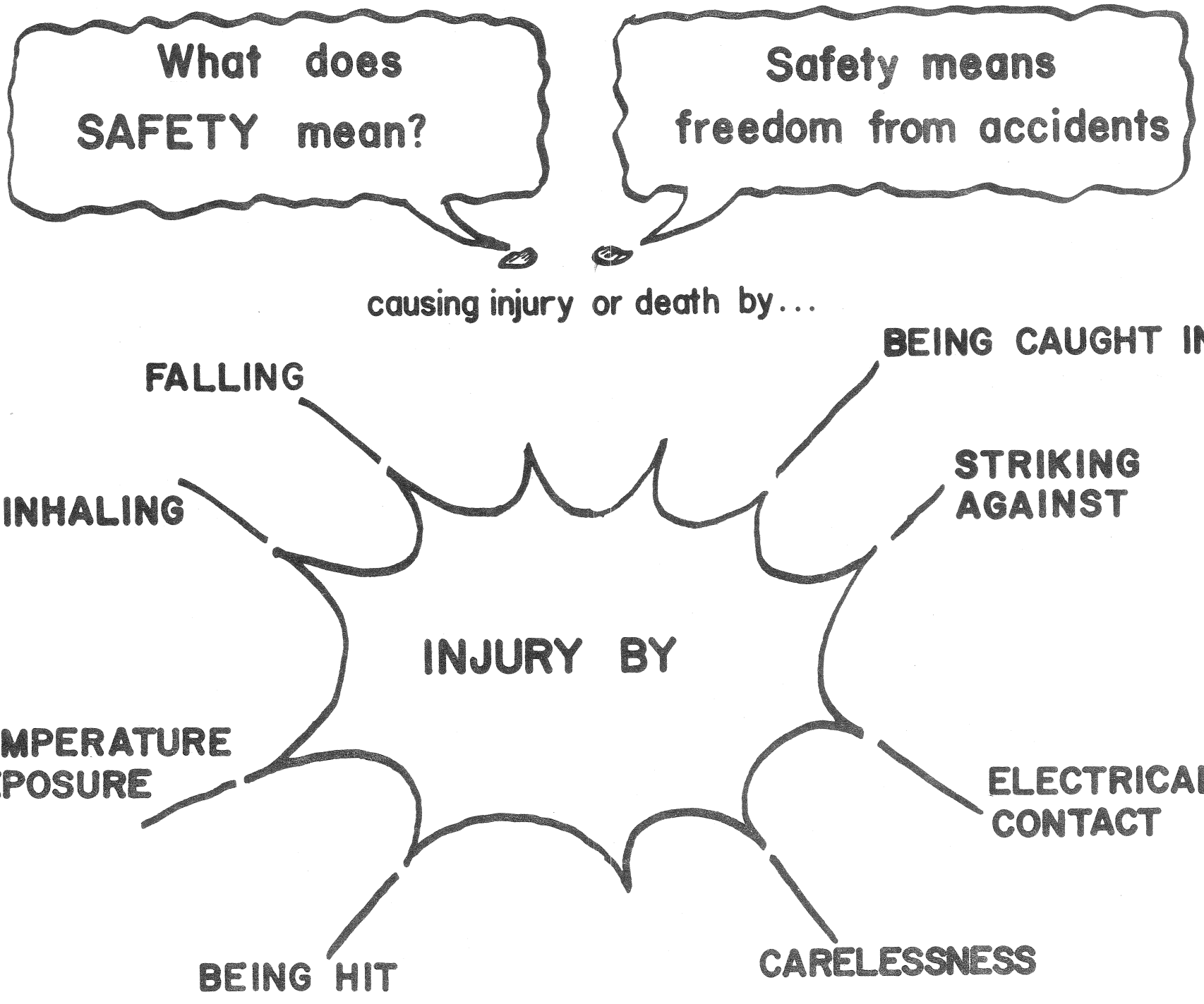
36% ARMS AND HANDS

12% LEGS

12% FEET

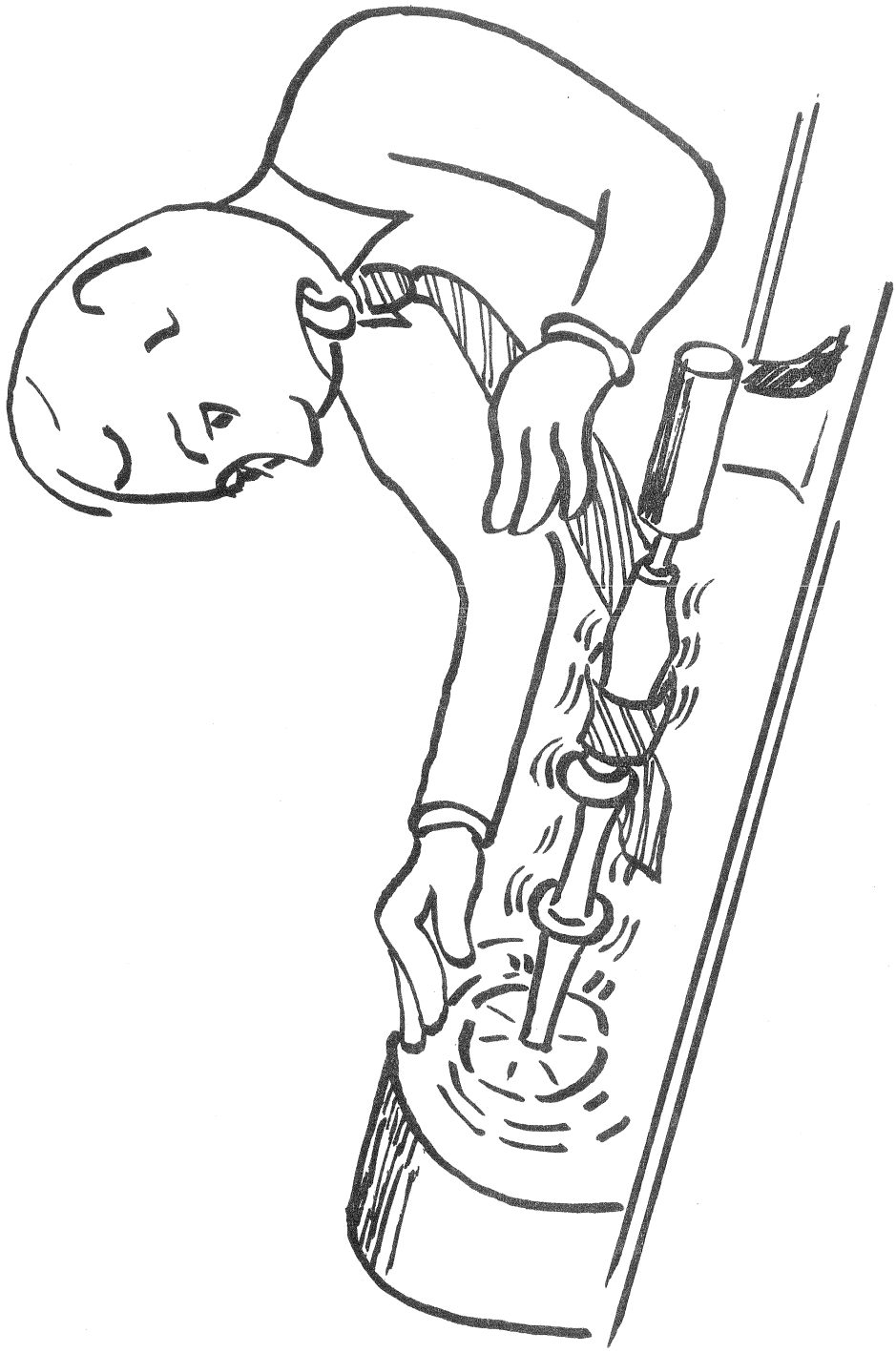


Doing a job SAFELY costs nothing
But... my job isn't dangerous!
It's not where you work... but how you work

