# CHAPTER 1: AUTOMOTIVE

## Tune-up/Maintenance Equipment

Automotive d-i-yers have gone far beyond simple car care and appearance projects, graduating into full-scale maintenance tasks that include tune ups, oil changes and more.

With the available product knowledge and easy-to-use products and kits, the range of projects that d-i-yers are willing and able to tackle continues to expand.

### MOTOR OILS

One of the simplest projects is an oil change. When selecting a motor oil, a consumer should understand its designator. SAE (Society of American Engineers) ratings indicate the viscosity of the oil. The most commonly used oil for automobiles is 10, 20 and 30 weight or all weather combinations.

A rating of 10 represents a thinner oil than a 30 rated oil. The thin oil is recommended for winter driving, where cold weather causes the oil to become thick and sluggish. A 30-rating oil is heavier and is applicable in warm climates.

The designator "W" in a rating indicates that the oil has been tested for viscosity levels at specific cold temperatures. An oil rated 10W 40 is considered an all weather oil with sufficient viscosity for both summer and winter driving.

A "CC" or "CD" label on an oil indicates that it is for diesel engines. It should also be noted that high-compression diesel engines usually require more frequent oil changes than their gasoline counterparts.

Synthetic motor oils are higher priced than petroleum products, but extend change intervals up to 25,000 miles, according to some manufacturers.

Synthetics can operate under a wide temperature range since the molecular chemistry is specifically developed at the outset rather than relying solely on refining procedures and additives to fortify a petroleum based product. However, additives are still used in synthetics.

Generally, synthetics lubricate better, thus reducing engine wear; they are purported to enhance performance and economy. Two of the major drawbacks are increased price, which can run up to four times the price of conventional oils, and educating consumers to alter their oil-change intervals.

Rerefined oils are used oils reprocessed for consumption. Although rerefined or recycled oil is almost equal in quality to virgin oil lubricants, the consumer will have to be educated to eliminate the stigma of used oil.

### Detergent Oil

Detergent oils contain additives known as detergent dispersants, designed to suspend combustion by products and keep these by products from settling on engine parts.

Automobiles built since about 1970 require a high-detergent oil, designated by the American Petroleum Institute Service Classification SE or SF for gasoline engines and API Service Classification CC and CD for diesel-powered engines.

Nondetergent oils are classified under API Service Classifications SA and SB. These indicate a straight mineral oil type formulation and may have some rust oxidation additives added.

### OIL FILTERS

A specially treated paper filtering element contained in a metal screening is the prime component in virtually all oil filters. The paper is pleated into an accordion fold for maximum surface area and the metal screen is used to hold the paper in place and prevent its collapse under the high pressure that builds up in the oil system.

Filter quality is determined by the minimum-sized particle that the filter is capable of stopping. A 10-micron rating, for instance, will stop a particle measuring approximately .0004 inches, but still allow the oil to circulate freely in the system.

**OIL RECOMMENDATIONS**

| TEMPERATURE | SAE GRADES | |
|---|---|---|
| AIR | SINGLE VISCOSITY | MULTI-VISCOSITY |
| Above 32°F | 20,30 | 10W-30<br>10W-40<br>20W-40<br>21W-50 |
| 0°-32°F | 10W | 20W-30<br>10W-40 |
| Below 0°F | 5W | 5W-20<br>5W-30<br>5W-40 |

## HOW TO READ A CAN OF OIL

The first item you should look for on a container of oil is the American Petroleum Institute's symbol as an assurance of oil quality. It should read "API Service."

Next check the oil's performance level. An "S" means the oil is suitable for use in gasoline engines, and a "C" means the oil is suitable for diesel engines.

Following the "S" should be a letter from "A" to "F," indicating its service letter. "F" is the highest designation and will provide the greatest performance. Following the "C" will be a letter from "A" to "D".

If a customer says his owner's manual recommends an "SD" or "SE" oil, assure him that an "SF" will provide better protection and is preferable.

The words "Energy Conserving" on the label usually mean the oil contains friction modifiers and may provide a fraction of an mpg in fuel economy.

The grade of the oil is set in accordance with standards of the Society of Automotive Engineers (SAE). A multiple-grade oil will have two numbers. The first shows the oil's flow properties at low temperatures; the second indicates the oil's high-temperature properties. A single-grade oil will have only one number.

The "W" denotes the oil is recommended for winter use.

### Spin On Filters

Most cars are equipped with spin on filters. These come with the filter enclosed in the canister. When changing the unit, the used canister is thrown away. When selling this type filter, always consult the catalog; although the filter might appear outwardly to fit on a given car, there is a good chance that the gaskets might not seat properly, or that the bypass valves might not function.

Special wrenches are available for use with filters of this type.

### Long Life Filters

Dual or long life filters are basically spin on filters equipped with two filtering elements. The main paper filter handles the flow of oil under normal driving conditions. As oil pressure builds, pressure valves release some of the oil and channel it through a second element often made of a synthetic material such as rayon.

This relieves back pressure and prevents clogging as oil pressure increases. As the pressure declines, the valves close and redirect all of the oil through the main filter element.

### Cartridge-Type Filters

Cartridge-type oil filters, used primarily on older cars, fit into a canister that is mounted on the engine. The filter and the canister lid must be seated properly to prevent oil leaks and to ensure that the oil passes entirely through the filtering element.

## GREASE GUNS

Two types of grease guns are usually sold by d i y retailers. One is a long cylinder (about 14") that operates with a lever action. It frequently has a flexible hose that allows the user to maneuver the nozzle around corners and into tight spots.

A smaller, more compact pistol-type can is operational with one hand and usually has its nozzle at the end of a short, rigid tube. It is suited for work in tight quarters.

Grease can be bought in bulk to load into the guns or purchased in cartridge form. Grease containing molybdenum disulfide is recommended for auto chassis.

## SPARK PLUGS

Spark-plug performance is one of the single most important factors in maintaining gasoline mileage and engine efficiency. It is estimated that one spark plug firing improperly can rob an auto of 15 to 35 percent of its fuel efficiency.

A spark plug consists of an electrode encased in a ceramic insulator plus a metal shell threaded to fit into the engine block. A second electrode is attached to the shell.

The distance between the two electrodes is called the gap and creates the spark. Gap settings are specified by engine manufacturers and should always be checked with a gauge and reset prior to installation of the plug.

It is imperative that the consumer purchase plugs recommended for use in his or her car, based on the plug's size and performance profile. Just because they fit doesn't mean they will work efficiently in the auto.

### Hot and Cold Plugs

The terms "hot" and "cold" refer to the ability of the spark plugs to dissipate operating heat. They do not refer to the intensity of the spark.

As an engine runs, heat builds up in the upper cylinder. If the spark plug cannot dissipate its own heat, it can become hot enough to ignite the fuel without the spark, causing the engine to misfire. This is called preignition and can cause serious damage to the engine, if not remedied.

## SPARK PLUG PROBLEMS

*A spark plug, after extended use, can indicate many problems in an engine. Some of the common indicators are as follows:*

| | |
|---|---|
| Brown to grayish-tan deposits of powder on electrodes and slight electrode wear. | Normal for mixed high and low speed driving combination. |
| Dry, fluffy black carbon deposits. | Over-rich carburetion, faulty choke, sticking manifold heat valve, clogged air filter, faulty coil, condenser or spark plug coils. Can also be caused by excessive low-speed driving or idling so that engine temperature is not high enough to burn off carbon. |
| Wet, oily electrodes. | Oil is entering combustion chamber. Can be faulty rings, excessive valve stem guide clearance, etc. |
| Red, brown, yellow and white coatings on insulator. | Usually result from additives in fuel and oil. Can be cleaned if powdery, but when glazed will short out charge. |
| Burned or blistered insulator tips. | Caused by overheating. Can be due to pre-ignition, cooling system failure, improper fuel/air ratio, low octane fuel, over-advanced ignition timing, improper plug installation or defective heat riser valves. |

A cold plug will dissipate heat more rapidly than a hot plug. Engine manufacturers will specify heat range ratings for the engines. Situations where a colder plug might be recommended are when the engine is modified for greater output, hauling heavy trailers, sustained high speeds, or heavy duty applications for exotic fuel uses. Hotter plugs might be used for "oil burners," light duty applications or continuous city driving.

### SPARK-PLUG WRENCHES

Most socket wrench sets contain a deep-well socket designed for use on spark plugs. However, on many cars the plugs are extremely difficult to reach. A special long handled, T-shaped wrench with a socket permanently attached to the bottom of the "T" by a universal joint will solve the problem.

### SPARK-PLUG WIRE SETS

Spark-plug wires transmit the electrical charge from the distributor to the spark plug. They are available in sets of four, six or eight, depending on the number of cylinders. Length of the wires varies to reach the separate spark plugs.

They should be inspected annually and replaced as needed. Faulty wires cause ignition problems and a rough running engine.

### AIR FILTERS

Paying the labor bill on installing an air filter is a waste of money, since this is one of the simplest tasks for a d-i-yer. Air filters are contained in the air-cleaning system which may or may not be mounted on top of the carburetor. If not there, it is connected to the carburetor by a duct.

The filter requires inspection at least every 12,000 miles and should be replaced if light will not show through it. It should also be replaced if it shows wear such as tears.

### SHOCK ABSORBERS

Shock absorbers utilize a system that combines a piston with hydraulic fluid to cushion an auto ride, providing degrees of stiffness and load-hauling capabilities. Several varieties are available depending on how the vehicle is used, such as driving conditions, hauling and pulling requirements.

Changing shock absorbers is another task that d-i-yers can handle without special tools. You may want to suggest that they use penetrating oil before trying to remove the absorbers and either caulk or silicone sealant on the absorbers' fasteners to guard against rust after installing the units.

### HOSES

Hoses in a car's cooling system should be checked at least twice a year for cracks or other deterioration that can lead to leaks and overheating.

When selling radiator and heater hoses, make sure the customer purchases the size and shape required for his automobile. Also suggest clamps to fasten the hoses. Although there are a variety of clamp styles, the worm drive that uses a bolt to loosen and tighten the clamp's band is efficient and easy to use.

