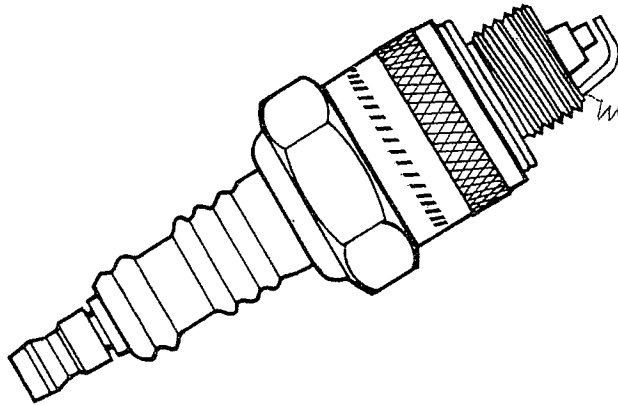


SMALL ENGINES

operation and service



Webster



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part 1

introduction — what is a small engine?

At first glance a small engine looks like a complicated piece of machinery. It is constructed of many parts and components and many different systems. However, each of the components and systems has purpose and operates on some very basic rules or principles.

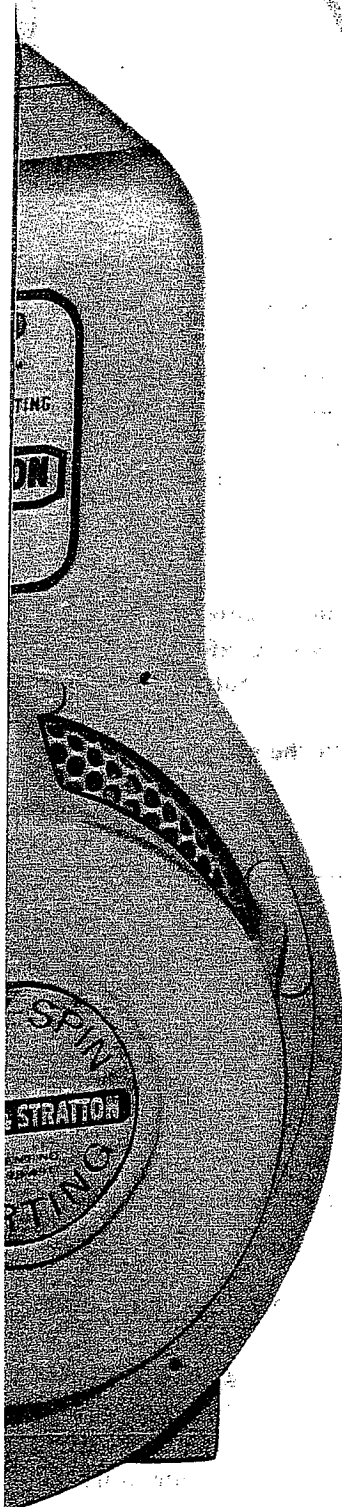
An engine is a machine that changes burning fuel into power. In an engine, a fuel such as gasoline is burned to develop heat. The heat is then used to develop power. Power is used to do work.

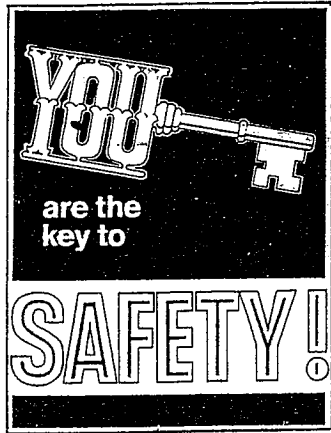
With an engine you can:

- mow a lawn
- drive a car
- power a motorcycle
- ride a mini-bike
- fly in a helicopter
- ski behind a boat
- ride through the snow.

Engines used to power lawn or garden equipment are considered small engines. Engines used in small vehicles such as mopeds, motorcycles and snowmobiles are also considered small engines. Most small engines work in the same way. All have about the same parts. If you learn how a small lawnmower engine works, you will know how a car or motorcycle engine works. When you find out how a small engine gets fuel you will know how a car or motorcycle engine gets fuel.

