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Lucky Peak Greenhouse Top Pruner *User's Guide*



Lucky Peak Greenhouse Top Pruner *User's Guide*



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**USDA Forest Service
Technology and Development Program
Missoula, MT**

5E52E99 Greenhouse Crop Mower

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Introduction

This user's guide describes a top pruner (figure 1) the Missoula Technology and Development Center developed for the U.S. Department of Agriculture, Forest Service's Lucky Peak Nursery in Boise, ID. Trees such as western larch grow tall in the greenhouse before they are ready to be planted. Top pruning (cutting the tops off of plants) controls shoot height, ensures that all trees are about the same size, decreases shoot-to-root ratio (important because the tree has to have enough root to provide water for the leaves and stems), increases stem diameter, and makes it easier to handle seedlings during transplanting and outplanting.

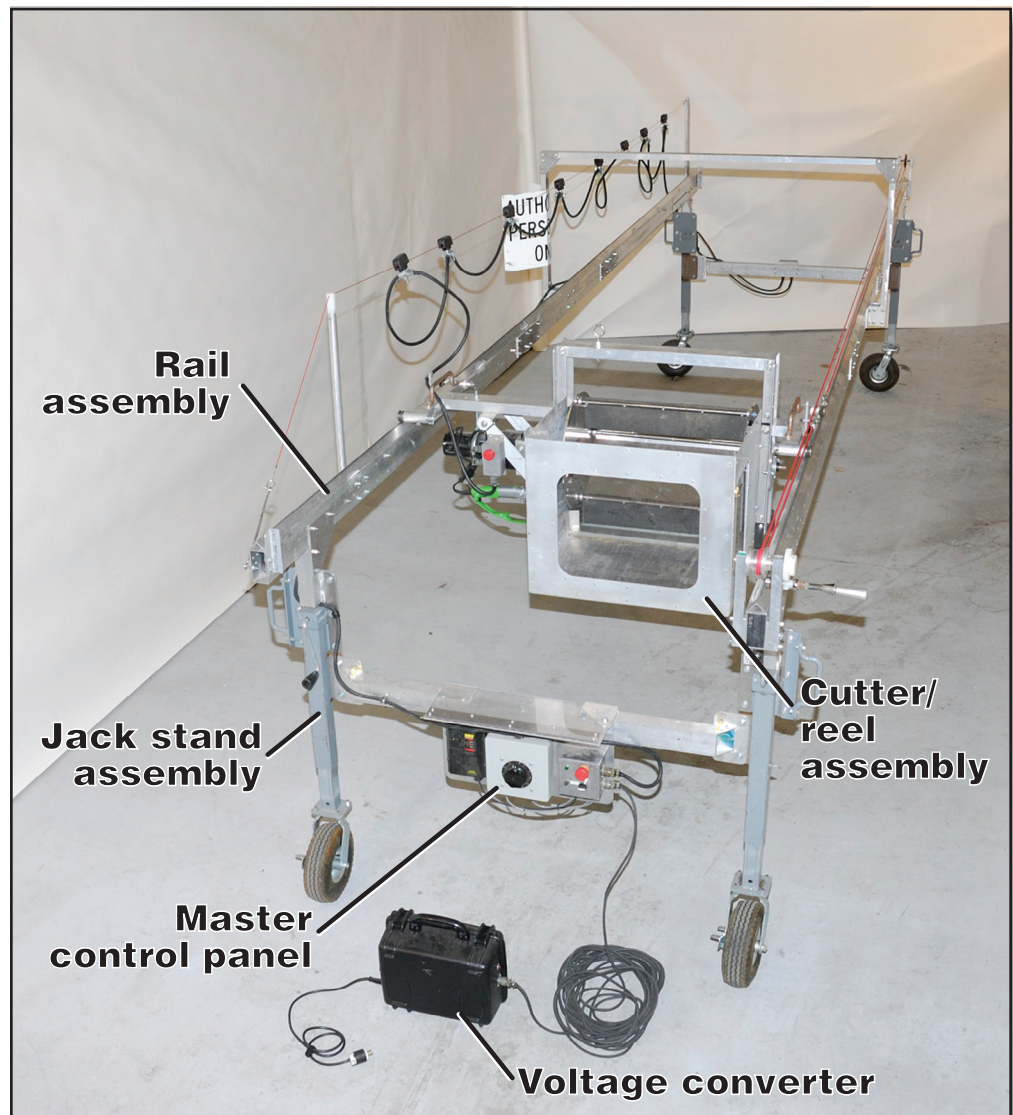


Figure 1—Key components of the top pruner.

Assembly Instructions

Assembling the Rails

The top pruner is modular for ease of transport. The cutter/reel assembly travels on two 8-foot, 6-inch-long 6061-T6 aluminum rail sections (figure 2) separated by a 4-foot, 6-inch center section. The sections are connected by side plates.

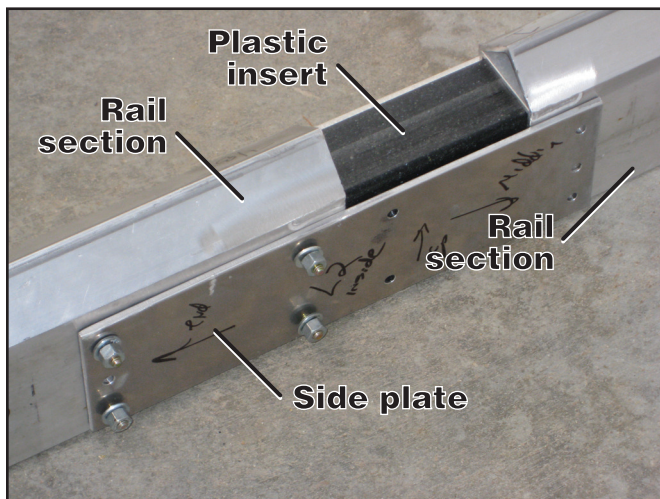


Figure 2—Connecting the rail sections.

A plastic insert is installed in the ends of the rail sections so the rectangular tubing will not be crushed when the spliced joint is bolted together with 1/4-inch nuts, bolts, and washers. The bolts fit tight in the bolt holes. Use a rubber or plastic mallet and a long tapered or pin punch when removing and installing bolts to reduce the chance of damaging the bolt's threads. Tighten nuts to 40 inch-pounds. Do not overtighten the nuts or you may crush the aluminum tube, making it difficult to disassemble the rail system.

Assembling the Jack Stands

Lay out two jack stands at each end of the assembled rails (total of four jack stands). Attach the jack stand crossbar using 9/16-inch nuts, bolts, and washers (figure 3a). Attach two top plates to each jack stand. Use 1/4-inch nuts, bolts, and washers (figure 3b).