### BELTS

A system of belts and pulleys driven by a main pulley connected to the motor's crankshaft harnesses engine power to operate the power steering pump, water pumps, fan, etc.

The most commonly used belt is the V belt, although there is another belt style that utilizes grooves corresponding to grooves in the pulley. Manufacturer programs offer a selection of common belts and pulleys to fit most of the cars on the road and target your inventory investment to the most frequently used items.

Consumers should be educated to check the condition of all the belts on the car and replace any that are cracked, slippery, dry or brittle. Broken belts can cause the engine to overheat.

### LIGHTING/ELECTRICAL

In addition to headlights, taillights, turn signals and license-plate lights, there are numerous lights in the car interior that must be replaced periodically.

Also, fuses occasionally need replacing.

#### Headlights

Sealed-beam headlights are the most common; many state laws require this type of headlight. When a nonsealed headlight goes out, only the bulb needs to be replaced. Sealed-beam headlights must be replaced as an entire unit.

In addition to conventional headlights, quartz halogen headlights offer nearly double the candlepower, but are also more expensive.

#### Exterior Bulbs

Although d-i-yers may have to remove the light lens, a whole light assembly, or reach the light from under the fender or bumper, exterior light bulbs are still relatively easy to replace.

Usually, the only tool needed to reach a defective exterior bulb is a screwdriver. To remove the bulb, push it into its socket, turn it and lift it out; then replace it with a new bulb.

### Interior Bulbs/Fuses

There are several bulbs in an auto's interior. Replacement can be as simple as putting in a new bulb to as difficult as disassembling the dash and other components.

Fuses are usually easy to reach and replace. Fuses prevent the electrical system from overheating. Fuses, which are either glass-tube types or ceramic, blow as the result of shorts in the system. Glass-tube types are in most American cars; ceramic fuses are used in some imports. When replacing a fuse, it is best to suggest using a special fuse puller. Point out that pullers are much easier and safer than trying to pry out a fuse with a screwdriver.

### IGNITION SYSTEM

With the exception of very old model cars, most cars have electronic ignition systems. In general, the wire sets on electronic ignitions need to be replaced every 30,000 miles, due to the high voltage (14,000 to 30,000 volts), which breaks down the wire sets internally.

Also, the higher under-hood temperatures of new cars deteriorate the wire sets externally.

Autos equipped with electronic ignitions have no need for points and condensers. Distributor tune-up kits containing points, rotor and condenser remedy ignition problems in cars without electronic systems.

## Automotive Chemicals

Automotive chemicals comprise everything from windshield, muffler, tailpipe and transmission sealers to windshield washer solvents and represent a major segment of retail automotive aftermarket sales in d-i-y stores.

### ANTIFREEZE

Almost all antifreezes are called "permanent" and are made primarily from ethylene glycol. Nonpermanent antifreeze is made primarily of methyl alcohol, which evaporates.

The ethylene glycol, while preventing water from freezing, also serves as a coolant because of its high heat transfer qualities. As an example, one major brand of antifreeze mixed with equal parts of water will lower the freezing point to -34°F and raise the boiling point to 260°F. It can be used year-round.

Compact automobiles, with their high powered engines and low capacity radiators, require the use of coolants and all major automobile manufacturers add permanent antifreeze at the factory.

Antifreeze containers should list the amount of antifreeze required according to radiator capacity and temperature level required. Manufacturers recommend that permanent antifreeze be changed every two years.

### RADIATOR ADDITIVES

Cooling system additives include sealants, rust inhibitors, lubricants and flush. Sealants, rust inhibitors and water pump-lubricants are added to the radiator and used under normal driving conditions. Sealing ability is restricted to minor holes.

Radiator flush requires that the radiator be drained after allowing the chemical to circulate through the cooling system. It is designed to dislodge accumulations of rust and other foreign materials that might impede the flow of water. Manufacturer's instructions will indicate the length of time the engine should be run prior to draining the radiator and block of the vehicle.

### TRANSMISSION FLUID

Automatic transmission fluid functions as a power-transfer fluid, hydraulic fluid and a gear lubricant. The fluid must perform these functions in a wide range of temperatures; it has an SAE grade rating of 5W 20.

Automatic transmission fluid must be high quality and fortified against oxidation caused by high operating temperatures in an automatic transmission.

Most vehicle manufacturers recommend against using automatic transmission fluid in power steering systems. It can cause deterioration of the connecting hoses.

### TRANSMISSION SEALANTS

Transmission sealers and conditioners are added to the transmission fluid and used under normal driving conditions to improve operation and to seal minor leaks.

Usually, they include chemicals that retard oil decomposition and improve stability. They seal by softening transmission gaskets and seals, closing up small leaks caused by dried or cracked seals. This remedies only minor leaks.

### OIL ADDITIVES

Oil additives are combinations of oil distillates and other chemicals that make engines operate more efficiently by freeing sticky valves, sealing piston rings, retarding oil breakdown, etc.

They are usually a form of extremely heavy oil more resistant to change under high temperature, so that viscosity (thickness) is maintained at high speeds. Increased lubrication and sealing capacities are attributed to greater adhesion to engine parts.

The additives are usually added to the oil and used under normal driving conditions.

Oil additives are not cure alls. They can improve engine performance by sealing leaks into valves and combustion chambers. They will prolong the life of an engine, but cannot repair serious damage.

### CRANKCASE CLEANERS

Unlike oil additives, crankcase cleaners or flush cannot be left in the crankcase. Instructions are indicated on the container, but normally the chemical is added to the crankcase and the engine is run for a specific period of time to allow the chemical to circulate and break loose accumulations in the oil pan.

The crankcase must then be drained and a new oil filter installed along with a new supply of motor oil.

### WAXES AND CLEANERS

Cleaners include solvents and other chemicals that remove road tar, dead pigment and other materials without damaging the car's finish.

Many car waxes include cleaning elements to clean and wax in a single application. Long lasting liquid and paste waxes usually cost more.

A stock of two or three varieties of liquid and paste wax and cleaners will usually satisfy most customers.

In addition to body cleaners and waxes, there are also tire-cleaning compounds, whitewall cleaners, tire blackings, vinyl-top cleaners and conditioners, rug and upholstery cleaners.

### WINDSHIELD CLEANERS

Windshield washer solvents are usually made of methanol and other solvents to keep the water from freezing as well as clean the windshield. Available in concentrated form to be added to water or in diluted form is ready to pour into the washer reservoir jar. Ready to use solvents are usually rated to about -30°F.

### CARBURETOR CLEANERS

If a customer is having engine performance problems that he thinks are linked to a carburetor, suggest that he try a carburetor cleaner before he invests in a new or rebuilt carburetor.

These cleaners can be applied several ways such as a fuel-tank additive or poured into the carburetor throat. Another cleaner connects the contents to the fuel inlet after disconnecting the fuel line.

Whichever the consumer decides to use, read the instructions carefully and make sure the cleaner will not damage the catalytic converter.

Similar additives clean fuel injectors.

## Batteries

An automobile battery produces electricity through chemical reaction. Two plates, made of different metals, are immersed in sulfuric acid (an electrolyte) which creates a flow of electrons to produce electrical power.

Automobile batteries have several cells, each of which produces two volts of power. Most automobiles require 12V batteries consisting of six cells. Each cell has its own plates and electrolyte to produce a portion of the total output of the battery. These are wired in series to the positive and negative posts of the battery.

As current is drawn from the battery, the acid is absorbed by the plates. When all the acid is absorbed, the electrolyte becomes essentially water and the battery can no longer produce a current. Charging the battery causes the acid to move from the plates back into the solution.

Ampere hour capacity or electrical size are terms referring to the number of plates per cell or the size of the plates. Increasing size or number means increased power capacity.

### Wet/Dry Charge

The terms wet or dry charge refer to whether the electrolyte is in the battery when it is shipped. If batteries arrive dry, the electrolyte must be added and the battery given a "boost" charge. The following procedures are recommended:

1. Fill each cell to the top of the separators with electrolyte (water cannot be used).
2. Boost charge until warm to the touch. Electrolyte should be about 80°F.
3. Check specific gravity with hydrometer. Should be minimum of 1.250.
4. Add electrolyte to each cell to bring level to appropriate level indicated by manufacturer.

Shipping and storing dry batteries has the obvious advantage of eliminating spillage, etc. The disadvantage is the time, labor and materials necessary to convert dry batteries to wet.

Maintenance free batteries are permanently sealed; the unit contains fluid but provides no access to it.

They are considerably more costly, but require no additional water throughout the normal life of the battery. Special alloy grids reduce water loss, and a greater reservoir of electrolyte works with the grids to extend the normal life.

**BATTERY SAFETY TIPS**

Batteries are filled with sulfuric acid and therefore can be dangerous if handled improperly. The acid can eat through clothing and burn flesh.

Do not smoke or cause sparking near an auto battery. Wear outer garments including gloves and safety goggles when working on a battery. If battery acid comes in contact with skin or eyes, flush with water for 15 minutes and get medical attention.x

### Cranking Amps

Cranking amps, or cranking performance, is a measurement of the power relationship between batteries and engine size. One cranking amp is recommended for each cubic-inch displacement of the engine.

A cranking amps value of 400, for example, is the minimum rating that should be used for an engine with a 400-cubic-inch displacement. High compression ratios, extreme weather conditions or high power accessories would require an even higher cranking amps rating.

### Battery Testing

The battery charge can be tested with an hydrometer, which measures the specific gravity of the electrolyte. A specific gravity of 1.000 means that the liquid is essentially water. A fully charged battery should have a specific gravity reading of approximately 1.265. A reading of 1.220 indicates a half charged battery and 1.180 means the battery is near total discharge.

Batteries must also be tested for variance between cells. A reading showing a difference of more than .050 between cells means the battery must be replaced; less indicates it can be recharged.

Batteries stored wet should be periodically checked to ensure that the specific gravity reading remains above 1.250. Every battery should be checked prior to its sale.

Another test that should be made prior to selling the battery is the load test. A meter is connected between the negative and positive poles to check the actual load produced. A poor reading indicates that the battery is either not fully charged or that it is defective.

