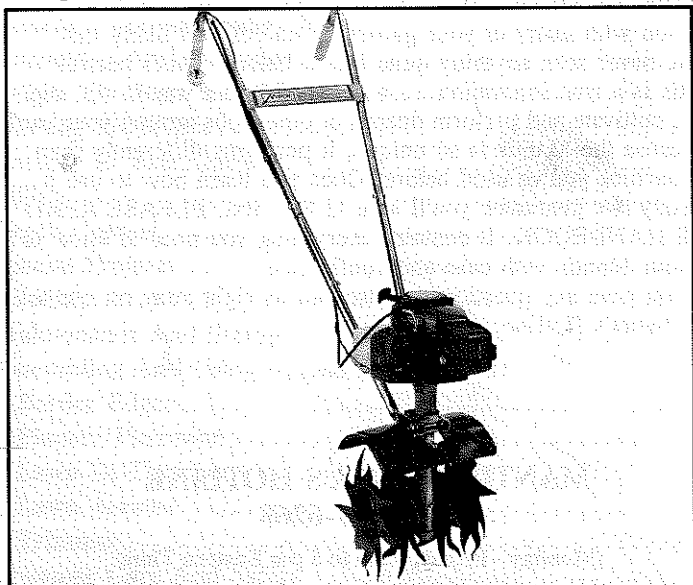




OWNER'S HANDBOOK



MANTIS-20 TILLER/CULTIVATOR

Your new Mantis Tiller/Cultivator has arrived, ready to help you with many of your gardening chores. It's likely that you've never seen anything quite like it before. That's because Mantis is a true innovation... a new and better way to till, dig, weed, cultivate and perform dozens of other jobs around your yard.

Because the Mantis is so unique, it performs differently than any machine you've used before. Once you learn how to use it correctly, we guarantee you'll love it! So, first, **PLEASE READ THIS HANDBOOK**. It contains everything you need to know to use your Mantis with ease and confidence.

If you have any questions, please call us right away on our toll-free Owner's Hotline:

MANTIS OWNER'S HOTLINE

1-800-366-6268

(Monday - Friday, 9 am to 5 pm Eastern Time)

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Important: Read This Before You Use Your Mantis!

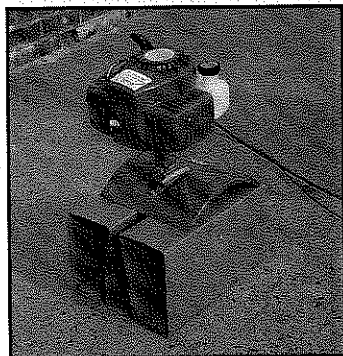
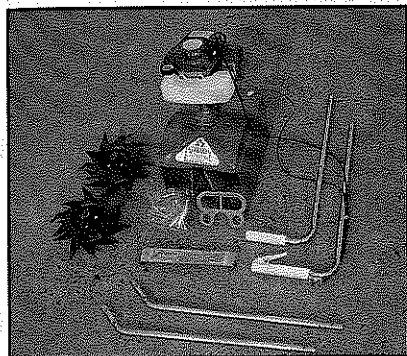
General Care and Safety Rules

- **READ AND FOLLOW** all instructions in this manual.
- **DRESS PROPERLY**—Do not wear loose clothing or jewelry. They can be caught in moving parts. Sturdy gloves, non-skid footwear (no sneakers or sandals) and safety glasses are recommended.
- **STAY ALERT**—Watch what you are doing and use common sense. Do not operate unit when fatigued.
- **KEEP CHILDREN AND INCAPABLE PERSONS AWAY**—Do not permit children to contact unit. Keep *children* a safe distance from work area. Never allow a person mentally ill, under influence of alcoholic drinks or drugs, or *too young in age* to operate unit.
- **DO NOT FUEL, REFUEL OR CHECK FUEL SYSTEM WHEN SMOKING OR NEAR AN OPEN FIRE**—Do not run the engine when fueling or refueling. Stop engine when transporting from one place to another. Do not leave engine running unattended.
- **DO NOT START OR RUN ENGINE INDOORS** as poisonous carbon-monoxide is emitted.
- **IF ELECTRIC SYSTEM CAUSES SPARK OUTSIDE THE CYLINDER, DO NOT USE THE ENGINE**—When checking spark plug, keep plug a safe distance from cylinder to avoid burning of evaporated fuel from cylinder.
- **MAINTAIN AND EXAMINE ENGINE WITH CARE**—Follow maintenance instructions and do not use if parts are defective or missing from engine.
- **STORING THE MANTIS**—Store unit inside a garage or tool shed - out of the weather, but **DO NOT STORE** the tiller inside your house with fuel in the unit.
- **DO NOT ATTEMPT TO REPAIR ENGINE**—Have repairs made by qualified dealer or repairman. See that only identical or quality replacement parts are used.
- **NEVER DEPRESS THROTTLE FOR FULL SPEED UNLESS TINES ARE ON THE GROUND.**
- **IF TINES SHOULD BECOME JAMMED, STOP THE ENGINE IMMEDIATELY**, free the obstruction, and—if necessary—remove tines to help free obstruction.
- **IF THE IGNITION SWITCH FAILS TO STOP THE ENGINE**, stop the engine by pulling out on the choke.

Unpacking And Assembly

Your Mantis is almost fully assembled. All that remains to be installed are the handlebars, carrying handle and tines. This will take just a few minutes if you read the instructions first.

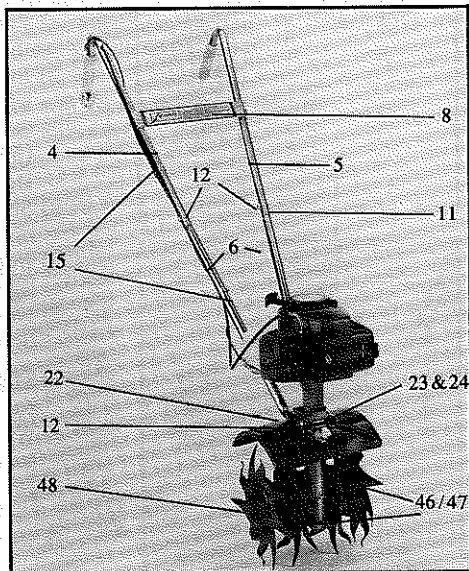
Start by removing all items from the carton, but *do not remove the cardboard from around the base of the tiller.*



You should have the following parts:

Qty.	Part Name	Part No.
1	Upper Handle With Throttle	4
1	Upper Handle Without Throttle	5
2	Lower Handles	6
1	Pair Tiller / Cultivating Tines	46/47
1	Engine Assembly Hood and Transmission	7
1	Cross Bar Handle Brace	8
1	Plastic Carrying Handle	9
1	Bag of Hardware Containing:	
	4 Bolts	11
	6 Nuts	12
	2 Bolts (3" Long)	23 & 24
	2 Pins	48
	2 Clamps	22
	1 Clip	15

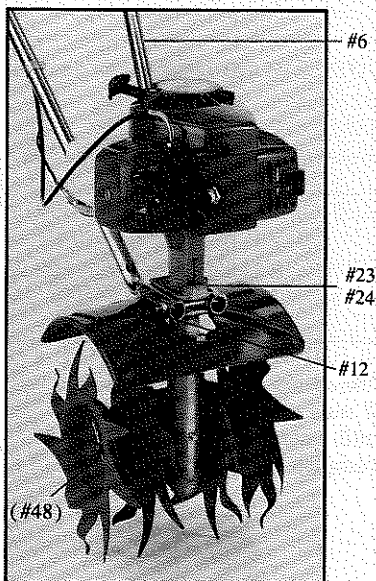
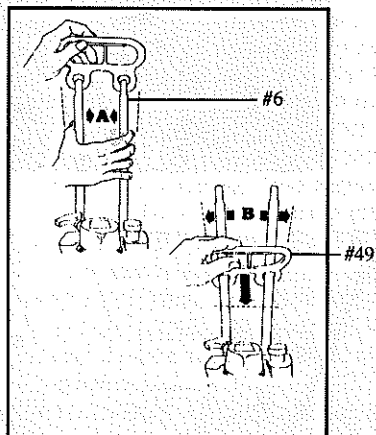
The bag of hardware is located between the two tines.



All you need to assemble your Mantis are two 7/16" wrenches (or two adjustable wrenches). We suggest that you install all nuts and bolts only finger tight (generally one-half to one full turn) until assembly is complete. The nuts are self-locking, but must be completely tightened using a wrench.