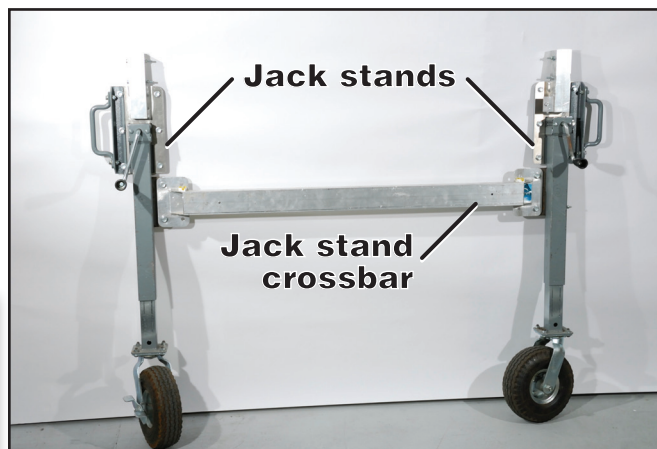


Figure 3a—A jack stand assembly (two jack stands and a jack stand crossbar).



Figure 3b—Top plates attached to the top of a jack stand.

Attaching the Rails to the Jack Stand Assemblies

Once the rails and the jack stands are assembled, each end of the rails must be attached to the top of a jack stand assembly. The jack stand assembly with the center kill switch (figure 4a) attaches to the ends of the rails with the adjustment slots. Get the jack stand assemblies in about the correct position and stabilized so they don't move. Lock the caster wheels!

Lift each rail assembly and place it between the jack stand assembly's top plates (see figure 4a). Install $\frac{1}{4}$ -inch nuts, bolts, and washers. Ensure that each bolt is routed through the plastic insert so the rectangular aluminum tubing will not be crushed when the nuts are tightened. Use a long tapered or pin punch to help align the holes. Install the second jack stand assembly on the other end of the rails (figure 4b).

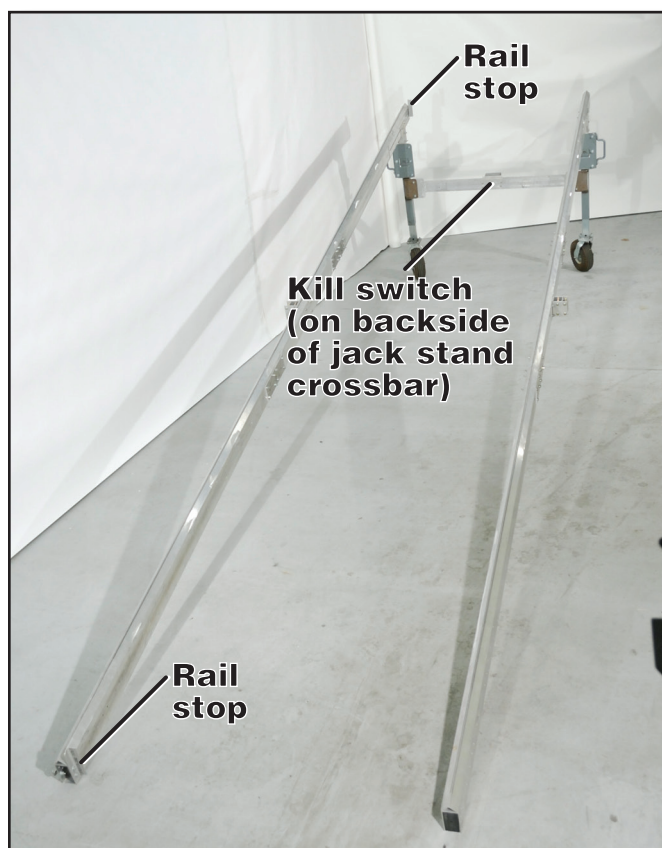


Figure 4a—Attach the rails to the jack stands after locking the caster wheels.



Figure 4b—Both jack stand assemblies are attached to the rails.

Attaching the Center Rail Uprights

Attach the center rail uprights as shown in figures 5a and 5b with $\frac{1}{4}$ -inch nuts, bolts, and washers. The “Authorized Personnel Only” sign must be installed on the inside of the center rail upright beside the overhead trolley system. The sign helps keep the trolley cars from snagging on the uprights.

If the rail stops (see figure 4a) haven't already been installed, install them now. Both stops are installed on the rail assembly that has the sign.

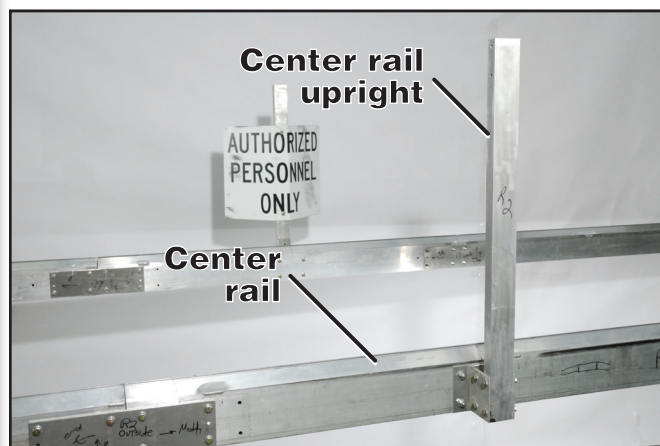


Figure 5a—Attach the uprights for the center crosspieces.

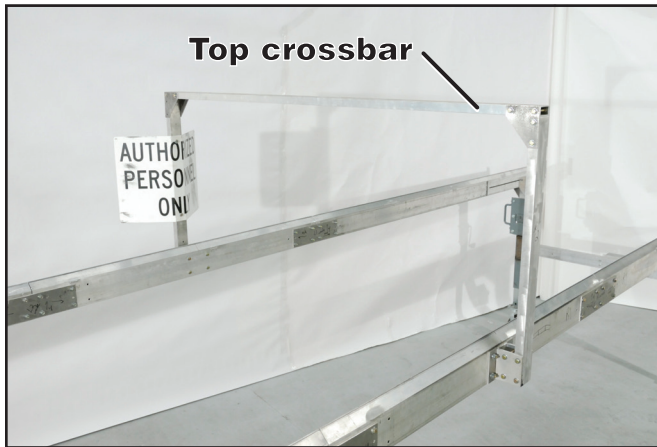


Figure 5b—Attach the top crossbar for the center rail uprights.

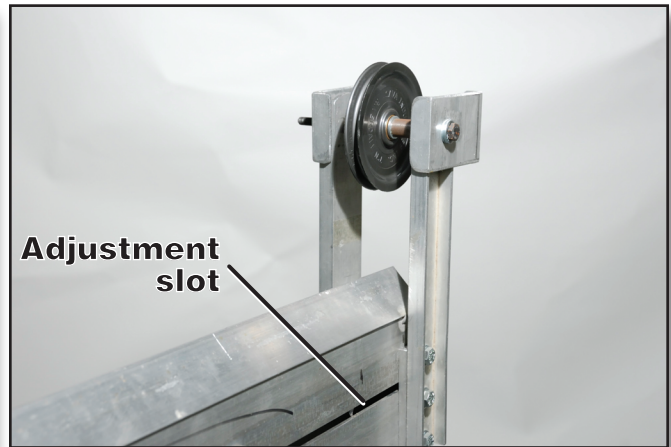


Figure 6b—The idler pulley for the capstan drive.