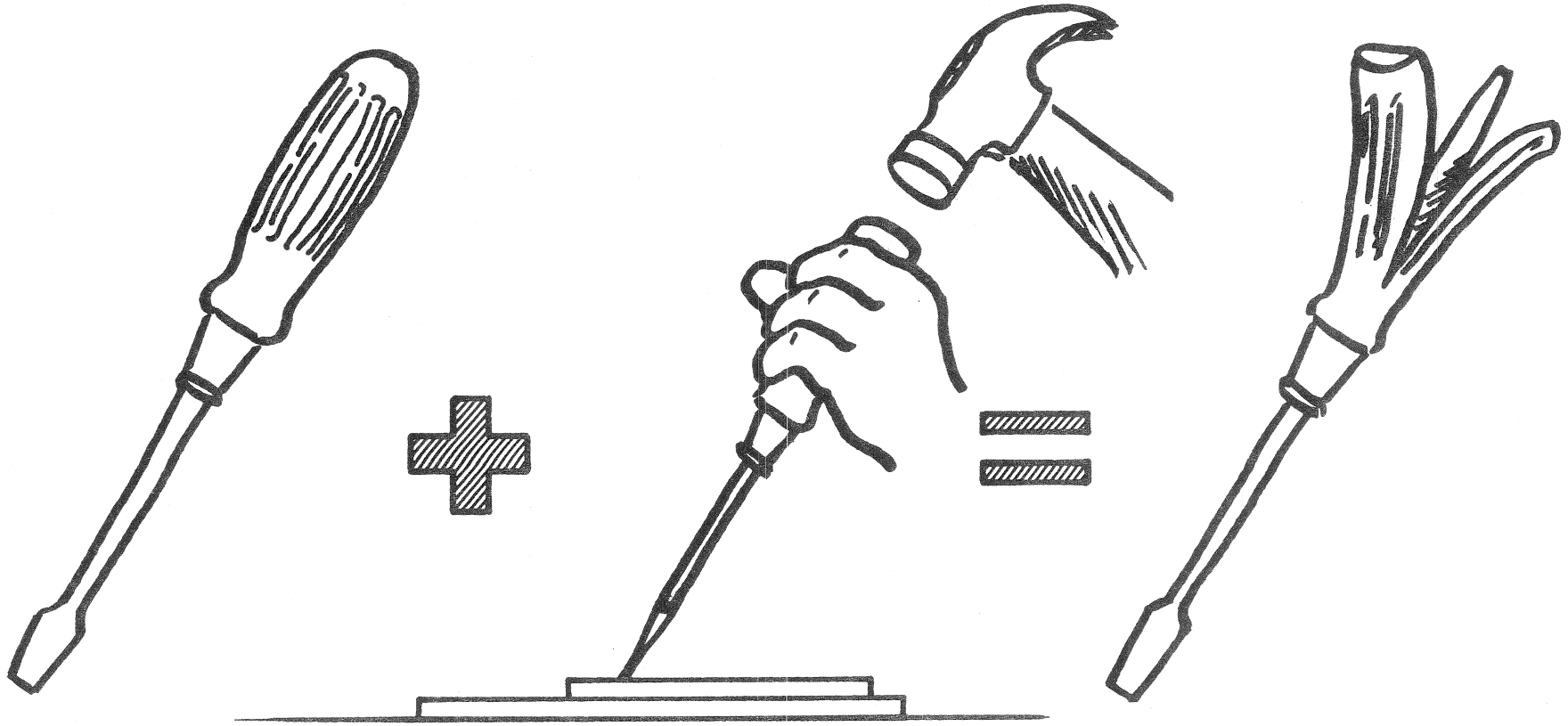

What does SAFETY mean?
Safety means freedom from accidents
causing injury or death by...
FALLING
BEING CAUGHT IN
INHALING
STRIKING AGAINST
INJURY BY
TEMPERATURE EXPOSURE
ELECTRICAL CONTACT
BEING HIT
CARELESSNESS