#### LEAD ACID BATTERY ALERT

Lead acid batteries are the major source of lead entering the municipal solid waste system. Disposals of batteries in landfills and incinerators can result in human exposure to lead via ground water, drinking water and ambient air.

High levels of lead exposure can cause brain and nervous disorders, anemia, high blood pressure, kidney and reproductive problems and even death. Children are particularly sensitive to the effects of lead poisoning.

Many states have enacted legislation which bans the disposal of batteries in municipal solid waste landfills and incinerators. Most of these laws are specific regarding how used batteries are handled. Retailers selling a new battery are required to accept and recycle the old battery. In addition, many states require that the secondary lead smelter or state-authorized collection and recycling facility by the retailer who accepts used batteries.

Check to see if your state has such legislation and be sure your store has a copy of the law.

### Maintenance Tips

Fluid levels should be checked once a month and cells filled to within ¼" of the bottom of the filler neck.

If it is necessary to add fluid, distilled water should be used and the engine run for a time if the temperature is below freezing.

Dirt and water should be cleaned from the top of the battery and corrosion removed from the terminals and clamps.

### BOOSTER CABLES

Booster cables are insulated conductors with alligator clamps at each end to provide a temporary booster charge from a live battery to a low battery.

Copper-core cables are considered quality with better conduction capabilities than aluminum conductors. Aluminum cables are frequently used for promotional purposes.

### BATTERY CHARGERS

Battery chargers range from 1-amp-output promotional models to commercial units with amp ratings in excess of 100.

For normal home auto use, a 3- to 10-amp rating is sufficient for slow charges and 60 to 100 amps for fast charges. The amp rating is the output of the charger and controls the length of time required for the battery to charge.

Most car batteries are rated around 50 to 70 amp/hours. A constant amp output multiplied by the number of hours would indicate the charge in the battery. Ten amps output for 5 hours would equal 50 amp hours.

Most battery chargers, however, have tapered charges, meaning that the output is not constant. As the charge builds up in the battery, the battery voltage retards the output of the charger to as much as 50 percent capacity. A 10 amp charger, then, might be putting out only five amps as the battery nears its full charge. Constant output chargers are available, but have limited applications.

Another element found on some chargers is the "booster charge." This is a device that converts household alternating current to direct current, allowing the automobile engine to start directly from the outside current supplied. This eliminates having to wait for the battery to charge before the engine can be started.

Booster capacities are available in ratings as high as 300 amps, but most cars require from 90 to 110 amps of cranking power, so that a 100 amp booster element is usually sufficient for normal home use.

### Battery Voltage

Battery chargers specify the voltage of the battery on which they can be used. Some can be used only on 6V or 12V batteries while others can be used on both types. Manufacturer's specifications should indicate output at specific voltages.

### Automatic Chargers

If a charge is applied to a battery after the battery is fully charged, the amperage converts to heat energy causing the electrolyte to evaporate. Automatic chargers eliminate this problem by automatically switching off when the battery is charged and back on again if the charge decreases.

This is useful for people who own boats, electric golf carts and other items used occasionally. The charger can be attached to the battery to keep it fully charged for months at a time. Virtually all batteries will lose their charge during a long period of inactivity; an automatic charger keeps them at peak efficiency.

A quality automatic charger should be capable of keeping a battery fully charged over a long period without causing electrolyte evaporation or any noticeable increase in the electrolyte temperature.

## Auto Body Repair Products

Auto body repair lines are natural additions to do it yourself automotive departments.

Popular items, in addition to basics such as tack cloths, sandpaper, files, automotive paint, etc., are:

Plastic filler and hardener--mixes, spreads and then dries extremely hard, but sandable, for auto body repairs.

Glazing putty--sands to smooth finish. Used for small imperfections, dents, scratches.

Plastic applicators--used to apply plastic filler and for other spreading jobs.

Spray undercoating--rust prohibitor used under fenders. Also comes as aerosol for touch up.

To repair fiberglass auto bodies, the customer will need hardener, fiberglass resin and either fiberglass mat or fiberglass cloth. The mat builds up new surfaces and shapes; cloth refinishes existing surfaces. Combined with hardener and resin, both cloth and mat will change from cloth-like consistency to a solid surface in 30 minutes.

## Accessories

When selling oil and oil filters, suggest an oil drain pan to catch the old oil. Also, specially designed oil-filter wrenches make changing the filters much easier and cleaner.

Pour spouts and funnels are excellent add-on purchases for oil or other chemicals and additives. Fender covers protect a car's finish while a d-i-yer is working in and around the engine compartment.

Working on a car raised on a jack is extremely dangerous. Recommend that the person use jack stands or drive on ramps to support the auto. It is suggested that jack stands with a rating of 1½ to 2½ tons should be used depending upon the size of the auto. Also, ramps with a support rating of 2½ to 4 tons are recommended.

Road safety items include emergency lights and flares. Flat tires are less of a problem if the consumer has an air pump. These are available as either foot-operated types or ones that plug into the cigarette lighter.

Auto emergency kits contain first aid products, aerosol tire filler and sealer, flares, fire extinguisher and flashlight.

### Interior Accessories

Portable vacuum cleaners that plug into a car's cigarette lighter are convenient for cleaning up auto interiors. Car mats help cut down on interior carpet wear. Interior accessories such as compasses, litter baskets, beverage holders and phone/GPS holders appeal to most drivers.

### Towing Equipment

In addition to chains, tow ropes, some made of nylon or polypropylene, are specially made for pulling vehicles. They are resistant to oil, grease, etc., and come with braided eyes, hooks and protective collars to guard against cuts.

### Additional Accessories

Some other basics in an auto department include splash guards to protect a car's finish from rocks, gravel and asphalt kicked up by the tires. Snow brushes and ice scrapers are a must for winter driving.

Chamois, polishing cloths and drop cloths are also staples for add-on sales with car care and clean up products. Gas cans are steady sellers in this department also, and you will want to highlight garage door openers and tie them into auto promotions.

Don't forget d-i-y auto repair books. Auto d-i-yers are learning a new set of skills, and the number of projects that they are willing to undertake increases continually.

# CHAPTER 2: OUTDOOR POWER EQUIPMENT

## Power Units

Power sources for lawn and garden equipment fall into three categories: gasoline engines, electric motors and battery powered electric motors.

For smaller equipment, the convenience of cordless operation is a major selling point. Not only has extended battery life contributed to the popularity of cordless tools, but lightweight gasoline engines on products such as string trimmers allow the consumer to move about freely without the fear of cutting an electrical cord.

Starting cordless units powered by electrical motors is easy, and battery charges will usually last through most typical yard jobs. The unit can be recharged between jobs. Increasingly, electric motors are being used in a wide range of outdoor power equipment and starter motor applications.

Larger power equipment is primarily gasoline powered.

### STARTERS

Recoil starters are most widely used, but battery-powered starters have grown in use over the years.

The batteries for electric starters can be recharged either with chargers that connect to electrical wall outlets or with electrical chargers built into the engine, which recharge the battery while the engine is operating.

Battery voltage may be 6V or 12V, and the number of starts possible depends on the battery amperage rating and the output of the engine charger.

The convenience and reliability of electric starters are good selling points. Electric starters may add $50 or more to the retail selling price of a walk-behind mower and as much as $150 to the price of a tractor.

### GASOLINE ENGINES

Gasoline engines are available in two- and four-stroke cycle constructions. The four operating functions are intake, compression, power and exhaust stroke.

In two-cycle engines, compression and power are combined in one cycle, and exhaust and intake are the second cycle.

A four-cycle engine uses valves and a two-cycle engine utilizes intake and exhaust ports.

Lubrication for two-stroke cycle engines comes from the oil being mixed with the gasoline. The four-stroke cycle uses a reservoir.

Two cycles are easy to start, but speed regulation is usually limited. Some models have fuel primers for easier starting.

When selling gas engines, features such as visible oil and gas gauges may be stressed, as well as the power to weight ratio and ease of adding oil and gas. Salespeople will also want to point out what grade and quantity of oil and gas to add, how to mix oil and gas for two cycle engines and how to drain the oil and clean the air filter.

Some gasoline engines have solid-state ignition systems and improved carburetor designs that can be stressed as well.

### SPARK PLUGS

Selling spark plugs requires knowledge of exact engine specifications. Failure to use the correct plug, or substitution, could result in poor performance or engine failure.

Engine manufacturers specify spark plugs for specific requirements and best performance. Some of the considerations made in specifying spark plugs include heat range, size, sealing features, materials, depth projection (position of electrode) in the cylinder head and electrode shape/design.

Original equipment manufacturers can supply data on the specific plug needed for individual power equipment engines. Manufacturer representatives can also supply information such as charts and brochures on use and interchangeability.

## Rotary Mowers

The performance characteristics of rotary mowers depend a great deal on the design of the mower's deck.

Usually steel or aluminum is used in deck construction. Steel decks cost less, but can rust.

Fourteen gauge is the most common thickness. If the steel is thinner, regardless of the grade, the mower deck will flex easier, resulting in increased vibration.

Stiffness can be increased by properly shaping the housing and adding reinforcements. It should also be noted that the higher the number used to denote metal gauge, the thinner or lighter the product.

More suction is derived from extra deep decks; this decreases the possibility of objects being thrown out from under the mower. These mowers also permit cutting heavy and tall growth.

However, deep decks require long engine shafts, which are subject to bending, and allow cut grass to pile up against the deck's underside.

Shallow decks have the advantage of a short engine shaft that resists bending. However, objects can be thrown out from under shallow decks easily, and these engines won't perform well in tall or heavy growth.

Rather than hitting objects head on, engine shafts may be bent when the blade goes over or under objects like large tree roots or rocks.

Decks also have additional safety features such as trailing plates at the rear. All walk behind mowers comply with federal safety standards, requiring the blade control to be held for the blade to turn and the blade to come to a complete stop within three seconds after the control is released.

To accomplish this, some mowers have a blade brake clutch (BBC) mounted on the engine crankshaft that will stop the blade or turn off the engine.

If engine stop is chosen, the mower will have either an electric starter to restart and battery that will be constantly charged while the engine is operating; or the engine can be manually restarted by a recoil starter if the pull handle is located within 24" of the top of the mower handle.