Installing the Capstan Drive

Install the capstan drive assembly as pictured (figure 6a); install the idler pulley on the opposite end, which has the adjustment slot (figure 6b). Use ¼-inch nuts, bolts, and washers. Be sure to install plastic inserts in the aluminum tubing so the tubing won't be crushed when the nuts are tightened.

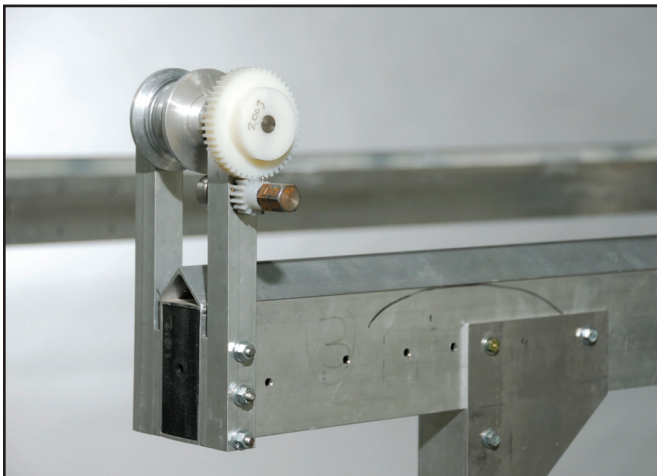


Figure 6a—The capstan drive assembly.

Installing the Overhead Trolley Cable Supports

Install the trolley cable's vertical anchor on the end of the rail that has the adjustment slot (figure 7a). Plastic inserts

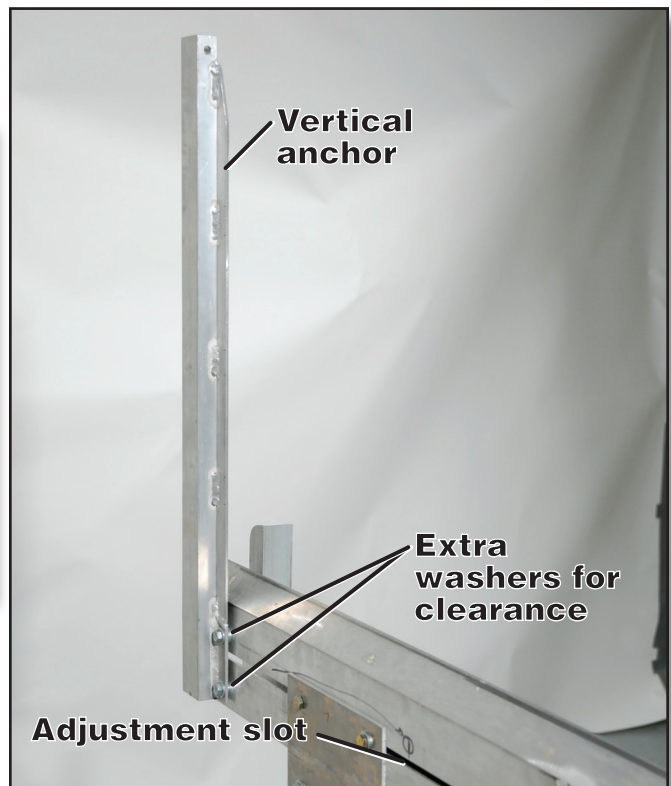


Figure 7a—The trolley cable vertical anchor.

are not needed because the bolts don't go through both sides of the rectangular tubing. Use ¼-inch nuts, bolts, and washers. Extra washers between the vertical anchor and rail provide the proper clearance from the top of the rail. The intermediate support rod is installed near the opposite end of the same rail (figure 7b). The trolley cable turnbuckle stays attached to the end of the rail.

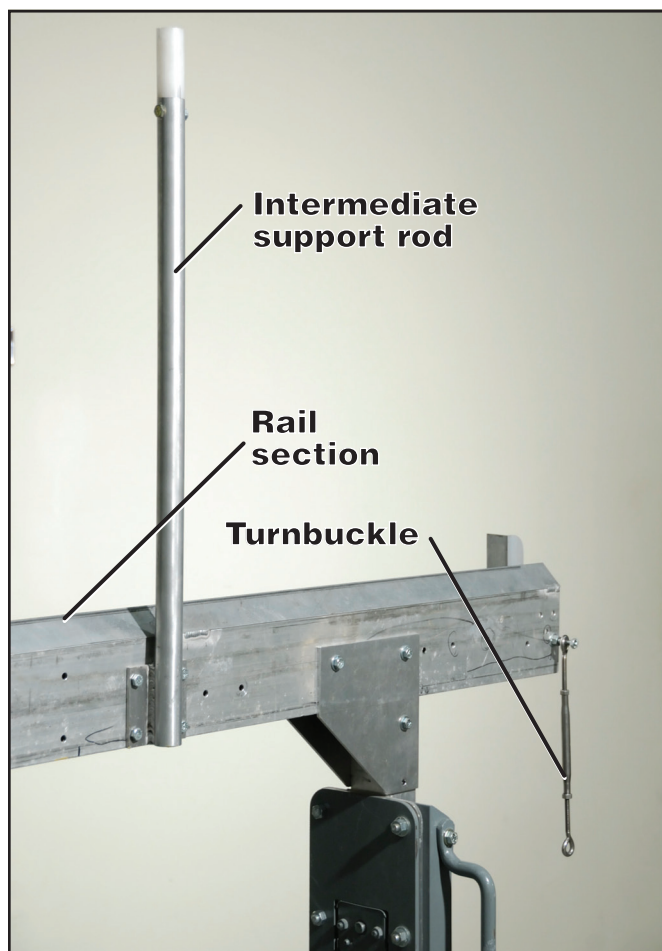


Figure 7b—The trolley cable intermediate support rod and trolley cable turnbuckle.

Placing the Cutter/Reel Assembly on the Rails

Two people are needed to lift the cutter/reel assembly (figure 8) safely onto the rail system. Make sure that the cutter/reel assembly rolls freely along the entire length of the rails.



Figure 8—Two people are needed to place the cutter/reel assembly safely on the top pruner's rails.

Attaching the Master Control Panel

The master control panel (figure 9) is modular. It hangs over the crossbar on the jack stand assembly that does not have the permanently mounted kill switch. It can be placed in any position along the rail as long as the operator can reach the controls—especially the kill switch—during the top pruning operation. Although the electrical boxes and connectors are waterproof, make sure that the panel's plastic splash guard is down to keep water off electrical components.