TM-78

LOOSE CLOTHING



MAY CAUSE INJURY



SCREW DRIVERS

MISUSED

DANGEROUS WEAPON

TM-80

TM-81

LIVE WIRES AND SOCKETS

TOUCHED WITH METAL OBJECT

ELECTIC SHOCK

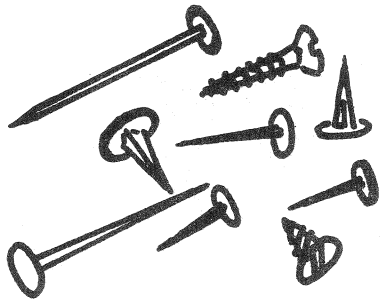
INJURY

TM-83

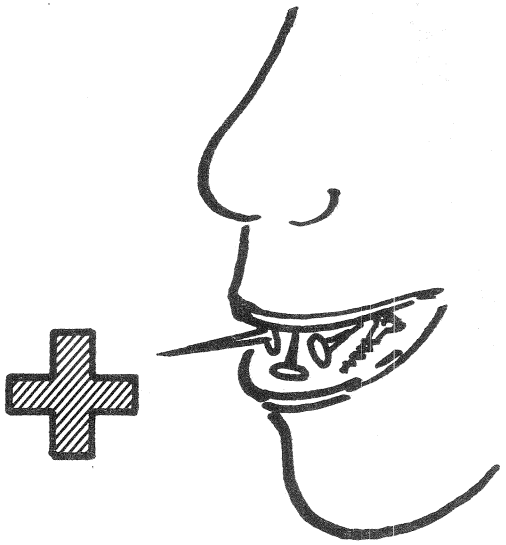
TO OTHERS

THROWING TOOLS

POSSIBLE INJURY
SOMEONE AT MACHINE
TURNING ON SWITCH



TACKS, SCREWS,
AND NAILS



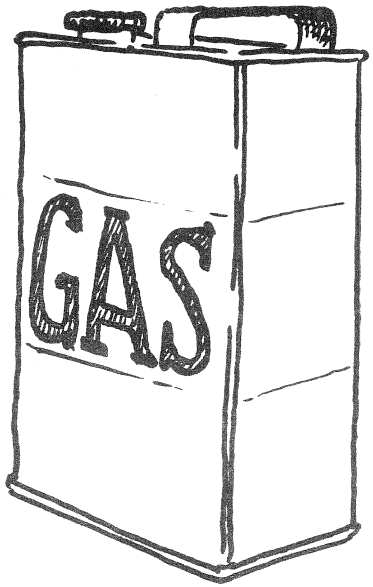
HELD IN
MOUTH

IRRITATED MOUTH
OR