Assembling Lower Handles

- 1) Using the protective cardboard sleeve to stabilize your Mantis, stand the Engine Assembly up. Lay the attached handle parts to the side.
- 2) Secure Lower Handles (#6) to Worm Gear Housing in the recesses provided, located below the engine under the fuel tank. Place Bolt (#23) through hole in Handle Clamp (#22), then through inside hole in short leg of Lower Handle, through back channel provided in Worm Gear Housing, through inside hole in short leg of opposite Lower Handle. Place the other Handle Clamp (#22) on this side and add Nut (#12), finger tight.
- 3) Repeat procedure with Bolt (#24) as above, using front channel of Worm Gear Housing. Note: Gas Tank should face you as you hold the handles in operation. Use wrench to partially tighten all nuts and bolts.



Assembling Upper Handles And Plastic Carrying Handle

- 1) Lightly squeeze Lower Handles (#6) towards one another so they line up with the two smaller holes on the Carrying Handle (#49). Then slide the Mantis Carrying Handle over and down the Lower Handles to Point "A" on the diagram. Gently pull Lower Handles back to their original position "B".
- 2) Install the Upper Handle, the one with the wire and Throttle Cable, to either lower handle (whichever you prefer). Use the Bolt (#11) and Nut (#12) to secure it in position. Do the same for the other handle.
- 3) Secure the Throttle Cable and wire in position on the Lower Handle using the Clip (#15).
- 4) Install Handle Brace (#8) using wrench to tighten Bolts (#11) and Nuts (#12).
- 5) Now use wrenches to **tighten all nuts and bolts** firmly and securely.

*Make sure when handles are installed to engine, that they are installed properly. When standing behind Tiller, holding the handles, the operator should be facing the gas tank.

Assembling Tines

Remove cardboard from around housing and slide Tines onto axle shafts with tine points curved towards the front of your tiller. Secure the Tines to the axle using the Pins (#48) provided.

Your tines are now installed in the tilling position. See page 16 to switch to the weeding position.

Important: Before using your Mantis, read the care and safety instructions on page 4.

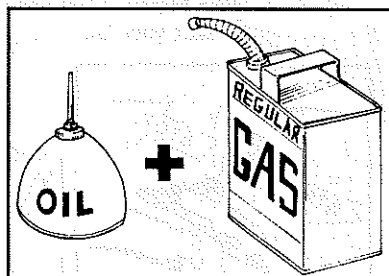
AN IMPORTANT STEP! Do this *before* you start your Mantis!

Your Mantis is powered by the super-hero of the engines, our 21.2 cc, 2-cycle Echo engine. With this type of engine, *you must mix the oil with the gasoline in a separate container.*

Your Mantis comes with a convenient, pre-measured container of special Engine Oil. Fill a clean gasoline can with a half-gallon of unleaded gas. Add the Engine Oil, then add another half-gallon of gas.

You can buy additional pre-measured containers of engine oil from Mantis (just call!). Or, you can use any *high-quality*, 50:1 air cooled 2-cycle engine oil in cans from your local hardware, auto supply or discount chain store. If using any other oil besides Echo follow instructions on oil can for 50:1 mix.

- Use unleaded gasoline (minimum octane 87). Do *NOT* use gasohol.
- Remember—*never* use your Mantis without the 2-cycle oil mixed into the gasoline.
- Always mix the gasoline and oil in a clean container. Fill the fuel container halfway with fresh gasoline, add the engine oil, then add the rest of the gasoline, close the container and shake thoroughly for proper mixing.
- Do not attempt to mix the gasoline and oil in the engine fuel tank.



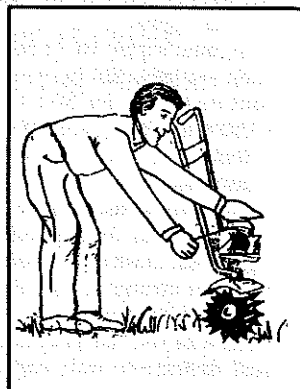
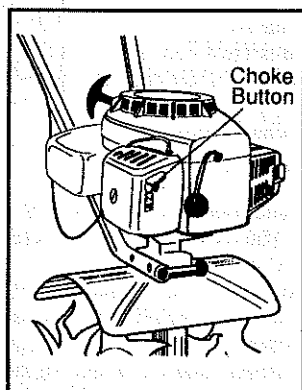
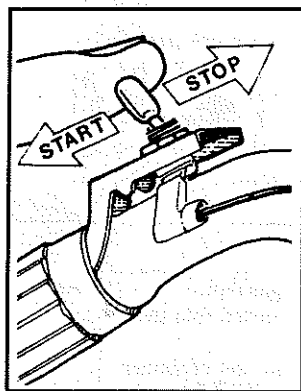
Failure to use the proper oil/gasoline mixture will result in rapid, permanent damage to your engine and will void the warranty.

Mix 1 container of our
2-cycle oil to one gallon of
unleaded gas.

You will have the exact
amount (2.6oz.) of oil in
our bottle! Even though
the container is 1/2 full.
Do not add additional oil
or use bottle as a measur-
ing device.

Starting Mantis For The First Time Or After The Fuel Tank Has Been Run Dry

Mantis has a special feature for instant, easy starting: our short-pull recoil starter. We recommend that you *always* use several short, brisk pulls to start your Mantis. (You don't need to give it the forceful, long yank that's needed to start your lawn mower!) Remember: short pulls equal easy starting.



For Cold Engine Starting

- 1) Fill tank with proper gas oil mix (50:1).
- 2) Tighten gas cap till snug. Do not over-tighten.
- 3) Put start/stop switch to start.
- 4) Close engine choke by pulling out on the choke button.
- 5) Give starter cord 10 to 15 short brisk pulls or until engine begins to start (just catches then dies). Open choke by pushing in choke button, pull starter cord again and engine should start & continue to run.

If the engine does not start, repeat the steps above 1 or 2 more times. If the engine still does not start, call us.

NOTE: When starting for the first time, or after the engine has run out of gas and tank has been refilled, it may take more than 6 pulls for the engine to catch with the choke button pulled out.

Alternative Starting Procedure

If engine fails to start, try this —

- 1) Loosen gas cap.
- 2) Turn switch on.
- 3) Place choke button in open position (pushing in).
- 4) Pull starter rope approximately 15 to 20 quick pulls.
Engine should start and run.
- 5) If not, close choke by pulling out. Pull starter 5 or 6 times. Engine should start and then stall.
- 6) After engine stalls, push in on the choke button. Then pull starter cord. Engine should start and run.
- 7) If not, repeat steps 2 through 6.

***If engine still doesn't start call 1-800-366-6268**

Starter rope should not be pulled more than 15 times with choke closed. Flooding will occur.

Troubleshooting: If Your Mantis Doesn't Start

- Be sure you have the ignition switch on start.
- Follow the steps for starting the engine.
- Remove spark plug by using 3/4 inch or 19mm wrench. Check the condition of the plug, make sure it's clean.
 - If the plug is wet, dry the plug off, then reinstall. Then start engine with the choke button in. Pull starter rope 5 to 10 times. The engine should start and run.
 - If the plug is dry, the engine is not pulling the gas through the fuel line. Reinstall the plug, and pull the choke button out. Pull the starter rope 5 to 10 pulls. The engine should start then stall. Then push the choke button back in and pull the starter rope 2 to 3 times. The engine should start and run.
- **DO NOT USE STARTING FLUIDS.** Use of starting fluids will cause permanent engine damage and will void the warranty.

To Stop The Engine

Simply push the ignition switch on the handlebars to the *stop* position. Should this switch fail to stop the engine, you can stop it by pulling out on the choke.

A Special Safety Feature

Even with the engine started, *the tines will only turn when you squeeze the throttle lever* located on the handlebars! Release the throttle lever and the tines stop *instantly!*

About The Choke

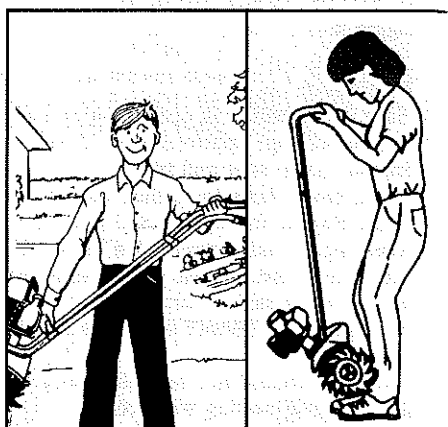
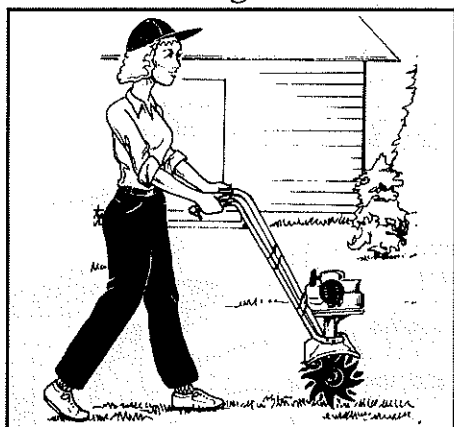
The choke controls the amount of air that is drawn into the engine. Your Mantis will run only if the choke is open (pushed in).