The uses for small engines are many and varied. They are used to do work on equipment such as lawnmowers, edgers, generators, water pumps and chain saws. Small engines are used to power many types of recreational vehicles such as snowmobiles, snow trikes, trail bikes, mini bikes, home-built aircraft and outboards. Small engines are becoming more and more popular for transportation vehicles on mopeds and motorcycles. The things you will learn in this book will help you understand each of these power machines.





unit 1

working safely

When you work on small engines you will be working in a shop or lab. You will work near many things that must be used carefully. Working in the shop is not dangerous as long as you always keep in mind *safety first*. Before you do any job, always ask yourself if what you are doing is safe. If you do not know, ask your teacher. In this unit you will find out how to prevent accidents.

LET'S FIND OUT: When you finish reading and studying this unit you should be able to:

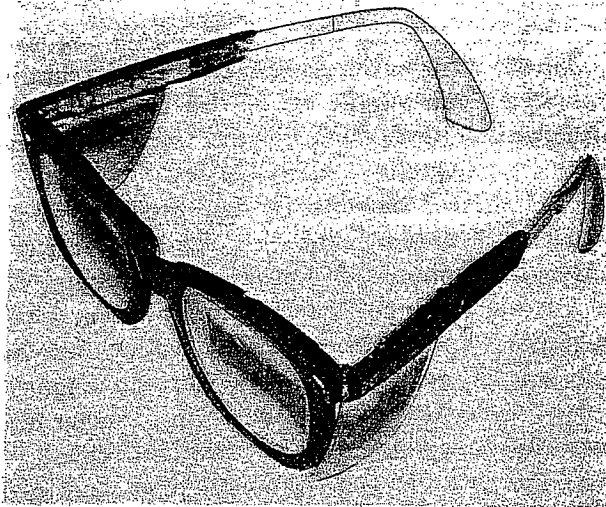
1. Demonstrate your knowledge of safety practices by working safely.
2. Recognize the common hazards in using hand and power tools.
3. Explain how to use cleaning equipment safely.
4. Describe the hazards involved in running an engine in the shop.
5. Explain how fires are prevented and extinguished.

USING HAND TOOLS

Believe it or not, many accidents are caused by the improper use of ordinary hand tools. Greasy tools can slip out of the hand. They may fall into a moving part of an engine and fly out to injure someone. Some tools have sharp edges that may cut you if you do not use them correctly. Follow these simple rules when using hand tools:

1. Be sure your hands are free of dirt, grease and oil.

2. Use the proper type and size hand tool.
3. Make sure the tools are sharp and in good condition.
4. Use sharp-edged or pointed tools with special care.
5. Make sure to point the edge of a sharp or pointed tool away from yourself and others.
6. Wear eye protection when filing or cutting metal, Figure 1-1. Arrange your work so that other people are protected from flying chips.



7. Pass tools to others with the handles toward them.
8. Clamp small workpieces on a bench or secure them in a vise when driving screws.

USING POWER TOOLS

Tools which are powered by electricity, hydraulic fluid or compressed air are called power tools. Power tools move very fast, and if not used properly, may cause very serious injuries. The following rules apply to all power tools:

1. Obtain permission from your instructor before using any power tool.
2. Check adjustments on machines before turning on the power. Whenever possible without causing danger, rotate the machine one revolution by hand.
3. Make sure that no one is near the tool when you turn on the power.
4. Always wear eye protection when operating a power tool.
5. Keep all machine safety guards in correct position.
6. Start your own power tool and remain with it until you have turned it off and it has come to a complete stop.
7. Stay clear of power tools being operated by others.
8. Notify the instructor when a machine does not seem to work properly.
9. Wait for power tools to come to a complete stop before oiling, cleaning or adjusting. If possible, unplug the tool first.
10. Be sure clothes are safe and suitable for shop work. Remove or fasten any loose clothing or jewelry. Roll loose sleeves above the elbows. Keep hair away from equipment in operation.
11. Observe rules concerning safety lines around equipment.