UNEXPECTED MEAL

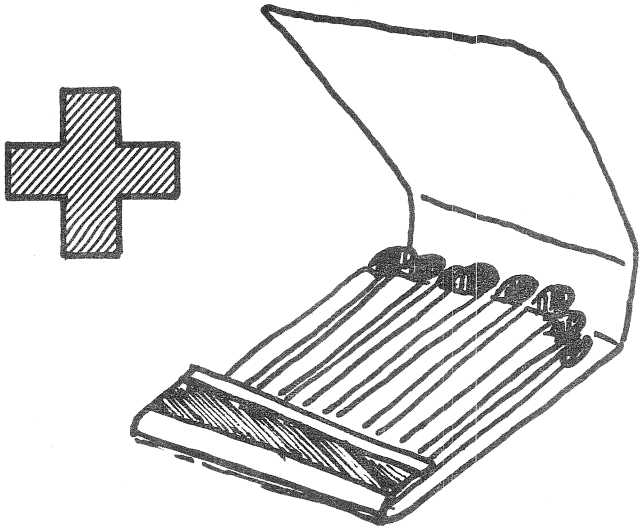
HAND INJURY

WITHOUT HANDLES

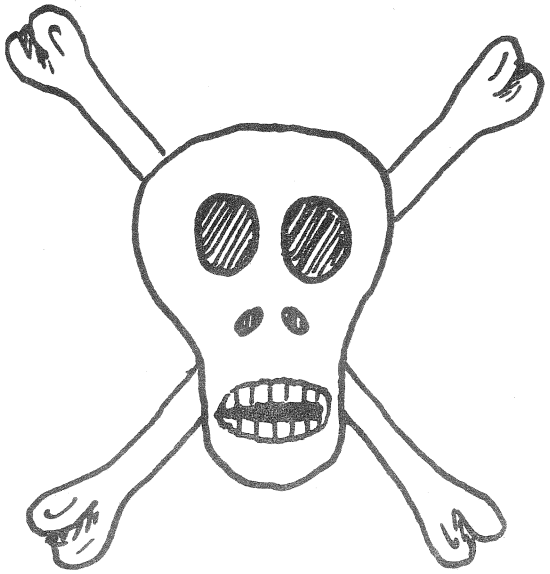
FILES



FLAMMABLE LIQUIDS



FIRE



DEATH

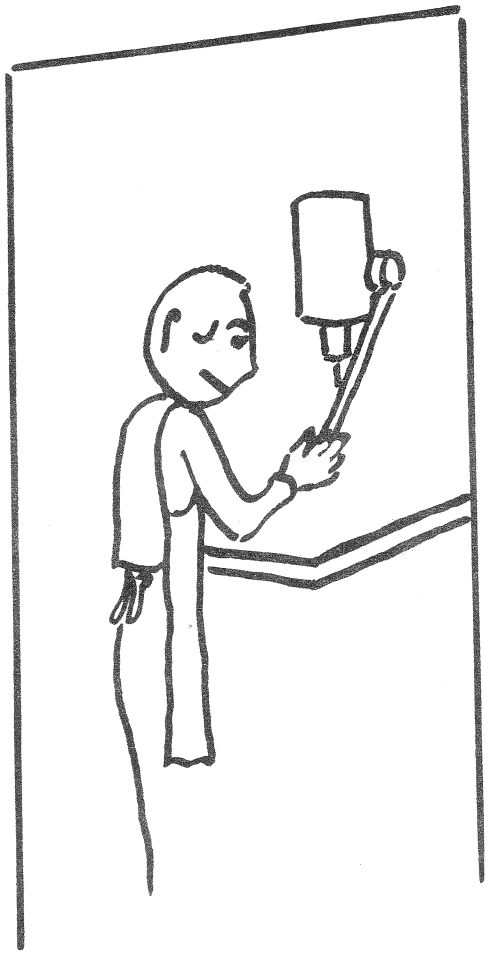
TM-88

TM-89

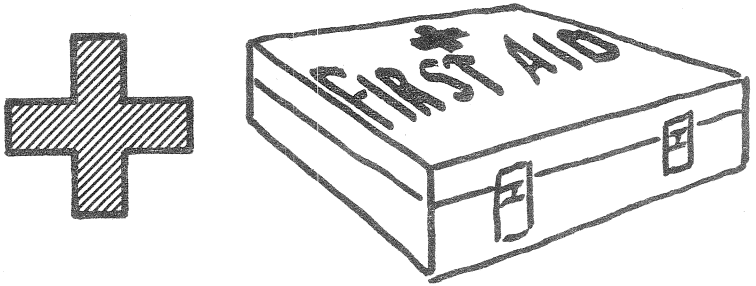
INJURY

STEPPED ON

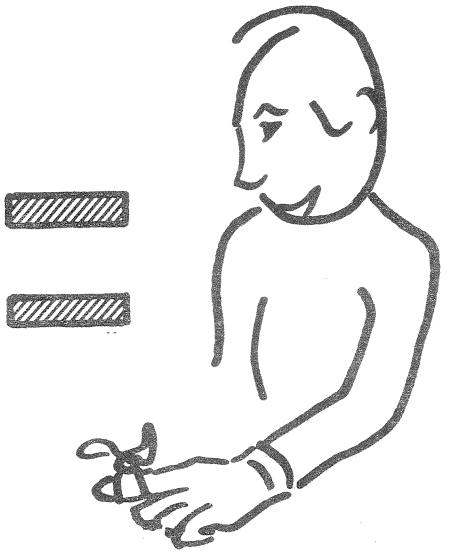
NAILS IN BOARDS



A SHOP



FIRST AID KIT



PREPARATION

General References

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