For Maximum Engine Life

After starting the engine, let your Mantis warm up for a minute or two before using. And, before you put the Mantis away, let it run at idle to give the engine a chance to cool down.

Before using your Mantis, please read the important care and safety instructions on page 4.

Getting To Your Garden



YES!

NO!

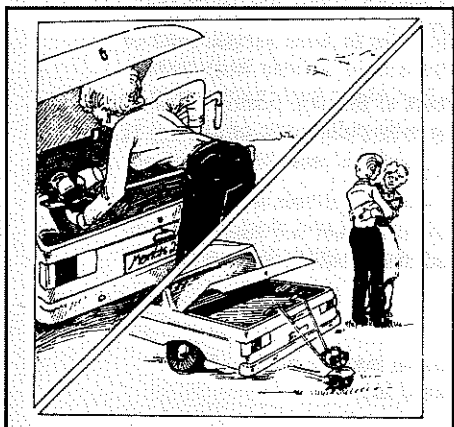
Your Mantis can “walk”...

Just squeeze the throttle lever gently and let the Mantis “tip toe” across your yard on its tines. (It *won't* hurt your lawn or driveway—try it.)

Your Mantis can be carried...

With the engine *off*, you can carry the Mantis with its convenient carrying handle.

Safety Reminder: Do not hold or carry Mantis as in the picture at the top right; if tines engage, you can be badly hurt.



Your Mantis can ride...

For longer trips (say, to your mother-in-law's garden), just put the Mantis in the trunk of your car. It's easy to take in and out of a car without straining your back. Always empty the fuel tank before carrying Mantis in a car or truck.

Tilling With Your Mantis

The Mantis Goes Backwards—Now That's Progress!

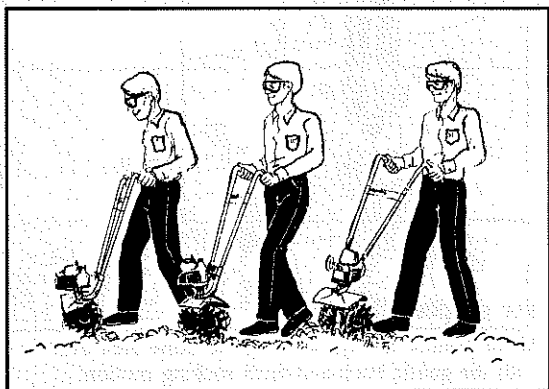
Most gardeners who've seen other tillers are surprised that Mantis works best when you pull it *backwards*!

Pulling Mantis backwards gives extra resistance to the tines for better, deeper digging.

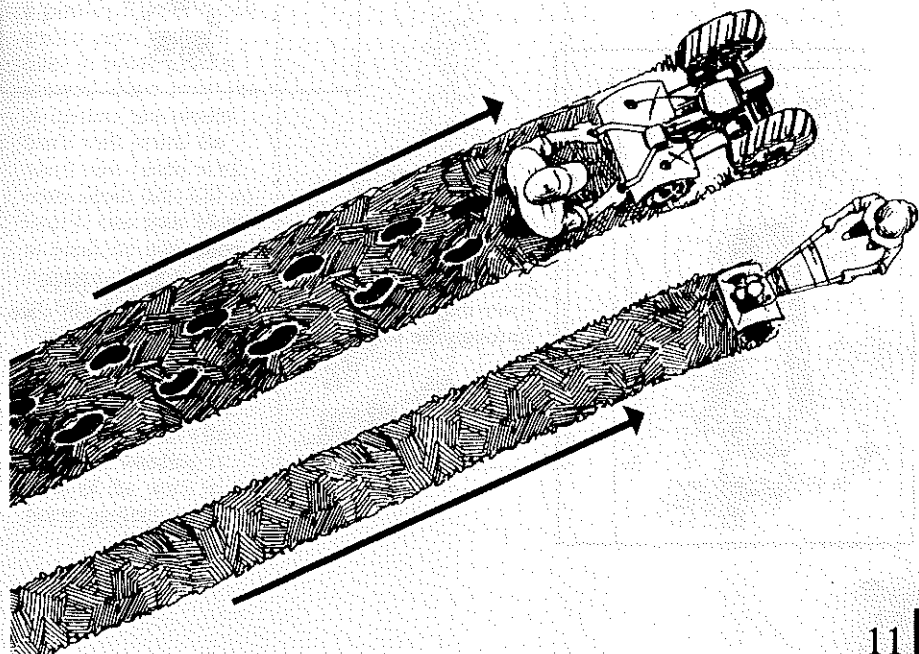
By pulling Mantis backwards, you'll erase your foot-prints as you pull it along.

Run the Mantis like a vacuum cleaner.

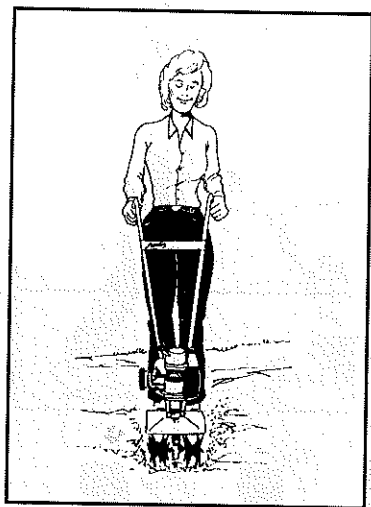
This easy "rocking motion" is the key to super-effective tilling.



- Pull Mantis backwards
- Let it move forward a bit
- Pull it backwards again



Controlling The Depth Is Easy, Too!



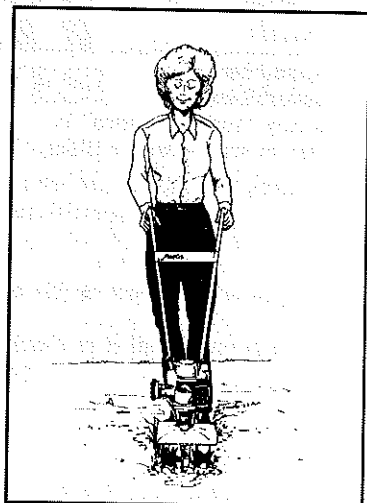
For shallow tilling

Move Mantis quickly over soil surface. For shallow tilling or weeding, switch the tines to the "cultivating" position.

(Please see page 16.)

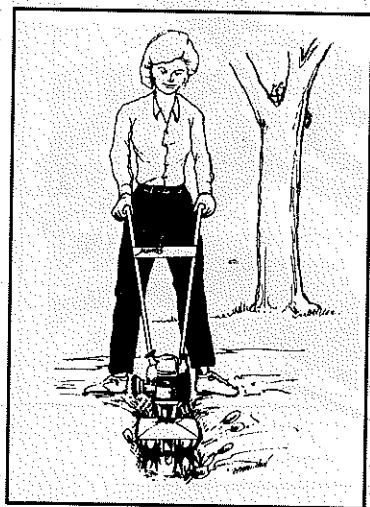
For deeper tilling

Move Mantis slowly, working the same area over with the gentle back-and-forth rocking motion.



For big weeds or tough roots

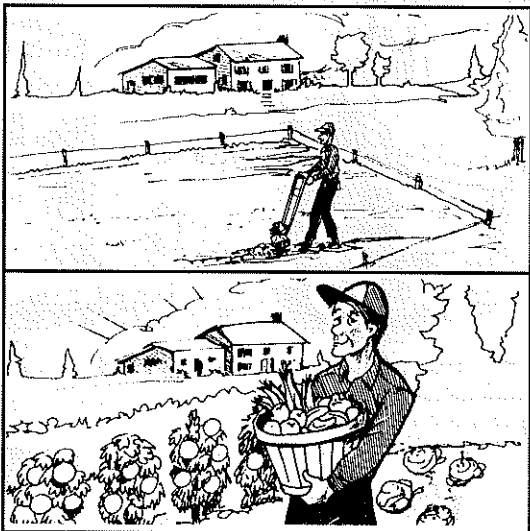
Let the Mantis rock back and forth several times over the "tough spot" until its sharp tine teeth slice through the root or weed.