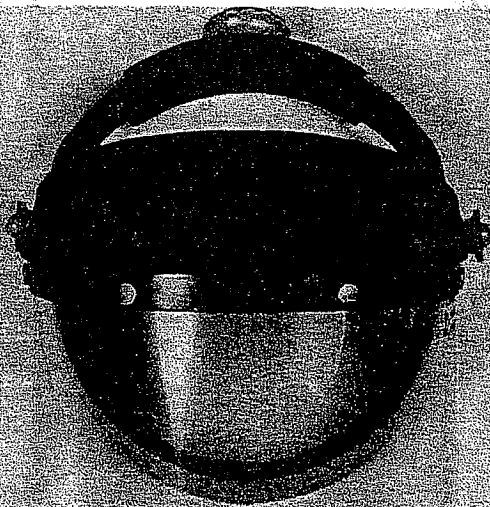


Figure 1-1. Eye protection should be worn when there is danger of flying particles.

USING CLEANING EQUIPMENT

Almost every repair operation requires that parts be cleaned. Most shops have several methods to clean parts. You may have to use a steam cleaner, cold tank, hot tank or solvent tank.

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The main danger from cleaning equipment is getting harmful chemicals on the skin or in the eyes. Burns are an added danger when using the hot tank or steam cleaner. To avoid injury, follow these rules:

1. Obtain permission from your instructor before using any cleaning equipment.
2. Never use gasoline to clean parts.
3. When operating the steam cleaner, use a shop apron, face shield and gloves to protect from burns and splash.
4. Wear a shop apron, rubber gloves and a face shield when taking parts in or out of a hot or cold cleaning tank.
5. Wear protective clothing when cleaning parts to prevent chemical splash on the skin.

RUNNING AN ENGINE IN THE SHOP

You will be working on engines in the shop. Sometimes the engines will be running. If you run an engine at too fast a speed it could explode. Never run an engine too fast. Always wear a face shield or safety glasses.

There is another problem when running an engine in the shop. A poisonous gas called carbon monoxide comes out of an engine's exhaust. Carbon monoxide cannot be seen; it has not color or smell. Make sure large doors or exhaust vents are open before you start an engine, Figure 1-2. Always check with your teacher before you start up an engine. Follow these rules:

1. Get permission from your instructor before starting an engine.

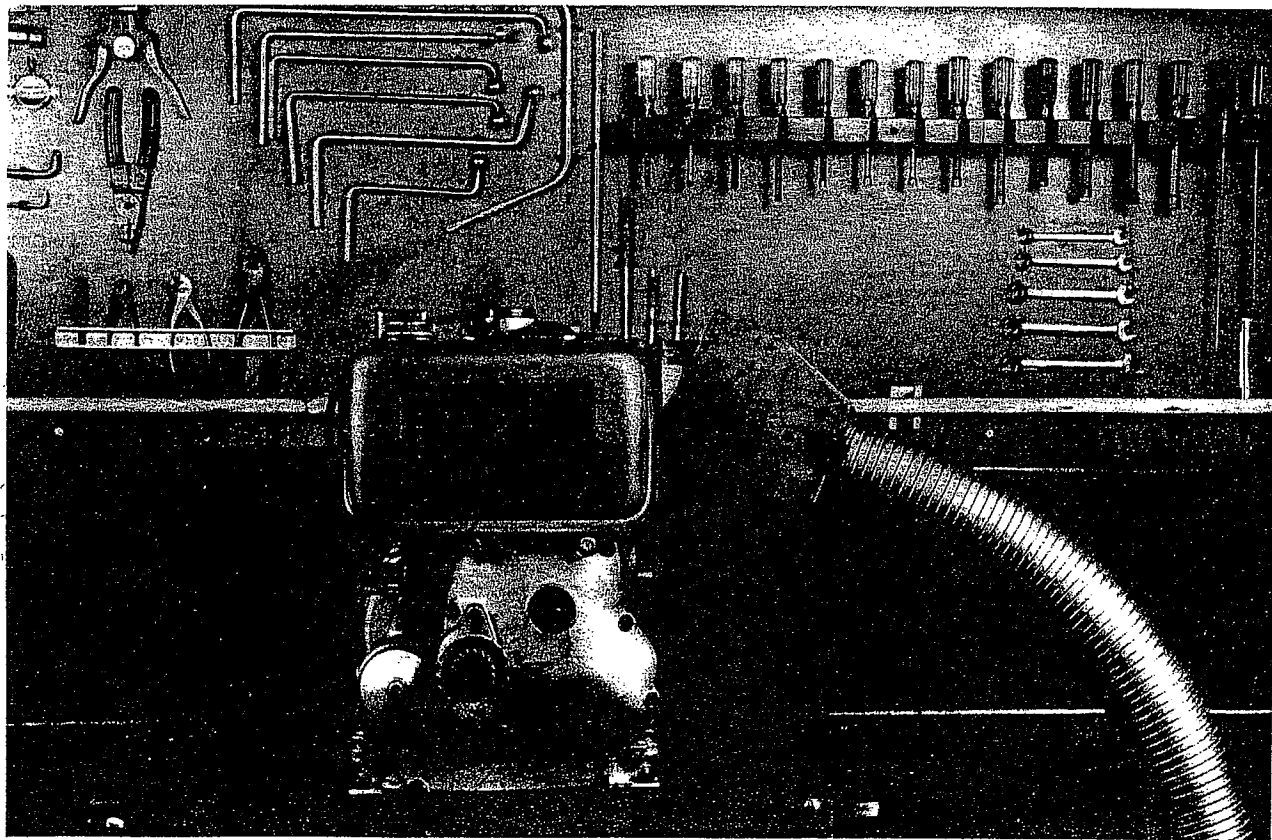


Figure 1-2. An exhaust vent must be used when running an engine inside.

2. Check fuel line for possible leaks.
3. Vent exhaust to the outside of the building, and make sure there is ventilation when you run an engine.
4. Keep your head and hands away from moving parts.
5. Do not run an engine higher than its rated rpm (revolutions per minute).
6. When running an engine at high speed, wear face and ear protection.

USING COMPRESSED AIR

Many shops have compressed air in an air line. It can be dangerous if not used correctly. Follow these rules when you use compressed air:

1. Check all hose connections before turning on the air.

2. Hold the air hose nozzle to prevent it from slipping while turning air on or off.
3. Do not lay the hose down while there is pressure in it. It might whip around and strike someone.
4. Do not use air to dust off hair or clothing or to sweep the floor.
5. Wear safety glasses when using an air hose.
6. Never aim an air nozzle at another person.

FIRES

Many things in the shop can catch fire. You should know how to prevent and fight a fire. Three things must be present to have a fire: oxygen, fuel and heat. To put out a fire, you must remove one of these. Every shop should have a fire extinguisher. Figure 1-3. Find out where the