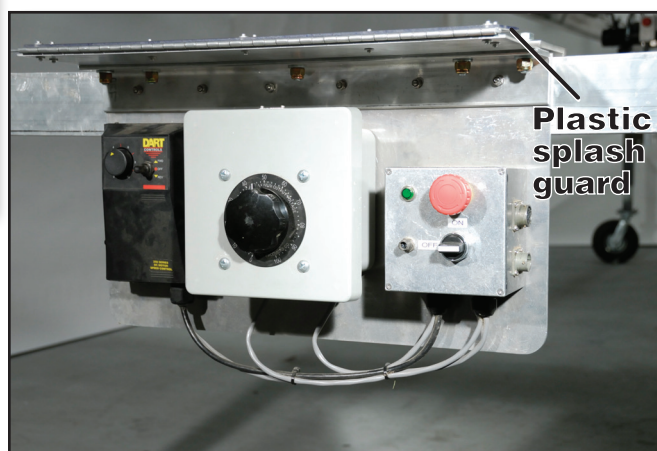


Figure 9—The master control panel hangs from the jack stand crossbar.

Installing the Trolley System and Electrical Wires

The trolley system suspends a five-strand electrical wire that runs from the cutter/reel assembly to the kill switch permanently mounted on the jack stand assembly. Another five-strand electrical wire runs from the master control panel alongside the rail with the trolley system to the same kill switch.

Attach the longer of the two five-strand electrical wires to the trolley cars while they are on the ground. Route the trolley cable (steel cable coated with plastic) through the trolley cars. Attach one end of the trolley cable to the vertical anchor (see figure 7a). Lift the cable with the trolley cars, attach it to the intermediate support rod and tighten the turnbuckle (figure 10a).

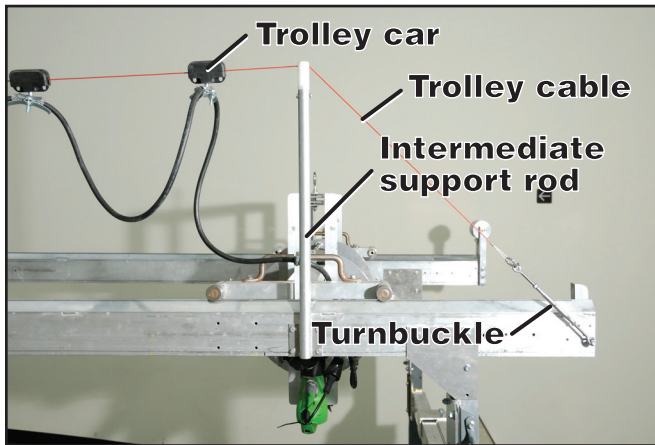


Figure 10a—The trolley cable with trolley cars and electrical cable.

The trolley cable does not have to be perfectly level. The electrical wire must not hang down so far that it could interfere with the cutter/reel assembly as it travels by. Attach the appropriate electrical connectors to the kill switch on the cutter/reel assembly and the kill switch permanently mounted on the jack stand assembly (figures 10b and 10c).

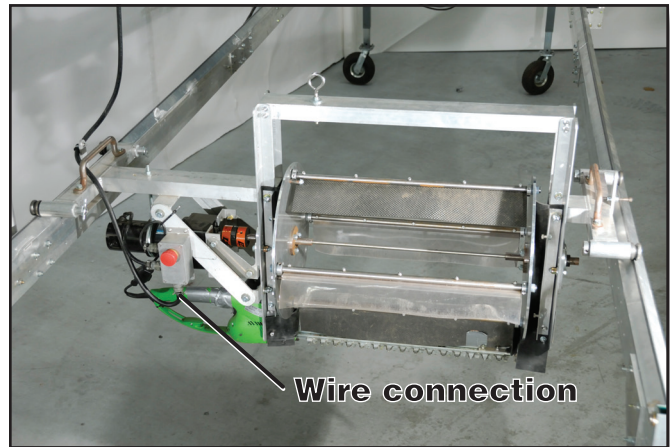


Figure 10b—The electrical connection at the cutter/reel assembly.

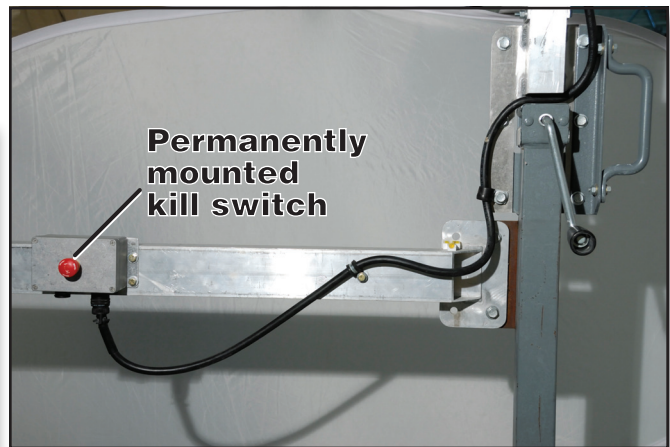


Figure 10c—Routing the electrical cable into the kill switch permanently mounted on the jack stand assembly.

Figures 10d to 10i show the shorter of the two five-strand electrical wires that is routed from the kill switch permanently mounted on the jack stand assembly to the master control panel along the side of the rail that supports the trolley system. Figure 10j is an overall view of the wiring.

IMPORTANT! When making the final connections to the kill switch, master control box, and cutter/reel assembly, take a close look at the connectors. These special fittings can only be connected one way. To prevent damaging the pins, carefully match the pins to their mating sockets in the connectors.



Figure 10d—Routing the electrical wires into the kill switch.



Figure 10e—The electrical cable and electrical wire are routed along the end of the rail.



Figure 10f—The electrical wire is routed along the side of the rail.



Figure 10g—The electrical wire is routed around the intermediate support rod.



Figure 10h—The electric wire is routed above the crank handle on the master control box end of the top pruner.

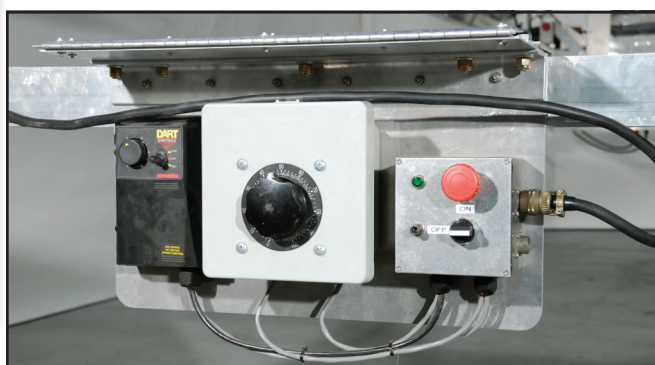


Figure 10i—The final routing of the electrical wire to the master control box.