Special Projects . . . Let Mantis Help

Starting a flower bed border

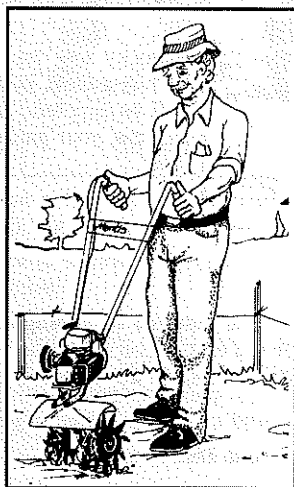
It's easy to turn a section of your lawn into a flower border. Run the Mantis back and forth until sod begins to break up. Continue tilling . . . Mantis will finely chop sod clumps and thoroughly work them into the soil.



Starting a family-sized vegetable garden

To turn a large plot into a garden, hire someone with a plow or large tiller to break ground for you. It's a *once-in-a-lifetime* investment that's well worth the small cost (such work costs about \$15-\$20 an hour). Use your Mantis to break up any remaining clumps of soil or sod, and pulverize your soil into a smooth, perfect seed bed.

Then, use your Mantis for *all* of your weeding chores. (Remember, weeding is 95% of the work in home gardens.)



More Special Projects



Digging holes for shrubs, bushes, etc.

Hold Mantis in one place, letting the tines dig down into the soil. Once they've dug down about 6"-8", lift Mantis up and simply shovel or rake out the loose dirt. Repeat until desired depth is reached.



Clearing stones and rocks out of your garden

Unlike other tillers which bury rocks, Mantis pulls them to the surface. You can then remove them from your garden.

In rocky soil, use half throttle. When Mantis hits a rock, pull back gently and the rock will be exposed. Take out rocks as you go. In time, your garden will be virtually rock free!

A Safety Reminder:

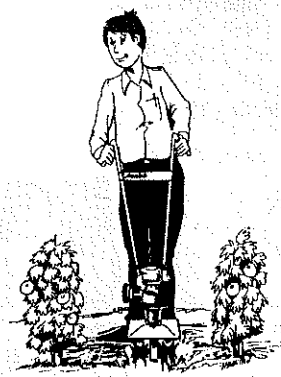
If your Mantis tines become jammed or entangled, shut off the engine immediately and remove the obstruction while the engine is off. Never attempt to remove an obstruction while the engine is running. Serious injury can result.

****Call our office to ask about Tine Detangler.***

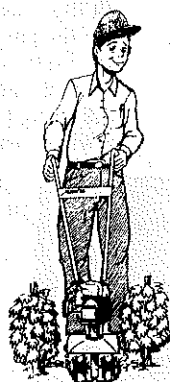
Just Guide the Mantis to Where You Need to Weed!



Between Plants



In wide rows



In tight rows



Against Fences



In corners



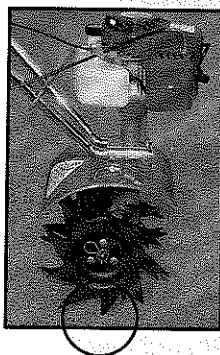
On raised beds

- Use the gentle rocking action pulling Mantis backwards slowly and letting it rock forward to knock out weeds.
- For tough weeds, slow it down, working back and forth until the weeds are removed. Easy and effective!

(Remember: *any* type of tiller will tangle on tall grass, stringy vines or big weeds. Cut material up first with a knife or hand pruners. If material does tangle in tines, shut off tiller completely *first* before removing tangled material.) The Tine Detangler makes this job a breeze.

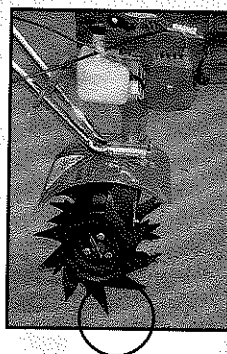
Mantis Makes Weeding A Pleasure (Which is why gardeners love it!)

With just a quick two-minute step, you can switch your Mantis from a tiller that digs down 6"-8" into a super weeding machine that gently cultivates only the top 2"-3" of soil. You'll cut your weeding time in half—and have more time to enjoy your garden! With the tines in the weeding position, the 36 sharp tine teeth will slice and chop weeds, burying them as you simply walk along (and protecting the deeper, precious root systems of your growing plants).



**TILLING
POSITION**

*Biting Action
(Tines rotate
towards back
of tiller)*

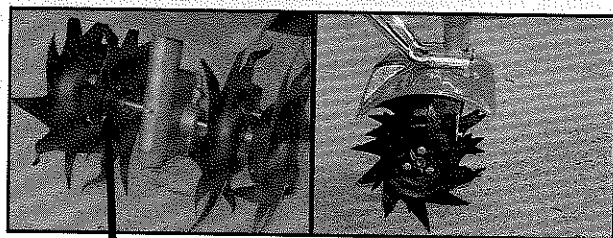
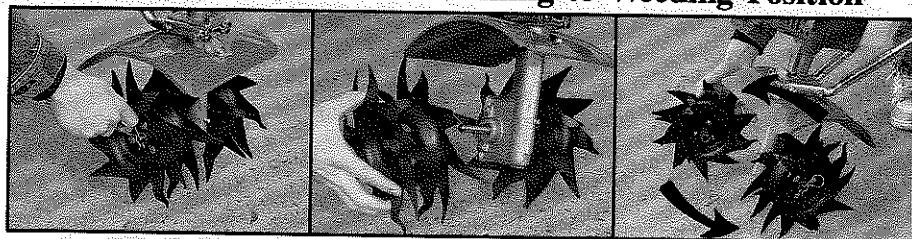


**WEEDING
POSITION**

*Slicing Action
(Also useful
for shallow
tilling)*

** Notice the angle of the tine and the way it comes in contact with the ground.*

How to Switch from Tilling to Weeding Position



- Remove pins
- Remove tines from axle
- Place the right side tine onto the left side axle and the left side tine on the right side axle making sure the extended hub is towards the transmission.

Note: The protruding end of the hub always faces toward the worm gear housing.

Maintenance And Storage

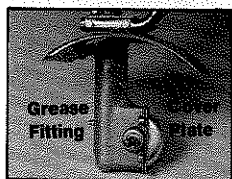
Maintaining the Air Filter

To be done prior to each use or when working for prolonged periods in a dusty environment.

A wet or dirty air filter can cause poor engine performance, difficult starting or decreased engine life. Be sure to check your air filter frequently. If you work in dusty soil, or want to be sure, check your air filter before each use. Under more normal conditions, check the filter once a month. Always check your air filter once a year in the spring or fall. Replace or clean as needed.

Checking The Lubricant Inside The Worm Gear Housing

The Mantis worm gear housing has been lubricated at the factory and should provide years of satisfactory service with no additional attention. Once a year, it is a good idea to inspect the lubricant level in the worm gear housing. To do this, remove the worm gear housing cover plate and clean. The GREASE LEVEL INSIDE THE WORM GEAR HOUSING SHOULD BE NEAR THE TOP OF THE HOUSING. If it isn't, top it off with lithium #0 grease or equivalent. DO NOT OVERFILL. This can create pressure which can cause seals to fail. Do not use grease fitting to fill. You may overfill.



How to change or clean your Mantis-20 Air Filter

Your Mantis-20 features a newly designed higher efficiency air filter that does not require an oil bath.

To Remove the air filter:

- 1) Unscrew the large screw on the side of the air cleaner cover (Key #21F on your parts layout).
- 2) Take off the cover making sure to clear the choke button.
- 3) The air filter is the white pad on the inside of the air cleaner cover. Remove it by carefully lifting an edge.

To Clean the air filter:

- 1) Use a brush or air compressor to remove debris from pad. Do not use solvents or cleaning chemicals.

To Install the air filter:

- 1) Insert a clean, dry filter into the air cleaner cover and reassemble in reverse of the above removal instructions.

New air filters and other repair or maintenance parts for your Mantis-20 engine and tiller can be ordered directly from us. Write, or call Toll-Free 1-800-366-6268.

Storing Your Mantis

To be done each fall or before storing the Mantis for any long period of time. Be sure to store in an upright position in a dry, sheltered location.