An exception allows the pull handle to remain on the engine if the mower meets a 360° foot-probe test.

The pull handle also can remain on the engine if the mower deck has extra guarding around the outside.

The bottom edge of the front of the deck should be lower than the cutting edge of the blade. In order to meet recommended safety codes, the blade cannot be exposed at more than a 15° angle from the front of the mower to reduce the risk of objects being thrown.

### BLADES

Quality rotary mowers must have properly designed tempered-steel blades. If they are not tempered in the middle, blades can twist or bend, ends of long blades

may flex up or down when run at high speed. Range of Rockwell hardness should be about 42 to 47. Ask your source about the rating on his lines. Rotary blades have a lip behind the cutting edge that creates suction and throws cut grass out the chute. A lip one or two inches long, with a moderate angle, performs both functions well. If the lip is too long or if the angle of the lip is too steep, it will have a tendency to throw the cut grass up against the deck instead of out the chute.

If a blade isn't sturdy, it will vibrate when run at high speed; this is especially true of longer blades. For safety, the blade tip must ride 1/8" or so above the bottom edge and along the sides and rear of the deck and it should ride ¼" or so below the top edge of the rod or bar across the bottom of the grass chute.

It is necessary to take extra care to maintain precision balance when a blade is resharpened.

## CUTTING WIDTHS

Cutting widths vary from 16" to 22", depending upon the blade length.

Smaller sizes cost less, can be easier to handle and may use less gas. Some have 2½-hp engines, but most have 3 hp. The 21" and 22" models usually have 3½ hp.

Persons who choose the larger mowers because they have large lawns may be good candidates for a move up to riding mowers when they replace their old mower.

"Mini mowers" with 16" cutting widths are good suggestions for trimming or for cutting small lawns.

## HANDLES AND WHEELS

Bow shaped, T shaped or slanted T shaped with rubber or plastic grips are the basic handle designs.

A handle attached at an angle that allows the user to push forward instead of down provides easier operation.

Quality features to look for are easy attachment and removal, height adjustment and upright position locks for storage or transportation in car trunk.

Swing over handles may be dangerous, allowing the mower to roll back on the user's foot. Also, it encourages the user to run the mower backwards half the time, and this results in poor performance.

Wheels can be plastic or steel.

### GET READY FOR NEXT YEAR

When the mowing season ends, advise customers to get their lawn mower in shape for next season by:

1. Disconnecting the spark plug wire from the lawn mower.
2. Cleaning out old grass and dirt from the blade and the mower surfaces by brushing them with kerosene.
3. Draining gas and oil from the tank.
4. Removing and cleaning the spark plugs.
5. Removing and sharpening the rotary blades.
6. Tightening all bolts.
7. Checking and replacing the muffler if it has rusted.

Mowers with larger wheels are more easily pushed. Wide wheels are best; narrow rubber tires may leave wheel marks or tracks.

Plain wheel bearings have steel, plastic or nylon sleeves, requiring at least some lubrication. Sintered bearings require no lubrication. Because sand will destroy plain bearings, some are replaceable. Ball bearings, if shielded or sealed, require no lubrication since oil cannot get out and dirt cannot get in.

Wheels are held by a threaded stud or by a bolt-and-nut arrangement.

## HEIGHT ADJUSTMENTS

Three types of height-adjustment mechanisms exist. Removal of all four wheels is the first. This system is inexpensive and used on low priced mowers.

The most widely used mechanism is a lever-and-cam arrangement at each wheel. The prime disadvantage is that it may encourage the dangerous practice of holding the deck up with one hand and shifting the lever with the other.

The third approach raises or lowers the entire deck by adjusting a lever or turning a knob. This costs more, but is convenient and safe.

Many mowers have up to five height adjustments. A height change from 1" to 3½" is usual, with four to six heights available. In California, many prefer a mower that will cut closer than 1".

## GRASS CHUTES

Grass-chute location determines whether the mower is staggered wheel or an inline model.

Rotary mower cuts are done in the 180° semicircle in the front half of the deck; with a staggered wheel model, grass is cut and ejected instantly, much of it in a straight line.

If the chute is in the center of the right side of the deck, little grass is ejected in a straight line, and a hard object hit by the blade has a good chance of hitting the deck before it is thrown out, thus losing much of its speed and danger.

Clogging is often the result of a thin deck edge at the rear end of the chute and/or too small a chute opening. If the engine isn't stopped before the chute is cleaned, this can be dangerous.

A baffle at the rear of a side chuted mower may help to prevent clogging, depending on the design.

A rod or a bar across the bottom of a side chute is necessary for safety to prevent the blade hitting the ground.

Staggered and in line wheel mowers trim on the left side only, since chutes must be extended to meet foot-probe requirements.

Rear-chute mowers that bag at the back offer several design advantages. They allow the user to trim closely with either side of the mower, since there is no bag or chute

protruding from the side, and clogging is less likely with their large discharge chute.

Also, the larger rear-bag size reduces the frequency of emptying, which is an excellent selling point.

### GRASS CATCHERS

Removing and reattaching grass catchers should be both quick and easy for the user.

There are two types of discharge for grass bagging. One utilizes the standard chute opening; the other blocks the normal chute and opens up direct entry into the bag, tending to fill it from back to front.

Leaf mulching does not require closing the chute if the blade is properly designed, and if there is a baffle in back of the chute.

### MULCHING MOWERS

Mulching mowers eliminate the need for bags altogether since they discharge clippings into the lawn. Thatch buildup is eliminated too, because the enclosed deck and cutting action converts grass clippings into tiny pieces that filter into the lawn without clumping.

Ecology minded consumers like the idea of the mulch produced by these mowers because it decomposes rapidly, usually in about two weeks, and returns valuable nitrogen to the soil. In addition, some states are beginning to ban community trash disposal of grass clippings and leaves.

The closed deck or cutting chamber produces a powerful vacuum action that straightens grass when cut and recirculates the clippings until they are recut into the fine mulch.

In addition to the benefits that the mulch contributes to the soil, mulching mowers also mean less work since there are no bags to empty.

It should be pointed out that mulching mowers may be less effective in heavy, wet grass, which may "ball up" and drop onto the lawn in clumps. And in extremely tall grass, the mulching action is less efficient.

Some manufacturers offer a mower that can be converted from a mulcher to a standard rotary by opening a plate in the side of the deck for discharge and changing to a standard cutting blade.

### SELF PROPELLED MOWERS

Based on different engineering approaches, a variety of driving mechanisms has taken the push out of hand propelled mowers.

This may involve front or rear wheel drive, but most are driven by two pinions. Some are driven by pinions that press against comparatively smooth tread rear tires; but under some conditions, these pinions slip and the wheels don't turn. This can cause the mower to become semi self propelled.

Cogged pinions which fit into grooved notches on rear or front tires power other models. This approach works well until the pinion teeth become worn. If the pinions are easily replaced, this presents no problem.

Some models are driven by metal pinions with teeth that mesh into the metal cog wheels attached to the inner sides of the mower's wheels.

A different approach uses pinions like those on a reel mower. These pinions are on a shaft driven from a transmission. This type of design usually costs more but is very satisfactory.

Another approach is to use a variable-speed transmission with a differential gear box located on the rear axle.

Putting some self propelled mowers into gear may require raising the handle, while pulling back on the handle disengages the gear. This works well with rear wheel drive, which is usually less expensive.

Others are put into gear with a lever and wire, or lever and rod, like a gas-throttle control. This is preferred with front wheel drive. When such a mower is standing with the engine running, it cannot be bumped and put in gear.

An engine kill/electric restart "deadman" control is available on self propelled mowers. This control bypasses the starter cord and allows the operator to start mower at the flick of a switch.

### BIG-WHEEL MOWERS

Often known as bicycle wheel mowers, these units have 14" to 24" rear wheels, 6" to 8" front wheels and 21" to 24" cutting widths. They are designed to cut heavy or rough growth and on uneven or rough terrain.

### A GUIDE TO BETTER MOWING

1. The lawn should not be wet when you mow.
2. Mow in the evening hours. Newly cut grass can be damaged by a hot sun.
3. Adjust the height of the mower blade on level ground with the power turned off. Cut upright grasses at about 2", Bermuda grasses at about 1-1/2" and bent grasses at about 1".
4. Don't let yard debris injure you or damage your mower. Clean it up before mowing.
5. Mow once a week if rainfall is normal.
6. Keep mower oiled according to manufacturer's specifications.
7. Tighten all mower parts periodically; any unusual rattle should prompt an extra check for loose nuts, screws or bolts.
8. Grass should be upright, not freshly walked on, when you mow. Mow once or twice around the perimeter of the lawn before cutting across. Change patterns each time you cut, and mow with as few interruptions as possible (this helps the appearance).
9. Don't leave cut grass on the lawn. It sinks down and keeps moisture and fertilizer away from soil and weakens grass. It also provides a "bed" for insects and fungi.
10. Clean mower after each use. Wipe grease, oil and grass from mower.
11. Always be cautious about using gasoline, whether fueling the mower, storing the fuel can or storing the mower. It's a good idea to drain the fuel tank before storing the mower.
12. Never mow with a dull blade. Sharpen occasionally. Dull blades tear and "injure" a lawn.

When seeking quality characteristics, consumers should look for sturdy rear wheels with strong spokes and rims, pneumatic tires and shielded or sealed ball bearings. Some engines are 3½ hp but 4 or 5 hp are preferred, and engines are sometimes mounted on marine plywood to reduce vibration.

Swivel front wheels that can be locked if desired are also offered. Most have blade clutch, permitting the belt driven blade to be idle while the engine is running; rear wheel drive is used if self propelled. Another feature to consider is extra sturdiness in blades longer than 21".

These mowers are used extensively in the South.

There are also lighter units available with 14"-to-16" rear wheels. These come with pneumatic or semipneumatic tires and with a regular rotary as the cutting unit. These cost less and are applicable for fine lawns as well as for rough cutting. Widths are 21" to 22".

### ELECTRIC ROTARIES

These models run at full speed and require no gas, oil or starting mechanisms. However, cords can present a problem in handling, especially around trees, shrubs and other obstacles. Also, some people will not use them in wet grass.