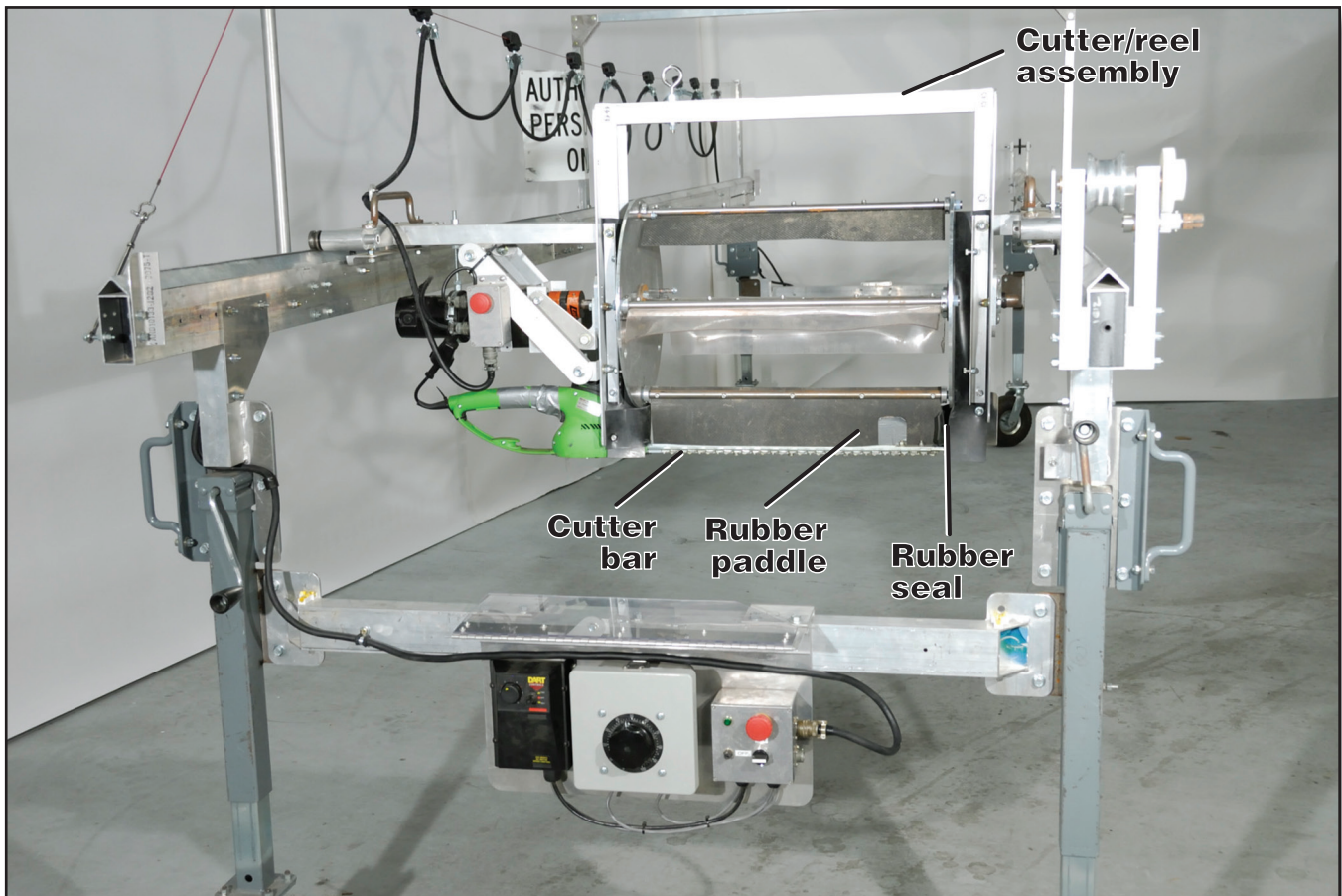


Figure 10j—An overall view of the top pruner's wiring without the voltage transformer.

Installing the Capstan Cable

Wrap the capstan cable around the capstan and the nylon idler pulley on the opposite end of the rail (figures 11a to 11c). Use 1½ turns of cable on the capstan. Secure the ends of the cable to the cutter/reel assembly as shown in figure 11c. Use the turnbuckle to take up slack in the cable. Do not overtighten the turnbuckle.

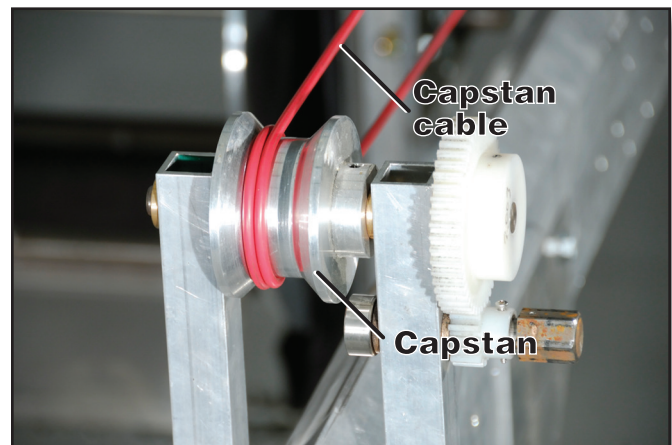


Figure 11a—Installing the capstan cable on the capstan.

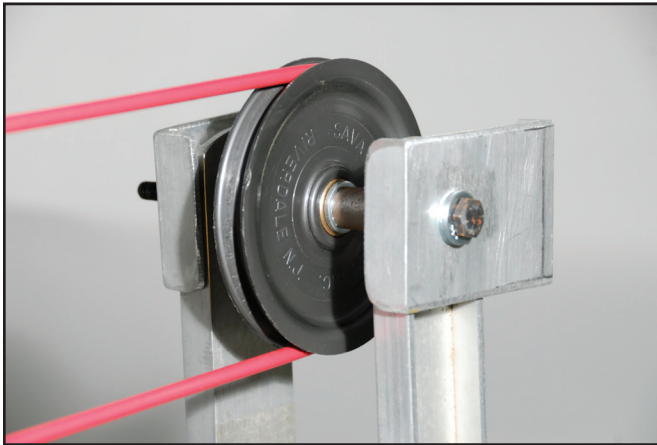


Figure 11b—Installing the capstan cable on the idler pulley.