Drain the gas tank and then run the engine until it stops. (Fuel stored under even the most ideal conditions may start to go stale in 30 days. Stale fuel has a high gum content which can clog the carburetor and restrict fuel flow.) Choke and re-start engine to make sure all fuel has been used from the carburetor. This prevents formation of gum deposits. Remove the spark plug and pour a few drops of clean, air-cooled 2-cycle oil through the spark plug hole into the combustion chamber. Slowly pull the starter 3 - 4 times to coat the interior of the cylinder wall. Inspect the spark plug (Autolite 2976), clean (or replace) and re-install.

If you have fuel left over at the end of the growing season, discard it rather than save it for use next spring. Clean out the air filter as explained on page 17. Clean the entire machine of dirt, grass, etc. and wipe the tines with oil or spray with WD-40 to prevent rusting. Oil the throttle cable and all moving parts that are visible (do not remove engine cover). Check grease level in transmission and refill if necessary. (Refer to pg. 17 for grease.)

Order new parts to replace any that are badly worn or broken (even though you may have been "living with" the inconvenience all summer). Order early, so you'll have the parts well before the gardening season starts. Put your Mantis away in a clean, dry place for the winter. Store in upright position.

Restarting After Storage

Remove spark plug and pull starter cord 3-4 times to clear out oil from combustion chamber. Wipe oil from spark plug. Place spark plug back into the cylinder.

Adjusting The Carburetor

To be done if Mantis won't start or lacks its usual power.

The carburetor has been adjusted at the factory for optimum performance. Should the carburetor require adjusting, proceed as follows:

- Low-speed needle valve (L) 1± ¼ turn
- High-speed needle valve (H) 1± ¼ turn

Turn the corresponding adjusting screw lightly clockwise to fully closed position and return the screw by the number of turns indicated above. The (L) and (H) markings are stamped on the carburetor body next to each screw. Do not make carb adjustments when the air cleaner cover is removed. (This causes the engine to run too lean.)

Spark Plugs

To be done if Mantis won't start or lacks its usual power.

Clean or replace the plug if fouled with oily black deposits. Replace the plug if the center electrode is rounded at the end or if the ground electrode is worn. Adjust the gap 0.6-0.7 mm (.024-.028). CAUTION — Do not over tighten the plug. Correct torque = 18 - 22 ft. lbs.

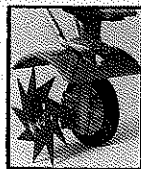
Use an Autolite 2976 or Champion CJ8Y spark plug to replace the old spark plug. Use a 19mm or 3/4" spark plug wrench.

In order to avoid possible damage to the threads, do not attempt to remove the plug from a hot aluminum cylinder head.

Using Your Mantis Precision Gardening Attachments

Your Mantis was designed — right from the beginning — to accept a variety of useful, work-saving attachments. All of the attachments (except the trimmers) slide onto the tine axles and are held in place with retaining pins. Your attachments are simple to care for . . . just hose them off and when dry, spray with a light pressurized oil such as WD-40.

Important Note: For all instructions, assume that you are standing behind the Mantis (as you would for tilling or cultivating) to determine left and right axles.



Border Edger

Give your yard that neat, attractive, finished look! Cut clean edges for plantings along paths and sidewalks, around flower beds, shrubs and trees, and along hedge rows. Your Mantis Border Edger does the job skillfully — and effortlessly.

To Install:

For shallow edging (1"-2" deep) — for areas with roots and other underground obstructions.

- Remove tilling/cultivating tines.
- Slide wheel onto the *right* axle.
- Slide edger blade onto the *left* axle so that the *angled face* of the blade hits the ground when spun in a clockwise direction.
- Insert retaining pins on both the left and right axles. For deeper edging (3"-4" deep) - for edging around walkways and garden beds.
- Remove tilling/cultivating tines.
- Slide edger blade on the right axle so the straight face of the blade is hitting the ground when spun in a clockwise direction.
- Insert retaining pins on both the left and right axles.



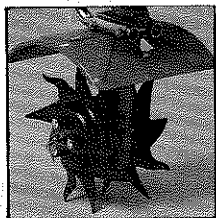
To Use:

- Position Mantis so that edger blade is along edge of garden bed and wheel is outside (on lawn, sidewalk, etc.)
- Pull tiller backwards.
- Rake away loose dirt.

Special Projects:

- Use Edger to cut sod strips. Use deep setting.
- Cut thin slits in the yard or garden for the submersion of thin electric and water lines.
- To edge and cultivate at the same time...use the edger blade on one axle, a tiller/cultivating tine on the other axle. Don't be afraid to experiment with mixing or matching the blades!

Planter/Furrower



This wonderful attachment makes the best planting and hilling furrower you've ever seen. It does the work faster and easier than hand hoeing. The furrows you create will have a uniform depth, whether shallow or deep!

To Install:

- Remove tilling/cultivating tines.
- Slide planter/furrower tines onto axle so the straight face of the blade hits the ground when spun in a clockwise direction.
- Insert retaining pins on right and left axles.

To Use:

- Go over your seed beds first with normal tilling/cultivating tines.
- *For shallow trenches* (for planting beans, corn, etc.): Install planter/furrower tines and pull Mantis backwards along the row. Let machine tilt slightly to clear earth from the trench.
- *For deeper trenches* (for planting potatoes, strawberries or asparagus): With planter/furrower tines in place, let Mantis run forward and then pull it backwards slowly. Do this along the entire row.
- *For hilling corn or potatoes*: Using planter/furrower tines, run Mantis along the right side of the crop row you want to hill. As you move along, lean tiller at an angle away from the crop row. This will throw soil up on the row.



Special Projects:

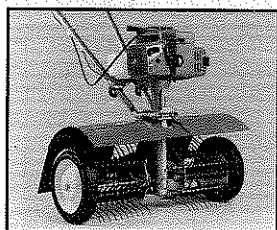
- Reverse the planter/furrower tines for very shallow cultivation of shallow-rooted crops. The planter/furrower tines are narrower than the usual tilling/cultivating tines and are ideal for spot weeding in extremely tight spaces.
- Use the planter/furrower tines (in normal position) to dig irrigation trenches as needed.
- Try "Invisible Composting" this fall! Dig a deep (6"-8") trench with the Mantis in your garden and fill it with compost materials. Shredding the material first with an electric chipper/shredder such as our Chip Mate will help speed decomposition. Cover the trench by digging a second trench beside the first one. (By leaning the Mantis away from the first trench, you'll throw dirt up to cover the original trench.)

Come spring, the materials will be decomposed, already enriching your soil with humus and nutrients.

Lawn De-Thatcher

Thatch is a harmful, tightly-woven mat of grass roots, both living and dead (not mower clippings as commonly believed) that forms just above the soil surface. Thatch keeps water and fertilizer from getting down into the soil, shuts out air and sunlight, and provides a home for unwanted insects.

Your Mantis Lawn De-Thatcher will effortlessly do in minutes what would normally take hours of backbreaking work with an iron rake. The two gangs of forty spring-steel picks *each* cleanly de-thatch a 15"-wide swath as you walk along. One or two passes each year will totally eliminate harmful thatch build-up and develop a healthy green carpet.

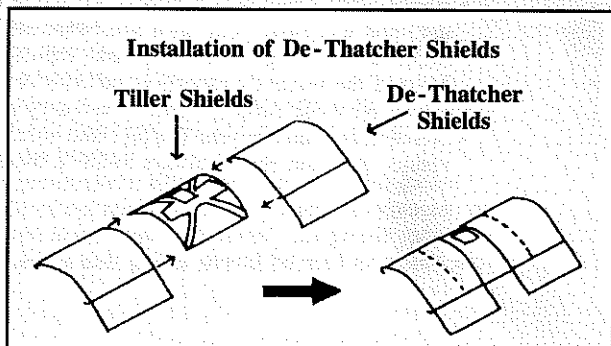


To Install:

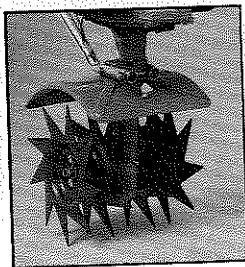
- Remove tilling/cultivating tines.
- Slide de-thatching attachments over the tine axles. Observe right and left-hand labels. The De-Thatcher combing springs must hit the lawn like curved down fingers.
- Insert retaining pins on right and left axles.
- Slip on the hood extenders by bending them in a semi-circle so that the channels on the extenders slip over the front and back edge of the tiller hood. Push hood extenders in as far as they will go towards the center.