Many have swing over handles to make it easier to reverse directions without tangling the cord. Such mowers should have front and rear baffles for operator foot protection.

Electric mowers meeting the Consumer Product Safety Commission's mandatory safety standard have controls similar to those required for gasoline powered units. The blade must stop when control is released and this control must require two movements before it can activate the blade. The two movements are required to prevent accidental blade startups.

## Power Reel Mowers

Whereas rotary mowers use a single blade to slice off the grass, reel mowers utilize multiple blades to shear off grass blades (similar to a hand mower).

The most efficient cutting results when the cutting blade contacts the grass at an angle.

Reels cost more than rotaries and are heavier. They are not well suited to cut tall or heavy growth, although the lifetime of a reel may be twice that of a rotary.

Proponents of reel mowers say that the danger of flying objects thrown by a reel is almost nonexistent and contact accidents are minimized because revolving cutters are in full view of the operator.

Most reels have five revolving knives and a stationary knife. The angle at which the revolving blades touch the stationary one is of major importance. When one revolving knife is about 3" away from losing contact with the stationary knife, the next revolving knife should just be making contact.

If the angle is greater than that, the revolving knife tends to push some grass away. If the angle is less, the revolving knife doesn't have a good shearing angle and whips instead of cuts.

The frame that holds the blades in place is called a spider. Eighteen-inch mowers should have three or four spiders; 21" mowers should have four or five spiders.

Proper adjustment can be tested by turning the mower upside down and pulling it toward you. The reel should turn and make a smooth shearing sound.

Revolving cutters run on ball, needle or tapered roller bearings. The drive is usually a belt from the engine to a small pulley and a chain from the pulley to the revolving cutter, which has two pinions attached to its shaft.

These drive 10"-, 10½"- or 11"-diameter, rubber tired wheels, which run on plain or roller bearings. Both reel and wheel bearings require lubrication and should be equipped with oil cups or fittings.

A cover for the belt and chain decreases the danger of catching clothing in them.

Rollers are sectional and should be at least 2" in diameter. Cutting heights range from 5/8" to 2½" or 3". These are determined by raising and lowering the roller. On most mowers there is an adjustment at the wheels also, so the mower remains level at all heights.

Since reel mowers can be set to cut at less than one inch, many Californians prefer them to rotaries because they are better suited to grasses in that region.

The handle should be attached so that when it is lifted, it will lift the roller off the ground to pass over hard objects that would damage the cutting unit.

Frames and wheels are usually cast iron or steel.

### HAND MOWERS

In recent years, sales of these mowers have been increasing. Improved maneuverability and a lighter-weight design combined with smaller lots for new homes are some of the reasons attributed to the renewed interest in hand mowers.

#### HOW TO CARE FOR RIDING MOWERS

1. Store the unit under cover. If it is impossible to place under cover, be sure to cover the exhaust system.
2. Block the unit up to remove the weight from the tires and to keep the tires from contact with a moist floor.
3. Remove the battery and store it in a cool, dry place, or keep it fully charged in the unit.
4. Fill the fuel tank to the top to prevent condensation. The fuel should be treated with the proper amount of fuel conditioner to prevent formation of varnish or gum. Run the engine long enough to be sure all filters are filled with conditioned fuel.
5. When the unit is removed from storage, it should be serviced throughout, including draining and refilling the engine crankcase with fresh, clean oil.

The mowers are available in four, five and seven blade reel models. Some of these are designed to cut specific varieties of grass. Lower end models have 14" cutting widths with 8½" wheels; higher end models have a cutting width of 16" with 10" radial tires. Steel fabrication and composite materials are used in all models to give easy maneuvering and lighter weight. Manufacturers claim that the mowers cut better than their motor powered cousins and they are safe to use.

**SAFETY TIPS FOR POWER EQUIPMENT OPERATION**

1. Never wear loose garments when operating outdoor power equipment. They may get caught in blades, belts, chains, etc.
2. Always wear proper protective footgear when operating power machinery.
3. Never leave a power tool or machine running unattended.
4. Don't let small children "play" with power equipment. Many like to ride power mowers. If the cutting unit doesn't completely detach, this is terribly dangerous. Even if it does, there is some danger.
5. Take care not to throw a unit in gear accidentally and have it jerk ahead unexpectedly.
6. Beware when operating some rotary mowers with a staggered-wheel design. Grass can be cut and ejected instantly at a very high speed. A rock can be kicked out at the same speed.
7. Rotary mowers with shallow decks are more apt to throw an object out from under the deck. Take extra care when using these mowers.
8. Store dangerous tools under lock and key, where children cannot accidentally start equipment.

## Riding Mowers/Tractors

Riding mowers, which cut a swath 2' to 4' wide, are for homeowners with more than half an acre of lawn.

Riding mowers and tractors fall into several basic categories--ride on mowers, lawn tractors, garden tractors and small acreage tractors. Consumers need to look at the engine power when comparing models. They don't want a small engine which will result in overburdening the unit. They need an engine with sufficient power not only to mow, but to power the mower over uneven and sometimes rough terrain.

Ride on mowers are for mowing. They may come in either front- or rear-engine models with capability for light towing.

The traction drive (wheels) is a separate transmission and differential connected by a chain which is exposed to dirt in all but the most expensive models.

Attachments for ride on mowers may include a very light duty snow blade; usually the only power attachment for these models is the mowing unit.

Lawn tractors can power optional snow-throwing equipment in addition to the mowing unit. The traction drive is a medium duty transaxle (transmission and differential in the same housing), which is fully enclosed and lubricated.

These provide increased performance over ride on mowers such as more towing capacity and greater snow-moving ability with a snow blade.

Although they are able to handle a variety of simple attachments, they are distinguished from garden tractors by their inability to handle ground engaging attachments.

Garden tractors are able to take more sophisticated attachments such as tillers and plows. They are equipped with heavy duty transaxles with three or four forward speeds and have more ground clearance.

In addition to hitches for these ground engaging attachments, these units have built in lift systems and greater power to pull the attachments.

Small-acreage tractors are more complex and employ more automotive features than any other item in the outdoor power-equipment group. They are best suited for large areas and small farm chores.

Unlike larger riders, engine power is greater, ranging up to 20 hp. Cutting widths of up to 6' or more can be accomplished by using gang reels.

Extreme versatility is achieved through attachments such as leaf mulcher, plow, snow thrower, snow/dozer blade, dump cart, sweeper, tiller, power sprayer, aerator, lawn roller, cultivator, front end loader, fertilizer spreader, flail mower and discing devices.

This is a complicated piece of equipment and you must study the lines your store carries in order to sell effectively.

Prices range from $1,000 to $2,000 for smaller riding mowers and tractors and from $3,000 to $5,000 for large lawn and garden tractors.

Also, safety is an important factor when selling this type of equipment. An industry safety standard calls for riding mowers to have three features:

1. Models must be equipped with interlocks to ensure the engine cannot start while the mower is in gear or when the blade is engaged.
2. Another feature is the blade stop system that stops the blade quickly when the driver disengages it.
3. "Deadman" switches connected to the seat kill the ignition and engine and stop the blade if an operator falls off or climbs down from the seat while the blade is still engaged.

Some mowers have other safety switches to prevent accidents. These safety features offer some selling points when educating the consumer about equipment benefits.

### ENGINE PLACEMENT

The design characteristics of riding units are major safety factors. Operating safety is increased if the driver's seat is located as far forward as possible. This is particularly important when operating the machine on slopes and for units with engines mounted behind the operator.

Both the blade and the rear wheels are powered by the engine. A few low priced riders may have the blade attached to the engine shaft, like a rotary mower, but most models have a belt driven blade, and usually such mowers have a blade clutch.

Another belt usually runs from engine to transmission and a chain runs from the transmission to the differential.

On units with transaxles, the differential and transmission are in one sealed housing. These usually have two belts and no chain.

The accessibility of belts, chains and other replaceable parts is an important feature to look for when selling these units as is the ability to remove cutting units easily so attachments can be utilized.

Electric starters are available on many models and are desirable for higher-horsepower engines.

Some riders can be upended and stored on the rear or front end to save space or to gain access to the mowing unit without problems from oil or gas drainage.

## WHEELS

Front-wheel diameters range from 8" to 12" and rear wheels are usually 10" to 16", but may measure in at 20". Pneumatic tires or semipneumatic tires are frequently used on lower priced models.

Turning radius for riding equipment is usually 32" or above, but can be as tight as 16" and consumers should look for both steering ease and a ruggedly constructed steering gear.

All controls, throttle, transmission, positions, brakes, brake lock, blade clutch, height adjustment and safety clutch (if so equipped) should be easily accessible.

Transmissions vary from one speed forward, neutral and reverse, to five speeds forward, neutral and reverse, with most models having three forward speeds. Driving speeds range from 1 to 7 mph. Three to 4 mph is usual operating speed.

## RIDER FEATURES

Suspension systems include a front axle that pivots up and down, or side to side, to keep the cutting unit level over uneven ground, or the cutting unit may be free floating. With a free-floating design, gravity is supposed to keep the unit level, even when a portion of the lower deck is not in contact with the ground. Guardrails are available on some units and run the full length of the deck to prevent the deck from contacting the ground and the blade from scalping ridges and large mounds.

Wheel bearings range from plain steel on lower priced models to sintered iron, sintered bronze, ball bearings or roller bearings.

Dealers may need to ask about bearing construction because it may not be included in manufacturer literature. Most riding mowers are designed to meet industry voluntary safety standards, which require that the blade stop rotating within five seconds after the blade is declutched. If the mower doesn't meet the voluntary safety standard B71.1 1986, and the blade takes longer to stop than five seconds, a warning to the customer is advisable.

Braking the blade to an immediate stop is a most important safety feature. Also determine whether the clutch can be eased into the "on" position or does it "grab" and sometimes kill the engine. Some riders are equipped with a seat switch that prevents the mower from moving unless the operator is sitting in the mower seat or depresses a foot pedal. Such devices provide extra safety by shutting off the engine if the operator gets off the machine without first declutching the blade and shifting the transmission into neutral.