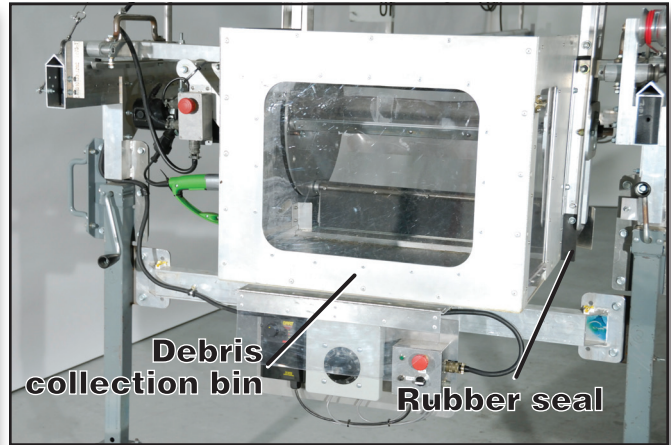


Figure 12a—Attaching the debris collection bin.

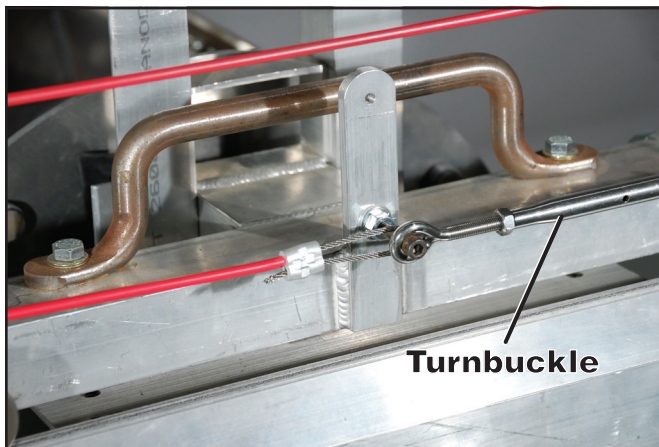


Figure 11c—The capstan cable connection at the cutter/reel assembly.

Attaching the Debris Collection Bin

Once the cutter/reel assembly is restrained by the capstan cable, attach the debris collection bin (figures 12a and 12b). Ensure that the bin is attached securely.



Figure 12b—The debris collection bin's quick attachment slots.

Connecting the Voltage Transformer Box

Connect the voltage transformer box (figures 13a and 13b) to the on/off switch on the master control panel. Plug the voltage transformer into a properly grounded 120-volt wall socket.

Ensure that the wall receptacle has a ground fault interrupter. The circuit breaker should be rated for at least 15 amperes.



Figure 13a—The voltage transformer.



Figure 13b—The waterproof plastic voltage transformer box.

The Fully Assembled Top Pruner

The Lucky Peak greenhouse top pruner is now fully assembled (figure 14).

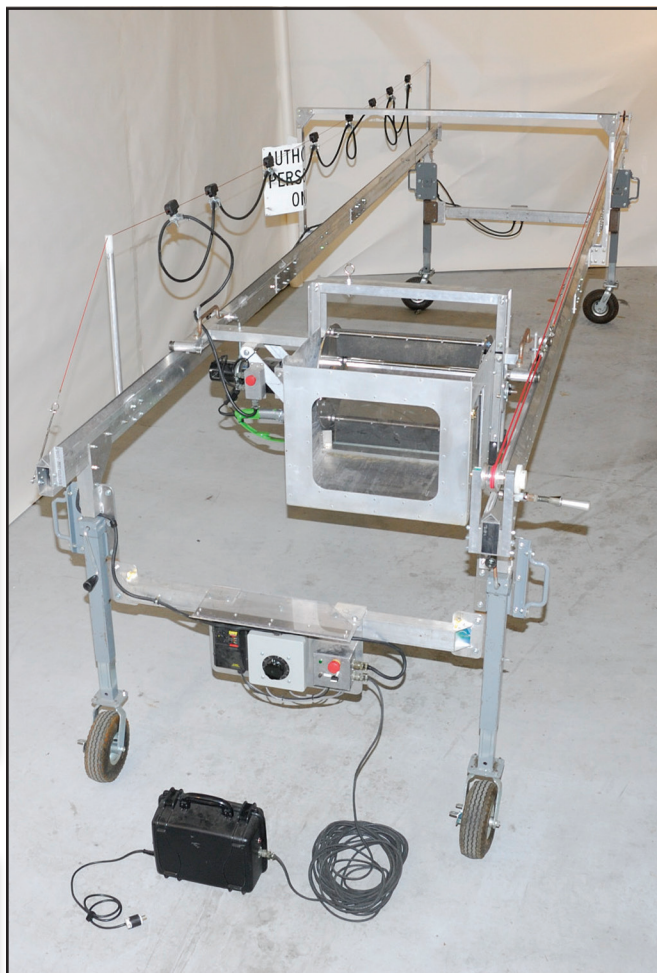


Figure 14—The fully assembled Lucky Peak greenhouse top pruner.

Operating Instructions

Precautions

- Ensure that the 120-volt electrical outlet the voltage transformer is plugged into is a properly grounded ground fault interrupter receptacle in a circuit with a circuit breaker rated for at least 15 amperes.
- Don't operate the top pruner when the floor is wet.
- Wear rubber insulated boots or athletic shoes with rubber soles when top pruning.
- Ensure that the greenhouse watering system does not come on during top pruning.
- Keep hands away from the cutter and moving parts during top pruning operations.

Adjusting the Height of the Top Pruner

Each corner of the top pruner has a trailer jack (figure 15). Move the top pruner's frame over the plants to be top pruned. Crank the jack handles until the cutting blade is positioned to cut the plants at the desired height. The distance from the top of the crossbar of the jack stand assembly to the

cutting edge of the hedge trimmer is 6 inches. Use the jack-mounted bubble levels when adjusting the jack stands' height. Use a tape measure to check the height of all jack stands. Seven full cranks raise the jacks 1 inch.

On/Off and Kill Switches

An on/off switch and power indicator light are on the voltage converter box. There is also an on/off switch on the master control panel. The top pruner has three kill switches—one permanently mounted on the master control panel, one on the cutter/reel assembly, and one on the jack stand crossbar on the opposite end of the rail system from the master control panel.

Controlling the Reel Speed

The left controller (manufactured by Dart) on the master control panel (figure 16) varies the speed of the reel and allows the reel to be reversed or stopped. The reel's rotation pulls the vegetation into the cutter blades. The optimum reel speed depends on the plant species being pruned. As a general rule, the reel works better at slower speeds. The reel can be configured to operate with two, three, or four rubber paddles.

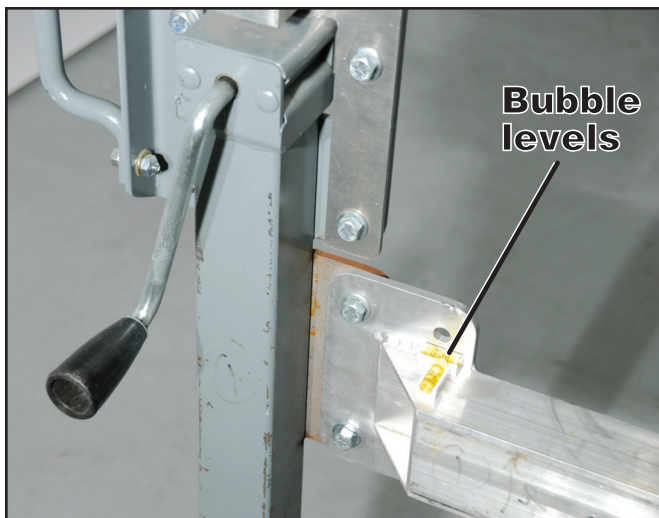


Figure 15—Leveling the top pruner.