To Use:

- The Mantis engine will turn the De-Thatcher combing fingers (not the wheels).
- For fastest de-thatching, pull the Mantis *backwards* as you walk along. (If you prefer, you can let it run forward and pull back as if you were tilling ... however, this is a bit slower.)
- Thatch will be combed up onto the surface of your lawn. Simply rake it away. (By the way, this material makes a terrific, weed-free mulch!)



Lawn Aerator



Lawn care professionals aerate lawns to give grass roots a chance to breathe and to allow irrigation to seep below the soil's hard crust to the root zones of plants. We also recommend aerating before reseeding or fertilizing. Your Aerator features four gangs of tempered steel "knives" The knives cut into the soil beneath your lawn to let water and nutrients penetrate easily and to encourage deep, drought-resistant root growth.

To Install:

- Slide off tilling/cultivating tines.
- Mount aerator tines so the sloped edge of the tines strike the soil when rotated in a clockwise motion. (This will provide aeration to a 1"-2" depth—recommended for your first aerating projects.)
- For deeper aeration (2½"-3" depth), reverse the tines so the straight edge of the tines strike the soil.
- Insert retaining pins on both the left and right axles.

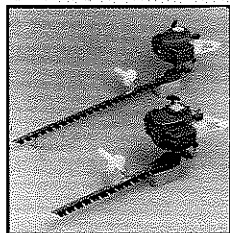


To Use:

- For best results, walk backwards and pull the machine as you go. This will cut four hairline slits, roughly 2½" apart and 1½" deep.
(Note: If you let Mantis run forward, it will tear out dime-sized patches of lawn and soil.)
- If your lawn needs radical restoration, aerate north to south and then aerate east to west to give you a checkerboard pattern of slits.
- Leave the loose earth where it is until you've sown fresh grass seeds and fertilizer along the slits, then rake off the loose soil. You'll get fresh bands of healthy green grass which will spread over your entire lawn, giving you a rich carpet of healthy green growth.
- Please note: Aeration is a radical procedure (regardless of the method you use) and will make your lawn somewhat unsightly for about 10 days. The improved lawn vigor and color make regular aeration more than worth it. Most of the unsightly aspects of aeration can be eliminated immediately by raking off loose surface earth, followed by a good watering.
- Aerate *three* times a year (spring, mid-summer and early fall only) for best results. Aeration should always follow a thorough program of de-thatching

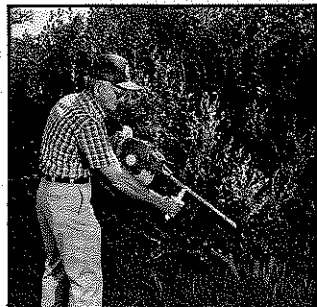
Trimmer

What once took hours of blister-making hand work with loppers can be done in minutes with your Mantis Trimmer. Use it to prune, manicure and trim your hedges, shrubs or small trees. Just pop the powerful Mantis engine onto the trimmer attachment (it only takes a minute or so) and you're ready to go to work.



To Install:

- Remove handle grip and trimmer from cartons.
- Screw handle grip into handle adapter located on frame bar in threaded hole provided. Handle should be sufficiently tightened to ensure that at least 3 or 4 clicks are felt on locking notches.
- Remove the engine from the Mantis Tiller as follows. Remove the air filter cover (see page 17). Loosen the locking nut that clamps the throttle cable to the engine housing. Detach the throttle cable end from the carburetor. Separate the ground wire at the connecting clips approximately 3" from the engine. (Pull on the clips not the wire!) Loosen the hex head screw at the very bottom of the engine just above where the handles are attached to the tiller. Lift the engine straight up off the tiller. When putting the engine back on the tiller transmission, be sure it is properly seated all the way down and snug against the top of the transmission.
- Remove the two 1/4" x 20 nuts preassembled to handle and place handle on hedge trimmer. Insert the two 1/4" x 20 handle bolts into 1/4" holes and half round slot provided at rear of hedge trimmer housing. Secure the handle with the 1/4" x 20 nuts and hex head bolts provided.
- Install engine to hedge trimmer by first aligning the hex drive on the hedge trimmer with the hex socket in the engine and place motor over 1" diameter stem of hedge trimmer and secure with 5/16" hex socket wrench.
- Attach ground wire and throttle cable from trimmer handle to motor.
- Follow all engine operating instructions for the Mantis tiller (see page 4). Always use the proper gasoline and engine oil mixture.



Lubrication And Maintenance

- A few drops of oil should be placed at each adjusting screw approximately every four hours of normal operation.
- To obtain trouble-free trimming, it is necessary to remove gum that collects on the blades. A mixture of 1/2 kerosene and 1/2 machine oil (*heavy grade motor oil*) will clean the blades.
- The gear housing has been permanently lubricated with a special grease which should last for the life of the trimmer. When blades are replaced, or any other time that the bottom cover plate is removed, the grease should be checked for proper amount and a new gasket should be used to ensure proper seating of cover plate.

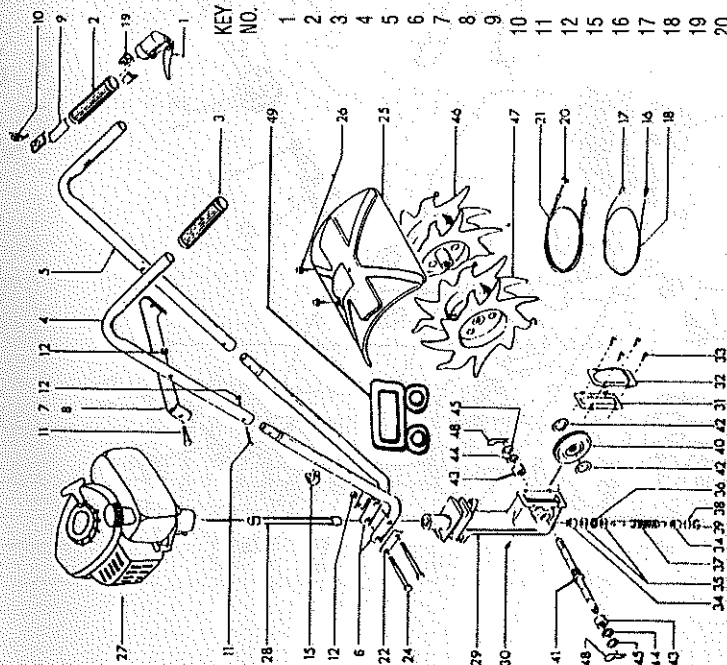
To Use Your Trimmer:

- Read the care and safety instructions carefully.
- Hold trimmer handle firmly and squeeze throttle to accelerate engine. Tilt trimmer so that cutting tooth is angled slightly toward the hedge or shrub and proceed to cut.
- Your trimmer is designed to cut any type of hedge or shrub; however, **THICKNESS OF CUT SHOULD NOT EXCEED 1/2" IN DIAMETER.**
- Be careful of hidden metallic objects in the hedge or shrubbery which may damage trimmer.

Trimmer Care And Safety

- 1) Before using trimmer, read and follow all instructions including all care and safety instructions for the Mantis Tiller.
- 2) **DANGER — KEEP HANDS AWAY FROM BLADES** — Keep both hands on handles when engine is running. Do not attempt to remove cut material nor hold material to be cut when blades are moving. Make sure trimmer switch is off when clearing jammed material from blades. Do not grasp the exposed cutting blades on cutting edges of trimmer.
- 3) **USE TRIMMER PROPERLY** — Use only for trimming 1/2" or less diameter branches from hedges or shrubs. Do not abuse trimmer.
- 4) **DON'T OVERREACH OR STAND ON UNSTABLE SUPPORT** — Keep good footing and balance at all times.
- 5) **STOP ENGINE WHEN TRANSPORTING** from one place to another. *Do not leave engine running while hedge trimmer is unattended.*
- 6) **MULTIPLE OPERATORS** — Keep a safe distance between two or more operators when working together simultaneously.
- 7) **MAINTAIN AND EXAMINE TRIMMER WITH CARE** — Follow maintenance instructions given in manual. Do not use the hedge trimmer if the muffler is defective or missing.
- 8) **STORE TRIMMER INDOORS** — When not in use, store trimmer indoors in a dry, sheltered area out of the reach of children.
- 9) **DO NOT ATTEMPT TO REPAIR TRIMMER** — Have repairs made by qualified dealer or repairman. See that only identical replacement parts are used.
- 10) **DO NOT USE WITHOUT HANDLE AND GUARD.**