An automatic blade-stop mechanism, available on some models, brings the blade to a stop after the pedal is released without stopping the engine.

Cutting heights usually range from 1¼" to 3½". Some still require the removal of wheels or bolts or loosening of nuts and retightening to change height. However, most better models utilize a lever or crank to raise and lower the deck.

### COMMON QUESTIONS CONSUMERS ASK ABOUT MOWERS

1. **WHAT SIZE MOWER DO I NEED?** Consumers usually need help in matching a mower to their yard. While most consumers, in the end, purchase a walk-behind mower with cutting width of 18" to 21", sales personnel need to find out who will operate the lawn mower, the property size and storage facilities.
2. **HOW MUCH DOES IT COST AND IS IT A QUALITY PRODUCT?** Although price is a major concern of most customers, consumers are increasingly willing to pay more for a mower with such features as being self-propelled, having an electric start or being equipped with a rear grass catcher.
3. **DOES IT HAVE A BAGGING SYSTEM OR IS IT A SIDE-DISCHARGER?** Most consumers prefer the rear bagging system, which allows you to mow close to trees, shrubs and walls, and offers greater convenience and maneuverability. Less meticulous consumers choose a side-discharge system that leaves the clippings on the lawn.
4. **WHAT KIND OF ENGINE DOES IT HAVE?** Consumers usually don't care about actual horsepower, dealers say, but they want to be sure the machine has enough power so its engine won't be overworked.
5. **DOES IT START EASILY?** Customers often want assurance that a lawn mower will start easily, remembering the past, when many engines were balky and temperamental. Although manual starting today is much easier, dealers say many customers are attracted to the convenience of an electric start.

   Another option, for customers who fear difficult starting, might be the electric lawn mower. Usually equipped with a 100' cord set, an electric mower can be ideal for smaller lots (up to one-third acre, about 15,000 square feet). Electric lawn mowers start with the flip of a switch, have essentially no maintenance requirements, don't require handling gasoline or oil and are lightweight.
6. **IS THERE AN IN-HOUSE SERVICE DEPARTMENT?** The ability to offer in-house service for a customer's lawn mower, dealers say, is a strong selling point. The customer who values quality and service as much as price wants to be assured that parts will be available and that the cost of service and time required for repairs will be reasonable.

*Source: Aircap Industries Corp.*

Moderate pressure on the brake pedal should stop the rider quickly. A conveniently positioned brake lock should hold the rider on a fairly steep slope.

Rider blades, being longer and subject to more engine power than hand rotaries, should be sturdier. When a blade is turning at high speed, the tips will try to vibrate up and down unless the blade is reinforced at its center by a channel-shaped or heavy bar. It is important that the center of the blade or its reinforcement should not extend below the cutting edge to prevent unnecessary rubbing of the cut grass.

Seats on riding models are usually adjustable to two or three positions, and the cutting properties of riders depend on the same quality features as on regular rotaries.

## Lawn Edgers and Trimmers

Electric- and gasoline-powered trimmers give homeowners an economical way to slice small trenches along sidewalks and driveways or trim close to trees, flower beds, lampposts, etc. One of the most popular types of trimmers whip cuts grass and weeds with a monofilament nylon line.

Unlike push type trimmers with rubber wheels and wide reels, string trimmers have no wheels, guides, adjustments or blades. A strong monofilament nylon line, spinning at up to 12,000 rpm, is the cutting "blade."

The line cuts both grass and weeds, but inexpensive models are best suited for smaller areas and lighter work like grass, while heavier weeds and larger areas require a heavy duty, more expensive trimmer with more power.

Safety is a selling point for string trimmers. The filament or line won't cut shoes, clothing or its own electrical cord, although the line could raise welts or break the skin.

Protective goggles or glasses should be worn, because the spinning line can throw debris. Electric powered string trimmers are lightweight and easy to operate. Cordless models provide even more mobility, but these are used primarily for light cutting jobs and operating time is limited. String trimmers allow users to cut around posts, rocks, shrubs, etc., without damaging the tool. The only wear is on the nylon line, which may need to be replaced as it frays. Some units have automatic feed systems to play out more cutting line.

The smaller electric units weigh about 3 lbs. with a 1/8- to 1/10-hp power source. The cutting diameter is approximately 7" to 10".

Heavier-duty models weigh 4 to 8 lbs. with up to a ¾-hp motor. Cutting lines are about .06" in diameter and can cut up to a 16"-wide swath. A second adjustable assist handle is usually available to provide two handed operation and more control. With the wider cutting radius and more powerful motors, these models can handle larger jobs more easily.

Gas powered string trimmers were originally made for commercial users and those with large acreage. These weigh about 14 to 25 lbs. and are powered by a two cycle engine.

Lighter, scaled down models can be used by homeowners; these models weigh about 10 to 14 lbs. and provide the operating freedom of a cordless trimmer.

The increased capacity of gas powered units allows the user to dig a trench between the grass and the walk with the string. In addition, metal bush cutting blades are available as accessories for heavier cutting. Optional accessories also include blade attachments for other lawn and garden uses.

By tilting the head of the trimmer at about a 30° angle, the tip of the line provides a more efficient tool.

When selling these units, be sure to point out the manufacturer's safety instructions and proper operating procedures, especially for metal blade accessories.

## Lawn Sweepers

If a homeowner is tired of raking leaves and grass, a powered or hand propelled lawn sweeper or a riding-mower attachment may be just what he or she is looking for. A rotating sweeping action picks up leaves, rocks, clippings, etc. Clippings are held in a container until they can be deposited in the trash or other area.

When looking for quality, the user should consider an adequately powered engine, large swivel-caster wheels for maneuverability, solid tufted steel backed brushes, wide semipneumatic tires with top traction for heavy loads and brush height adjustment.

A consumer also may want a sweeper with a wind apron to contain debris on a blustery day.

## Lawn Vacuum Cleaners

Another type of lawn cleaner uses the vacuum principle to handle debris. In addition to lawn applications and picking up grass and twigs, lawn vacuums can pick up paper, wood shavings and other trash from parking lots, factory or warehouse floors.

Two types of lawn vacuums exist. One is a wheel driven unit that is either pushed or ridden like a rotary mower. The other is a hand held unit that is carried around much like a lawn trimmer.

Attachments like flexible hose kits allow lawn vacuums to pick up debris in shrubs and around growing plants and flowers without the danger of damage from raking.

Flexible discharge hoses are also available on some models to load debris into a mobile container, eliminating the need to dump the bag.

Features in quality units include high-capacity, self discharging bags, interlocking tubes, antivibration handles, enclosed engines and grouped controls. On large units look for suction force to pick up a variety of debris, puncture proof, semipneumatic tires and a strong engine with direct drive.

Like many other types of outdoor power equipment, lawn vacuums may prove to be an excellent rental item.

## Shredder Grinders

As some states begin banning community trash disposal of lawn clippings and grass, these products may see increased demand. Depending upon the model, these machines shred, grind, tear and pulverize a wide assortment of materials such as leaves, twigs, hedge clippings, brush, branches and even thin metal.

Because of the variety of tasks performed by these machines, you should stock those best suited for homeowners in your market area.

The basic design usually includes two wheels, handle, intake hopper where the debris is funneled into the cutting area, blades and engine.

Ask the customer how he intends to use the unit before selling a shredder grinder. Some shredders utilize high speed rotating blades to pulverize and blow debris into a bag. These may be powered by lightweight motors that can handle only dry debris and bog down on damp material.

Avid home gardeners may require a heavier-duty model to produce compost from damp debris and leaves. These models shred the debris and force it through a screen back onto the ground.

Point out safety features such as shields that guard against flying debris or keep the consumer's hands from touching the cutting blades. Stress the manufacturer's safety instructions.

## Air Blowers

Instead of picking up leaves and debris, air blowers use a strong blast of air to clean sidewalks, driveways, patios and garage floors. The power unit is carried by the operator and a hose or tube directs the air.

In addition to these uses, air blowers can clear trash and leaves from around shrubs, bushes, fences; they can blow leaves into a pile instead of raking, and they can blow away light snow.

Gas powered commercial models were the first units on the market. Power is derived from a heavy two cycle gas engine worn on the back of the operator. The engine delivers a blast of air down a hose which is connected to a rigid tube with a handle to direct the air flow.

A lighter weight version of this commercial model, although still relatively heavy and worn on the back, is used on large acreage and commercial jobs.

Two cycle gas engines power some of these units and offer the convenience of no cord, but are more expensive than a similar model with electrical power.

Several types of electric models are lightweight. They are carried in the hand and the complete one piece unit is moved to direct the air. Some blowers accept vacuum kits as an accessory.

Make sure that you ask the customer what type of applications he will be using the blower for, so that you can suggest the correct model.

## Power Hedge Trimmers

The most frequently sold hedge trimmers and shears are electrically and battery powered units, although gasoline models are manufactured.

Usually these tools have 14" or longer steel blades and protective housings to guard against shocks to the user.

Consumers should consider some of the quality features in these tools when making a purchase. Double edge blades allow the home owner to cut in either direction, rather than in one direction as does a single edge blade.

Phenolic plastic housings or double-insulated metal housings protect the operator against electrical shock, and quality trimmers are equipped with serrated or scalloped teeth to cut through tougher stems.

The comfort of a wraparound handle is an excellent selling point, especially since it allows both right and left handed operation. Chrome plating is not just window dressing; it protects exposed parts from rust.

While less-expensive trimmers may have only one cutting speed, higher-priced models usually have medium and high speeds. Medium speed converts power from cutting speed to cutting power and provides better blade control, less vibration, clean cuts, penetration of heavy undergrowth and quicker, easier cutting of thick branches. High speed is better for trimming light hedges.