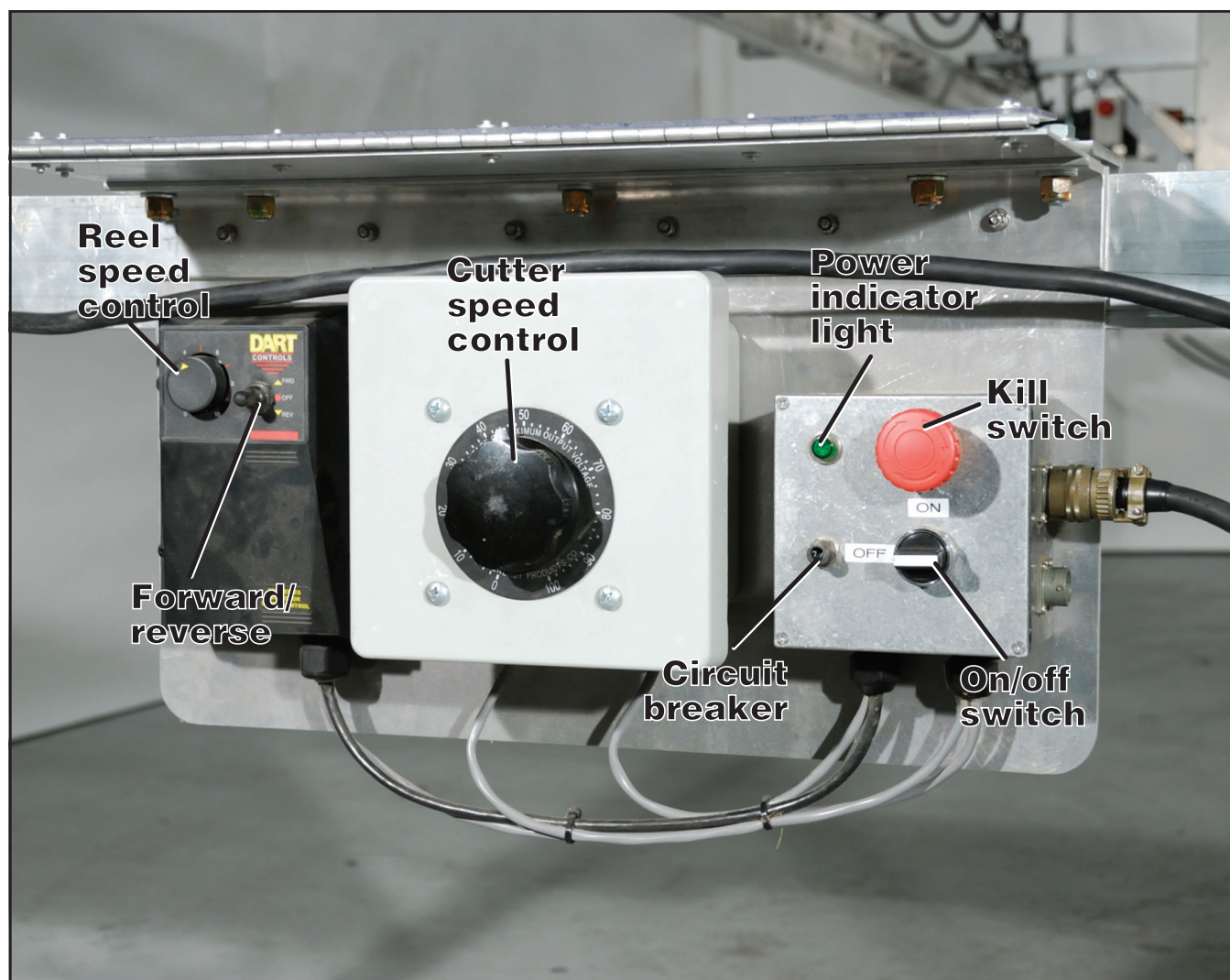


Figure 16—The master control panel.

Controlling the Cutter Speed

The center box on the master control panel contains a Variac (variable autotransformer) that controls the speed of the cutter's blades. The optimum speed depends on the plant species being pruned. As a general rule, the blades cut better when they are cutting faster.

Controlling the Cutter/Reel Assembly's Travel Speed

The travel speed of the cutter/reel assembly can be controlled by a handcrank (figure 17a) or by a variable-speed cordless drill. The handcrank allows a slow, precise cut. The drawback of this method is operator fatigue. A 9.6-volt, variable-speed cordless drill with a $\frac{3}{4}$ -inch socket (figure 17b) can also be used to move the cutter/reel assembly down the rail. The drawback of this method is that the operator may become tired of holding the drill trigger in the proper

position. Some operators prefer to cut the crop slowly by using the handcrank, relying on the drill to return the cutter/reel assembly quickly when the debris collection bin needs to be emptied.

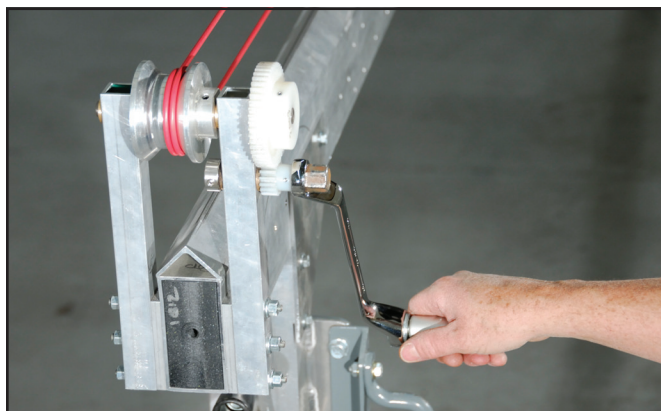


Figure 17a—Using the handcrank to move the cutter/reel assembly.

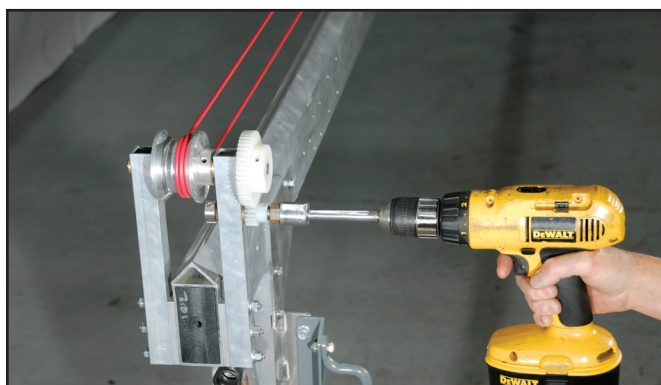


Figure 17b—Using a hand drill to move the cutter/reel assembly.