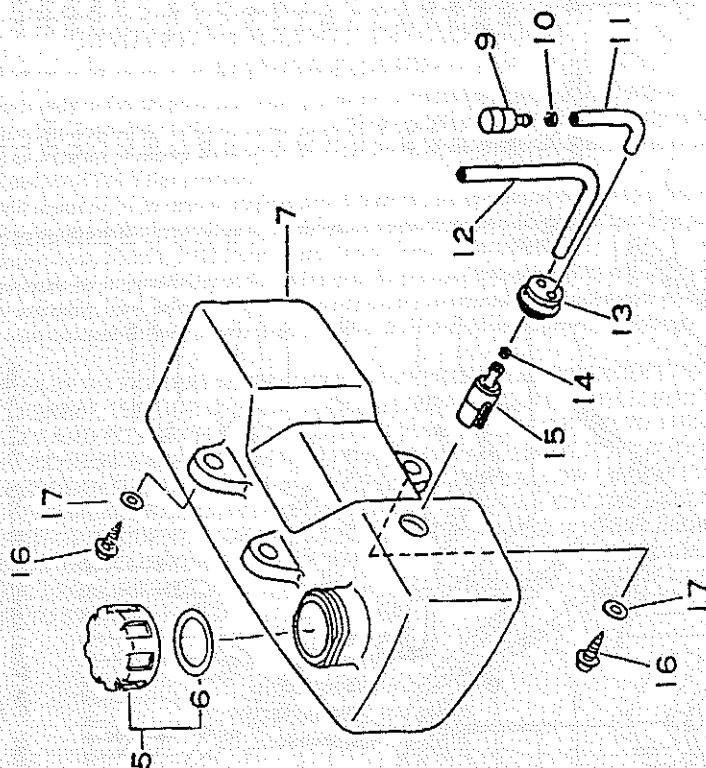
MANTIS-20 PARTS LAYOUT



KEY NO.	PART. NO.	DESCRIPTION	QTY	PART. NO.	DESCRIPTION	QTY
1	382	Throttle Lever	1	27	(qty) Engine	1
2	383	Grip-Thru	1	28	Drive Shaft	1
3	619	Grip	1	29	Worm Gear Housing	1
4	4062	Upper Handle - Left	1	30	Grease Fitting	1
5	4061	Upper Handle - Right	1	31	Gasket	1
6	4063	Lower Handle	2	32	Housing Cover	1
7	488M	Label	1	33	Rd. Hd. Self Tapping Screw	4
8	148	Handle Brace	1	34	Roller Bearing	2
9	464	Switch Bracket	1	35	Worm Bearing Race	2
10	479	Switch	1	36	Worm Thrust Bearing	1
11	410	Cap Screw 1/4-20 x 1" Lg.	4	37	Worm Shaft	1
12	972	Lock Nut 1/4-20	6	38	Worm Disc	1
15	478	Throttle Clip	2	39	Retaining Ring	1
16	477	Connector Female	1	40	Worm Gear	1
17	476	Connector Male	1	41	Tine Shaft	1
18	475	Ground Wire	1	42	Worm Gear Thrust Washer	2
19	379	Cable Retainer	2	43	Worm Gear Bearing	2
20	413	Retaining Ring	1	44	Bearing Seal	2
21	467-1	Throttle Cable Assy.	1	45	Bearing Seal Retainer	2
22	377	Handle Clamp	2	46	Tine Assembly (L.H.)	1
24	470	Long Bolt 1/4-20 x 3" Lg.	2	47	Tine Assembly (R.H.)	1
25	465	Fender Guard	1	48	Tine Retaining Hair Pin	2
26	140	Bolt 1/4-20 x 1/2" Lg.	2	49	Carrying Handle	1

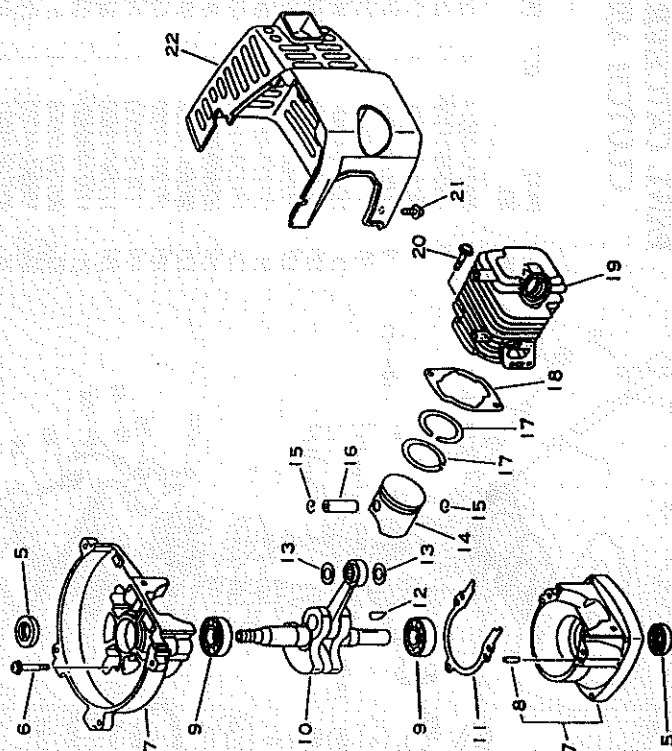
*Note: The Tine Assembly is only sold as a set.
They are not sold separately.

SV-4(A) ENGINE FUEL TANK LAYOUT



KEY NO.	PART NO.	QTY	DESCRIPTION
5	131004-40930	1	Cap Assembly, Fuel Tank
6	131016-40930	1	Gasket, Fuel Tank Cap
7	131005-11820	1	Fuel Tank
8	131300-40630	1	Vent Assembly
9	132013-02381	1	Clip, Pipe
10	131312-44330	1	Pipe 3" x 5" x 70
11	132010-11520	1	Pipe, fuel 3" x 5" x 210
12	132115-44330	1	Grommet
13	132013-09820	1	Clip
14	131205-07320	1	Strainer, fuel
15	900250-05014	3	Screw 5" x 14
16	900603-00005	3	Washer 5
17			

SV-4(A) ENGINE BLOCK ASSEMBLY LAYOUT



KEY NO.	PART NO.	QTY	DESCRIPTION
5	100212-42030	2	Oilseal
6	900238-05028	3	Screw SMB - 5 x 2
7	100200-11520	1	Crankcase Set
8	100215-03930	2	Pin, Dowel
9	900810-36201	2	Bearing, Ball 6201
10	100100-11520	1	Crankcase Assy.
*11	N/A USE KIT	1	Gasket - Crankcase
12	610325-02730	1	Key, Woodruff
13	100014-11520	2	Spacer, Piston Pin
14	100010-11520	1	Piston
15	100015-04630	2	Circlip, Pist. Pin
16	100013-11520	1	Pin, Piston
17	100011-05330	2	Ring, Piston
*18	N/A USE KIT	1	Gasket, Cyl. Base
19	101011-44730	1	Cylinder
20	900238-05022	2	Screw SMB - 5 x 2
21	900238-04018	2	Screw 4 x 8
22	101506-11520	1	Cover, Cylinder