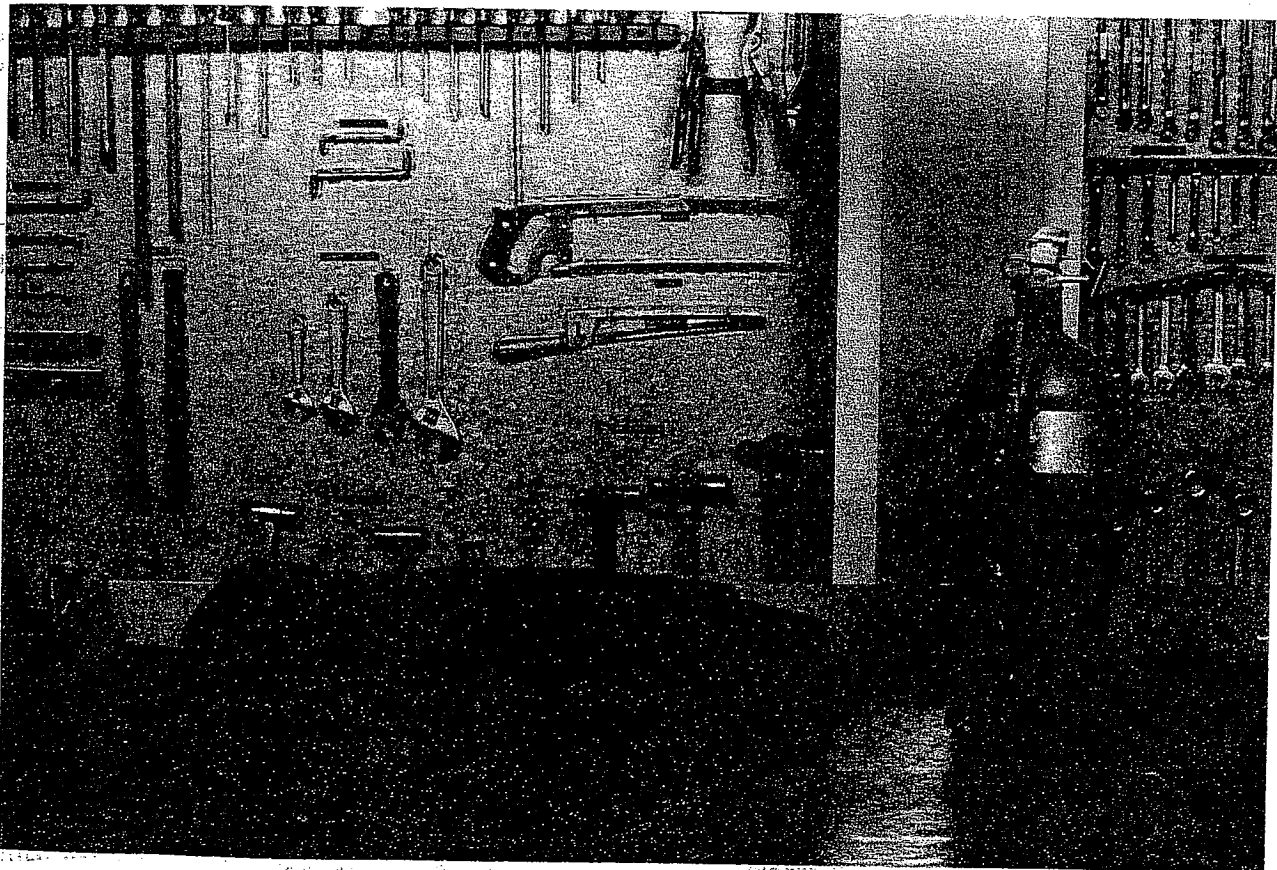


Figure 1-3. Have a fire extinguisher and fire blanket close by when you are working on an engine.



Figure 1-4. Gasoline must be stored in a safety can. (Eagle Manufacturing Co.)



Figure 1-5. Rags containing oil, gasoline or solvent must be kept in a covered metal container. (Eagle Manufacturing Co.)

shop fire extinguisher is and how to use it to put out a fire. To prevent a fire follow these rules:

1. Store flammable liquids in a fireproof room or cabinet.
2. Store gasoline in a safety can, Figure 1-4. A safety can has a top which is held closed by a spring so that gasoline vapors cannot escape from it.
3. Keep rags used to wipe up oil, gasoline, paint, or solvents in metal safety containers, Figure 1-5.
4. Keep the tops of oil cans clean.
5. Drain fuel from an engine before storing the engine in the shop.

NEW TERMS

cleaning equipment: Equipment used to clean small engine parts.

compressed air: Air under pressure.

fire extinguisher: A device designed to put out a fire.

fire prevention: Observation of safety measures to keep fires from starting.

hand tools: Tools that do not use any power except hand power.

power tools: Tools powered by electricity, compressed air or hydraulic fluid.

SELF CHECK

1. List two possible dangers when using hand tools.
2. How should sharp-edged tools be passed to someone?
3. What should you do before turning on compressed air?
4. What should you wear when using compressed air?

5. What should you wear when using cleaning equipment?
6. What can happen if an engine runs at too high a speed for too long?
7. Why is carbon monoxide dangerous?
8. How can you get rid of carbon monoxide?
9. What three things must be present to have a fire?
10. Where is your shop fire extinguisher?

DISCUSSION TOPICS AND ACTIVITIES

1. Examine your home garage for any of the hazards discussed in the chapter. Eliminate any hazards you find.
2. Pass a safety test based on the hazards in your school small-engine shop.