### POWER BLOWER OPERATING TIPS

1. Operate power blowers only at reasonable hours—not early in the morning, late at night or at other times when people are likely to be disturbed. From 8:00 A.M. to 5:30 P.M. on weekdays, and from 9:00 A.M. to 5:00 P.M. on weekends.
2. Operate blowers at the lowest possible speed to do the job. Maximum speed is seldom necessary.
3. Use only one piece of power equipment at a time to keep noise levels acceptable.
4. Make sure the power blower's muffler is in good working order.
5. Use the full blower nozzle extension so that the air stream can work efficiently close to the ground, minimizing the spread of dust.
6. In dusty conditions, wet down surfaces or use mister attachments.
7. Use rakes and brooms to loosen debris before blowing.
8. Before using a blower, check wind direction. Look for open doors and windows, freshly washed cars, children or pets at play, and other things that could be harmed by blowing dust, leaves or debris.
9. After using blowers and other equipment, clean up. Dispose of debris in trash receptacles. Make sure none has blown into neighboring yards.
10. Check the condition of your power blower, including air intakes and air filter to make sure the unit is operating properly.
11. Wear ear protection if you operate a blower for more than two hours per day.

*Source: Echo Mfg. Co.*

Trimmers should be balanced and lightweight.

Heavy duty models for professional use are equipped with motors that develop more than ¼ hp. Clutch protected for all day jobs, they may have up to 200' extension cords for access to a greater cutting area.

## Cordless Garden Goods

Advances in battery technology, especially in rechargeable nickel cadmium and lithium ion, add to the appeal of cordless tools. Units can be recharged more than 500 times.

Low voltage and a plastic housing protect the user from electrical shock. Safety switches prevent accidental starting.

Consumers can choose from hand or long handled models of cordless grass shears, and some units are convertible. Blades come in several sizes, and the larger the blade, the faster grass can be cut.

Blade life is usually longer than one season, especially since the majority of them can be resharpened. Replacement is required when they no longer cut cleanly after resharpening.

Like other cordless tools, cordless hedge trimmers eliminate the danger of slicing through a power cord. A cycle charge will usually last for about half an hour, while the cutting time on larger models may be as long as 45 minutes.

Interchangeable power packs that fit several cordless units such as grass shears, flashlights and trimmers, encourage consumers to build up a cordless workshop. They buy a single power pack and add whatever attachments they want. When selling these cordless tools, it is important to make sure that consumers don't expect to operate them like a corded tool. Dull, dirty cutting edges decrease operating time. Heavy duty cutting with a lightweight tool will drain the power source quickly.

Make sure that the customer understands these facts and is aware of the operating time for each tool he buys.

## Chain Saws

Lightweight, less-expensive chainsaws are a common homeowner purchase. Chain saws are gasoline or electric powered, but gas powered are most common. Power output is generally considered 1-hp-per-cu.-in. displacement; however, professional models have more horsepower per-cubic-inch displacement. At the bottom end of the power-ratings chart would be a lightweight model with as little as 1.4 cu. in. of displacement, while the professional model will run as high as 7.5 to 8 cu. in.

Homeowning customers rarely need more than about a 2.0 to 3.7 cu. in. model.

Chain saws are direct drive and have chain speeds from 3,000 fpm (ft. per minute) to 7,000 fpm. Advantages are lighter weight, lower cost and faster cutting.

Weights usually are quoted as the "dry" weight of the power head (with fuel and oil tanks empty) and without the bar and chain, which vary greatly by both type and length. Most homeowner needs can be satisfied with 8 to 16 lb. units. Smallest saws may offer only a single bar length as short as 10" or 12", while more expensive units offer much longer interchangeable bars ranging from 12" to 42".

Electric chain saws, especially the smaller models with 8" to 10" cutting bars, can be used for trimming and pruning. Their low cost is an especially important sales point for occasional users. Heavy duty extension cords are an absolute essential.

There are quality differences that need to be explained to customers. A sprocket-tip cutting bar increases cutting speed because it eliminates most of the friction around the bar tip. It also keeps the chain from dragging around the bar nose, thus eliminating bar wear, and reduces chain stretch.

Safety is an important factor in chainsaw operation. The product must be treated with great respect. Manufacturers are taking different approaches to the safety problem.

You should become familiar with the American National Standards Institute (ANSI) B175.1 safety standard for chain saws. The standard requires chain saws up to 3.8 CID (cubic inch displacement) to pass a test limiting the kickback of a saw and making at least two separate antikickback devices a part of each saw.

Kickback occurs when the top 90 percent of the bar tip comes into contact with an object. This may cause the bar tip to violently kick back toward the operator. The standard is aimed at reducing the potential harm to the operator.

Most manufacturers are meeting the standard by using a combination of low kickback chain and one other device such as a tip guard, chain brake or low kickback bar.

Low kickback chain has extra links or rakers added near the cutters which prevent the chain from cutting too deeply into the wood. This greatly reduces the risk of kickback. These chains can be retrofitted to older-model saws.

The United States Consumer Product Safety Commission points out that key features of the voluntary standard include a test for measuring the kickback potential of chain saws and the establishment of a maximum computed kickback angle limit of 45° for gasoline powered chain saws under 3.8 CID.

The standard also requires that all such chain saws must be equipped with a front hand guard plus at least two of the following: a low or reduced kickback saw chain, tip or "nose" guards, chain brakes, reduced kickback guide bars or some other feature that will reduce the risk of injury.

Reduced kickback bars are designed with a smaller radius, which reduces the kickback area and contact area for cutters at the tip of the bar. Bar tip guards eliminate the possibility of cutting with the tip of the bar, thus eliminating the potential for kickback.

Another safety device is called a chain brake. It is intended to stop the moving chain on a running saw. When the saw begins to kick back, the user's hand, if correctly positioned, hits the chain brake to stop the saw. Stress the necessity

of reading the owner's manual before using the saw and the need to regularly clean the brake of dirt and oil.

Other safety features include throttle latches for safer, easier starting; safety triggers to help avoid accidental acceleration; muffler shields and chain catchers to prevent a broken or slipped chain from lashing back at the operator; nonsymmetrical bars, and low kickback chains.

The cutting length of a saw without a tip guard is greater than the bar length. It is actually twice the bar length. In other words, a saw with a 10" bar can be used to cut through a 20" diameter tree or log, half the diameter from each side.

For specific details about saws carried in your store, it will be necessary to study manufacturer literature carefully. Features differ from brand to brand. But a few general points need to be stressed in conversations with customers.

You'll need to explain the proper mixture of oil and gas, and stress the importance of keeping the saw chain oiled. Some saws have automatic oilers; others require hand pumping. The oil filter must be kept clean. The oil and gas must be drained from the saw when not in use.

The saw chain accessory market is growing about as fast as the chain saw market. To sharpen saws, consumers need a file guide, depth gauge and proper files. Chain lubricant, engine oil, gas cans with flexible spout and funnels are other good sellers.

For specific details about the saws and parts needed, consult manufacturer's literature or ask your supplier.

### CHAIN SAW MAINTENANCE

First rule of caring and dueling of a chain saw, whether gasoline-powered or electric, is to follow recommendations of the manufacturer. But some rules are common to all power saws.

Manufacturers recommend a gas/oil mix ratio from 16:1 to 50:1, depending on the type of two-cycle lubricant used. Chain and guide bars need frequent lubrication, and many saws have a built-in reservoir and dispensing system. Special bar and chain oil is available which adheres to the chain components longer, providing greater protection against wear. On some models a manual override provides additional lubrication.

Chains should last a long time, but they will become dull eventually. The time to sharpen a saw is when it first begins to get dull. Sharpening kits are a good add-on suggestion. Professionals charge about the price of the kit each time they sharpen a blade.

Semi-automatic chain sharpening systems are available on some chain saws. With these, a sharpening stone may be activated against a specially designed chain to help operators avoid manual sharpening.

When a new chain is needed, the user will find no difficulty in changing it if he follows manufacturer's instructions. A new chain may "stretch" slightly when first used, so it should be operated initially at partial throttle and then adjusted.

Adhering to chain saw safety rules (see "Chain Saw Safety" in this chapter) will protect the user and the saw. It's basic, but worth mentioning: Be sure not to touch the cord of an electric chain saw with a blade when the saw is in operation.

## Log Splitters

Efforts to conserve energy and cut utility bills have brought the woodpile into sharp focus; cutting fireplace and stove wood is much easier with log splitters.

Manually operated log splitters drive a splitting wedge into logs after the wedge is hit with a sledge. Powered log splitters are much quicker.

Engineering techniques may vary from model to model depending upon the manufacturers, so you should familiarize yourself with the company literature on the models that you sell. Generally, hydraulic action provides the force to drive a splitting ram into a log secured in the frame.

There are also "screw" models that are cone shaped and turn or "bore" their way into the wood to split the log.

Log splitters may be powered by gasoline engines with as little as 3.5 hp. There are also models with electric motors. More horsepower doesn't necessarily mean more splitting power. Splitting power is the result of a well matched pump, cylinder and engine, which allows the system to operate more efficiently with less horsepower.

To find out how well matched these three elements are, extend the ram to the wedge after starting the splitter. Keep

### CHAIN SAW SAFETY

It pays to instruct customers on safe chain saw operation. Here are a few rules:

1. Read the instruction manual before operating the saw.
2. Wear gloves and safety goggles when working with the saw.
3. Wear proper garments when operating the saw. Clothing should be loose enough to permit free movement but not loose enough to snag on branches or get tangled in the chain. A safety-toed boot is also recommended.
4. Always start the saw on the ground or other firm base and be sure the chain and bar are in no danger of touching anything.
5. Stand to the side of the saw when cutting, never directly behind it.
6. Beware of "rotational kickback," the sudden upward and backward movement of the saw when the nose tip of the bar touches an object while the saw chain is moving.
7. Go slow in cutting. Chain saws cut so rapidly that it is easy to cut too deep or at the wrong angle. Don't press down on the bar in an attempt to make the saw cut faster. A properly sharpened chain will cut without pressure. Forcing it may damage the saw or injure the operator.
8. Always stop the engine before handing the saw to another person or moving it to a new location.
9. When finished with the saw, cover the bar and chain with a guard. If storing for a long period, empty the fuel tank.
10. Do not fill with gasoline when engine is either hot or running and do not smoke. Store the fuel in a safe container.
11. Keep saw clean of leaves and sawdust and keep handle free of grease.

the ram in this position for five to six seconds and if the engine stalls or labors heavily, the system is not properly matched or adjusted. This can result in less than optimum splitting power for the amount of horsepower the unit has.