* 889000-42030 Gasket Kit

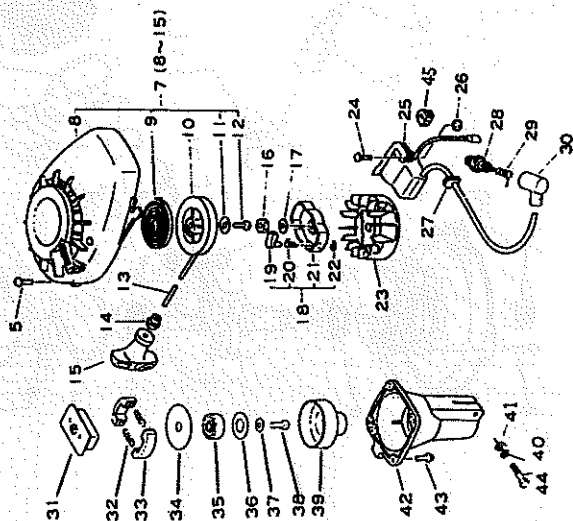
SV-4(A) ENGINE

STARTER ASSEMBLY

PAWL CATCHER ASSEMBLY

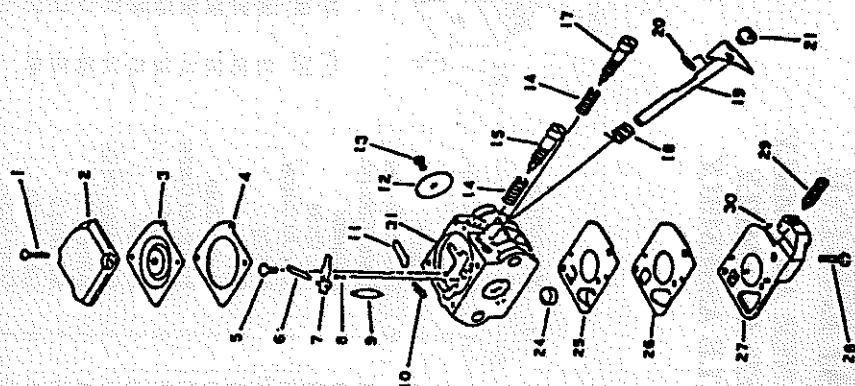
CLUTCH ASSEMBLY

KEY NO.	PART. NO.	QTY	DESCRIPTION	KEY NO.	PART. NO.	QTY	DESCRIPTION
5	900242-04016	4	Screw 4 x 15	25	150117-09130	2	Spacer
7	177200-11520	1	Starter Assembly	27	152112-07331	1	Bushing
8	101511-11520	1	Cover, Fan	28	159010-12330	1	Plug, Spark (CJ8Y)
9	177220-42030	1	Spring, Rewind	29	159011-03432	1	Coil, Spark Plug Cap
10	177215-42030	1	Drum, Starter	30	159012-01620	1	Cap, Spark Plug
11	177214-4203	1	Washer	31	175016-05020	1	Hub, Clutch
12	177236-11410	1	Screw	32	175018-05130	2	Spring, Clutch
13	177266-05530	1	Rope, Starter	33	175009-05130	2	Shoe, Clutch
14	177227-42030	1	Guide, Rope	34	175019-04630	1	Plate, Clutch
15	177228-11520	1	Grip, Starter	35	900802-06000	1	Bearing, Ball 5000
16	900500-00008	1	Nut 3	36	175044-04630	1	Washer, Clutch
17	900600-00008	1	Washer 3	37	175014-04630	1	Washer, Clutch
18	177202-42030	1	Catcher Assy, Pawl	38	900238-06012	1	Screw 5 x 12
19	177218-42030	1	Pawl, Starter	39	175010-04632	1	Drum, Clutch
20	177234-42030	1	Spring, Return	40	900605-00005	1	Spring Washer 5
21	177210-42030	1	Catcher, Pawl	41	900600-00005	1	Washer 5
22	900700-00006	1	E - Ring 6	42	610223-11520	1	Case, Clutch (AR)
23	150801-44330	1	Flywheel	43	900238-04014	2	Screw SM8 - 4 x 14
24	900238-04022	2	Screw SMB - 4 x 22	44	900100-05025	1	Screw 5 x 30
25	150626-11520	1	Coil, Ignition	45	156114-04920	1	Grommet



SV-4(A) ENGINE

CARBURETOR ASSEMBLY



KEY NO.	PART. NO.	QTY	DESCRIPTION	KEY NO.	PART. NO.	QTY	DESCRIPTION
1	125200-11520	1	Carburetor Assembly	14	125319-42030	2	Spring, Coil
2	125344-13931	1	Screw, Metering Cover	16	125320-42030	1	Needle, High Speed
3	125342-11520	1	Cover, Diaphragm	17	125318-42030	1	Needle, Idle
4	A, B	0	Diaphragm Assy.	18	125313-42030	1	Spring, Thrt. Return
5	A, B	1	Gasket, Metering	19	125317-42030	1	Shaft, Throttle
6	125339-42030	1	Screw	20	125327-13930	1	Clip
7	B	1	Pin, Arm	21	125372-42030	1	Swivel
8	B	1	Lever, Metering Cham	24	B	1	Swivel
9	B	1	Spring, Coil	25	A, B	1	Diaphragm, Fuel Pump
10	125327-15130	1	Valve, Needle	26	A, B	1	Gasket, Fuel Pump
11	B	1	Clip	27	125324-42030	1	Cover, Pump
12	125316-42030	1	Plug, Welch	28	125310-42030	2	Screw
13	B	1	Valve, Throttle	29	125334-13930	1	Screw, Idle Adjust
14	125319-42030	2	Screw	30	125378-13930	1	Place, Friction
			Spring, Coil				
				A	125303-42030		
				B	125300-42030		

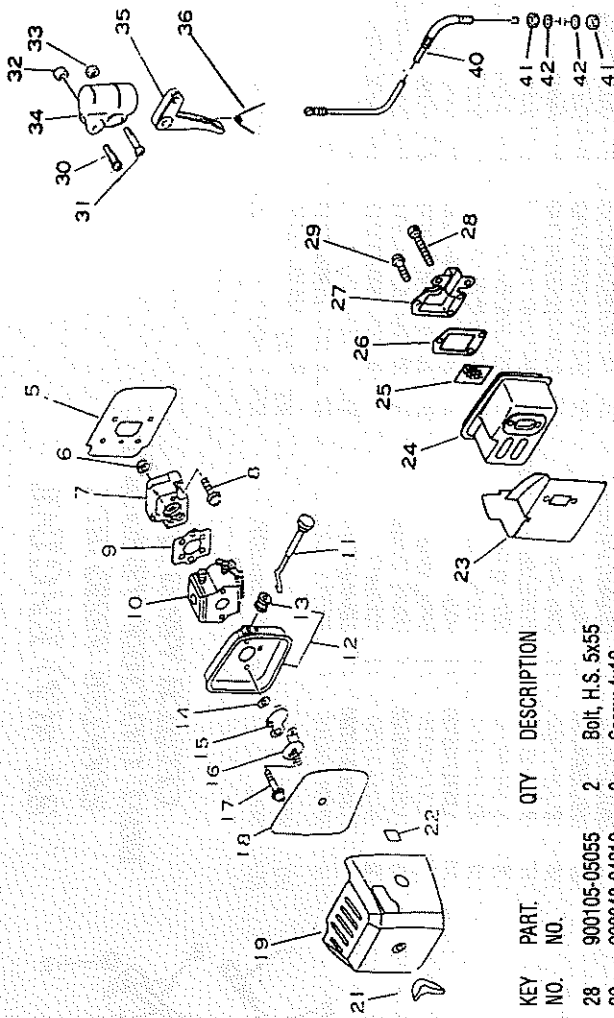
SV-4(A) ENGINE

AIR CLEANER ASSEMBLY

MUFFLER ASSEMBLY

THROTTLE ASSEMBLY

KEY NO.	PART. NO.	QTY	DESCRIPTION
5	130010-42030	1	Gasket, Insulator
6	900500-00005	2	Nut 5
7	130017-42030	1	Insulator
8	900238-05020	2	Screw SMB - 5x20
9	130016-42030	1	Gasket, Carburetor
10	125200-11520	1	Carburetor
11	178510-04560	1	Rod, Choke
12	130301-04560	1	Case, Air Cleaner
13	178810-052301	1	Bushing
14	178516-00830	2	Spacer
15	178515-04560	1	Shifter, Choke
16	130410-05360	1	Bracket, Air Cleaner
17	900242-05057	2	Screw 5x57
18	130310-04560	1	Filter, Air
19	130302-11520	1	Cover Assy., Air Cl.
20	900720-00004	1	O-Ring (P-4)
21	900525-00005	1	Nut, Wing 5
22	890121-12331	1	Label, Choke
23	145871-11520	1	Cover, Muffler
24	145810-11520	1	Muffler
25	145862-00630	1	Screen, Muffler
26	145866-42030	1	Gasket, Muffler Lid
27	145815-11520	1	Holder, Screen (A)



KEY NO.	PART. NO.	QTY	DESCRIPTION
28	900105-05055	2	Bolt, H.S. 5x55
29	900242-04010	3	Screw 4x10
30	900220-05028	1	Screw 5x28
31	900220-05025	1	Screw 5x25
32	433020-00830	1	Locknut 5
33	900500-00005	1	Nut 5
34	178024-06130	1	Bracket, Throttle
35	178010-05330	1	Control, Throttle
36	178043-05230	1	Throttle, Ret. Spring
40	178001-11520	1	Cultivator, Throttle
40	178002-11520	1	Cable
40	178002-11520	1	Hedge Clipper
41	900502-00005	2	Throttle Cable
42	900602-00006	2	Nut 5 (3W)
			Washer 6