Engines may range from 5 hp to 25 hp, and most units will split logs up to 24" long. Some splitters can also be towed behind a car to the woods to split logs.

A "deadman" neutral return control handle is a desirable safety feature. Cycling times vary with different models, but the faster the cycle, the more wood you can split.

**LOG SPLITTER GLOSSARY**

*The Logsplitter Manufacturers Association offers the following list of terms to help identify and explain elements of the log splitter.*

**AIR GAP**—the clear space remaining between the ram and the cutting wedge at the furthest outstroke of the ram drive or wedge drive system.

**DEADMAN CONTROL LEVER**—operator control lever that, when engaged into the forward position, activates the drive system of the piston; when released by the operator, disengages all forward movement of the drive system. When operator releases the control lever, it will automatically return to a neutral position.

**HYDRAULIC RAM DRIVE WOOD SPLITTER**—machine that utilizes pressurized fluid and a piston drive system to force wood through a cutting wedge or a cutting wedge through wood.

**LOG TRAYS OR LOG HOLDERS**—system to hold or position a log on top plate of the log splitter.

**MECHANICAL RAM DRIVE WOOD SPLITTER**—machine that uses a mechanical ram drive system to force wood through a cutting wedge or a cutting wedge through wood.

**RAM DRIVE**—a flat piece of steel mounted to a driven piston system that forces wood against a stationary or movable wedge.

**SPEED OF STROKE**—average rate of travel of the ram or wedge drive system through its splitting stroke under a no-load condition.

**WEDGE DRIVE**—cutting wedge that is mounted to a piston drive system that forces the wedge into a piece of wood, thereby causing the wood to split. With this system, the wedge moves into the wood which is stationary on the unit.

You may also want to offer these units on a rental basis, but be sure to provide adequate instruction to ensure safe operation.

The Logsplitter Manufacturers Association offers the following safety tips when operating one of these splitting systems.

1. Both ends of each log should be cut as square as possible to help prevent log from riding out of splitter.
2. Never place hands or feet between log and splitting wedge or between log and ram during forward or reverse stroke.
3. Don't straddle the splitter when using it.
4. Never split two logs on top of each other.
5. Never load splitter while ram is in motion.
6. Keep fingers away from any cracks that open in log during splitting operation.
7. Never move splitter while it is running.
8. Operate splitter on level ground and always block wheels to prevent movement of the log splitter while in operation.

## Power Rakes or Thatchers

Power rakes or thatchers may produce more volume as rental items or commercial sales than as consumer sales.

They are expensive, hard to store and infrequently used by most homeowners.

The power rake or thatcher brings up the thatch so it can be gathered by a vacuum or brush type sweeper. Thatch is matted dead grass imbedded in the turf lying just atop the soil, and the material must be removed if fertilizer, air and moisture are to penetrate into the grass root system.

A tine type reel will remove dead thatch without disturbing the soil or removing live grass. The action of a knife and flail reel is much more severe, but is required when it is necessary to depopulate or remove part of the turf with the dead thatch.

Thatch removal also eliminates a breeding place for lawn insects and fungus growth, which cause damage to a lawn.

## Tillers

Tillers can be used in both large and small gardens in addition to small-acreage farming to prepare the ground for planting and to cultivate the growing crop. After harvesting, tillers can mulch refuse back into the soil.

Multiuse tillers can convert into snowplows or pushers for winter use.

Tillers are available in both front and rear-tined models. Front positioned tines are driven by the engine and actually pull the tiller, relieving the user of pushing it.

Rear positioned tines are usually found in larger units, which are more suited for multiacre gardens than backyard gardens.

Front tined tillers can plow to within one or two inches of a walk, foundation or other plants, but some rear tined tillers need at least 8" clearance. Others, however, can till up to a walkway and within an inch or two of a wall.

Mini tillers are excellent for homeowners with small gardens. They are relatively low priced, lightweight and easily stored in a garage or basement.

Electric mini tillers or cultivators are even smaller and are good to use around flower gardens close to the house.

Mini tillers are powered by 2-hp motors, and are generally chain driven. Tilling area varies from 6" to 18" wide, while regular size tillers will handle areas up to 26" wide. Mini tillers weigh under 80 lbs., with some tipping the scales at only 60 lbs.

Regular-sized tillers have 10" to 14" tines which are driven by 3- to 5-hp motors. Some are chain driven but many are gear driven, and the units may weigh as much as 300 lbs. Tining attachments can expand the tilled area well beyond 26".

Many models have reverse as well as forward drive, and a deadman control is a good safety device on models with reverse drive.

Tines are available in a variety of designs, but the most common has its cutting edge slanted upward, so it strikes the soil at an angle, slicing into the soil, which decreases root and vine entanglement.

Tine assemblies usually have four knives, and if tines are detachable, all can point in one direction or they can alternate. Tilling widths range up to 26", depending on tine directions and on whether two, four or more tine assemblies are used. The best tillers for backyard work will have adjustable widths, narrowing to at least 11" for passage between crowded rows. Top tine speeds are usually 75 rpm to 100 rpm.

Some tines merely scratch the surface while others pulverize dirt as deep as 9".

Transmissions in top-quality tillers utilize precision fitted worm and ring gears, with two ball or roller bearings on both the drive and tine shafts. Some chain driven models are available.

Higher-horsepower motors enable the user to till at slower speeds without stalling the engine, and this is important when the going is rough.

### THE SAFE WAY TO REMOVE SNOW

1. If using a snow thrower, be sure the area is clean and avoid excessive force. Let the machine do the work.
2. If shoveling, use a shovel that is proportionate to your lifting ability. Use arms and legs to do the work.
3. Avoid twisting and jerking motions; they are the leading cause of back injuries.
4. Dress in several layers of clothing—muffler, jacket, sweater, etc., so you can take off outer layers as you warm up to the job.
5. Be careful. Snow shoveling requires 6 to 15 times the energy required during rest period. This is comparable to running at a speed of nine miles an hour.

To dig out a 50', double-car driveway after a 4" wet snowfall, you have to remove four tons of snow!

### WHO GETS THE MOST SNOW?

| | |
|---|---|
| Rochester, N.Y. | 89.6" |
| Denver | 59.5" |
| Cleveland | 52.7" |
| Hartford, Conn. | 52.0" |
| Milwaukee | 46.8" |
| Minneapolis/St. Paul | 46.3" |
| Boston | 41.9" |
| Detroit | 40.5" |
| Chicago | 39.8" |

*Amounts are record mean snowfalls for these cities.*

Chain driven tillers have no ring and worm transmission, and producers claim this is an advantage because it eliminates transmission heating. Another advantage claimed is that since tines can be turned backward as well as forward when not in gear, no reverse gear is necessary.

## Snow Throwers

Lightweight snow throwers or "powered snow shovels" are very popular, especially in regions that experience frequent, but moderate snowfall.

In congested urban areas and in the southern fringes of the Snowbelt, these models are big sellers, but in the primary Snowbelt, consumers prefer heavier equipment.

The basic components of a snow thrower are the engine, blades to break up snow, auger or paddles to pull snow in, impellers to eject snow and chutes to direct thrown snow. The combination of these components depends on whether the model is a single or two stage thrower.

Single stage units are lighter, easier to maneuver and less expensive than two stage units. Single stage units use one action to break up snow, draw it in and discharge it. Two stage throwers use separate augers or fans and impellers with the former breaking up and pulling in snow and the latter propelling it forward or out to one side. Directional controls adjust the discharge chute so snow is thrown in the desired direction.

Two stage units can maneuver as much as one ton of snow per minute, throwing it up to 30'. However, some high-performance single stage units can throw snow as far as smaller two stage units.

Heavy duty units are all metal, have 3 hp or larger engines (two or four cycle), 20" to 32" clearing widths and may be able to throw up to a ton of snow a minute as far as 40'.

Lighter-weight, less expensive models are usually sufficient for ordinary home snow clearing. These may have combination plastic (high-density polyethylene) and aluminum construction, 2½-hp engine and as small as 14" clearing width. These have the ability to clear a 50' driveway of 3" snow in about 10 minutes.

Gasoline powered units offer 3 to 11 hp, two or four cycle engines, cutting widths from 14" to 32", automatic rewind or recoil (optional electric) starters, two to five forward and one reverse speed (up to 2½ mph).

Electric units have clearing widths of 16" to 18". Power units must be totally enclosed to prevent snow and water from getting into the motor.

Quality features to look for in snow throwers are chain and gear drive, fully enclosed transmission and gear drive to eliminate problems of snow and ice on drive train, clutch control operating from handle, adjustable rollers for paved surfaces and skids for unpaved ones, heavy steel or good plastic/metal construction, semipneumatic tires (tractor treads recommended) and chains available for use on inclines.

When consumers are shopping for a snow thrower, find out how large an area they intend to clear to help determine which model best suits their needs.

For instance, in a region that experiences frequent snowfalls of 6" or more, if the customer has a large driveway to clear he may need an auger-type model. These spiral blades spin like a screw, compact the snow and throw it out the discharge chute. These can come in both single stage and two stage models.

Instead of the auger types, a paddle model with two to three paddles made of hard rubber or plastic mounted on a rotating drum may be more appropriate for areas with lighter snowfall. The paddles usually will not dig as deeply as augers, which could force the operator to make repeated

passes over the same area to remove a heavier snowfall.

Lightweight snow-thrower models, or "compacts," retail for about $250 to $500 and heavier duty, self propelled units such as the auger variety may run as high as $1,500.

*Consumer Reports* says that the "typical self propelled thrower has two deadman controls–one for the auger and one for the driving wheels. When the operator releases those controls, auger and wheels automatically come to a stop."

When selling a unit to a customer, reinforce the safety story. Most injuries involve hands used to unclog units. An operator should never use a hand or a stick to remove clogged snow or ice when the machine is running.

An operator should avoid touching hot mufflers, cylinders or fins; pull starter cord rapidly to prevent kickback, and allow engine to cool before adding fuel.

If the consumer has previously owned a snow thrower with a manual starter or if the person is elderly, an electric starter makes a good add on sale.