Emptying the Debris Collection Bin

When the debris collection bin (figures 18a and 18b) is full, move the cutter/reel assembly to the end of the rail where the master control box is mounted. Raise the door on the side of the bin and slide the retaining latch to keep the door up. Align a cardboard box or plastic trash can with the bin's opening. Use a short rake to drag debris from the bin into the container.

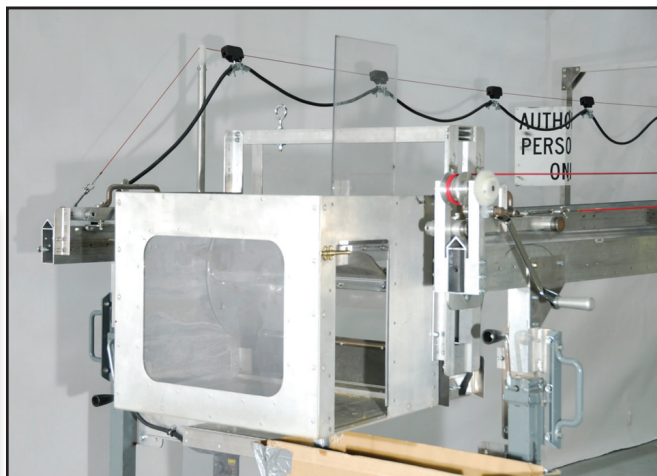


Figure 18a—The debris collection bin for the cut tops.



Figure 18b—Use a short rake to pull the cut tops from the collection bin into a cardboard box or trash can lined with a garbage bag.

Maintenance Instructions

Precautions

- Disconnect the electrical power to the top pruner before conducting routine maintenance or repairs.
- Always use two people to remove the cutter/reel assembly from the rail system.

Lubricating the Cutter

The industrial hedge trimmer requires a little light oil to keep the blades running smoothly. Use a solvent, such as kerosene, to remove pitch that builds up on the blades.

The shaft bearings are sealed. They need no lubrication.

Adjusting and Replacing the Reel's Paddles

The paddle reel accepts two, three, or four rows of paddles. The bolts (figure 19) holding the shaft hubs in the center of the circular disks must be removed and the reels spread apart to allow individual paddle mounts to be removed or another mount to be added. The paddles can be changed without removing the paddle mounting shafts.



Figure 19—Three bolts must be removed to change the reel paddles.

Adjusting the Capstan Cable Tension

Adjust the tension on the capstan cable by tightening or loosening the turnbuckle attached to the cutter/reel assembly. Do not continue tightening the cable once the slack has been taken out. Do not overtighten the cable.

Replacing the Voltage Transformer's Brushes

The only servicing required on the voltage transformer is periodic inspection of the brushes. Replace the brushes when they have less than 0.06 inch of service length remaining. To replace brushes, disconnect the electrical power, remove the old brush assembly, and insert the replacement. With the power off, insert a piece of fine garnet paper (nonmetallic 400 grit) between the brushes and brush track, rough side toward the brushes. Three or four swings of the brushes over the garnet paper will mate the brushes' contact face to the brush track. Remove the garnet paper and blow away loose garnet particles before applying power. (The replacement brush assemblies for the 1020B series for the top pruner are Part No. 808-0129-S available from Staco energy products.)

On newly installed brushes, when the voltage adjustment knob is at zero and the rotor is against its stop, the end of the brush should cover the first bar on the commutating surface. To adjust a brush, loosen the brush holder screw and press the holder to the side. Purchase replacement fuses from a local electronics distributor.

Parts List—Major Electrical Items

Part	Manufacturer	Model No.	Specifications
Hedge cutters	Freund Victoria	P55	230 V, 600 W, 2.8 A, 50 to 60 Hz
DC motor	Leeson Electric Corp.	CM34D25NZ78A	¼ hp, 180 V, 1.2 A
DC motor speed control	Dart Controls, Inc.	253G-200E-29	Fwd-Off-Rev, 1/8 to 2 hp
Variable autotransformer	Staco Energy Products Co.	1020B	0-240 V V _O , 3.5A I _O , 0.84 kVA, 240 V V _i , 50 to 60 Hz
Auto step-up transformer	Hammond Manufacturing Co., Inc.	176F	1,000 VA, 115 VAC V _i , 230 V V _O

Vendor Information

AgriNomix

(Freund Victoria hedge cutters)
300 Creekside Drive
Oberlin, OH 44074
<http://www.agrinomix.com>
800-354-3750

Allied Electronics, Inc.

(Hammond auto step-up transformer: Part No. 836-0181
and Staco variable autotransformer: Part No. 927-8606)
Fort Worth, TX 76118
<http://www.alliedelec.com>
866-433-5722

MSC Industrial Supply Co.

(Dart DC motor speed control: Part No. 35367580)
6700 Discovery Blvd.
Mableton, GA 30126
<http://www.mscdirect.com>
800-645-7270

Hammond Manufacturing Co., Inc.

(Hammond auto step-up transformer)
475 Cayuga Rd.
Cheektowaga, NY 14225
<http://www.hammondmfg.com>
716-630-7030

Staco Energy Products Co.

(Staco variable transformer)
301 Gaddis Blvd.
Dayton, OH 45403
<http://www.stacoenergy.com>
937-253-1191

LeesonDirect.com

(DC motor: Part No. M1135146)
<http://www.leesondirect.com>
562-907-7650

Engineering drawings for the “Lucky Peak Greenhouse Top Pruner” (MTDC-1085) will be available from MTDC.

About the Author

Keith Windell is a project leader for reforestation and nurseries, fire, residues, forest health protection, recreation, engineering, health and safety, range, and watershed, soil, and air projects. He has a bachelor's degree in mechanical engineering from Montana State University. Windell has worked for the California Department of Forestry; U.S. Department of the Interior, Bureau of Land Management; and the Forest Service.

Library Card

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This guide includes assembly, operating, and maintenance instructions for the Lucky Peak greenhouse top pruner developed by the Missoula Technology and Development Center. It also includes a electrical parts list and supplier information. Nurseries use top pruners to cut tree and shrub seedlings to a uniform height before they are taken from the greenhouse or nursery beds for planting. For more information on the Lucky Peak greenhouse top pruner, see “Top Pruner Developed for Lucky Peak Nursery” (1024–2322–MTDC).

Keywords: equipment development, manuals, nurseries

For additional information about the Lucky Peak Greenhouse top pruner, contact Keith Windell at MTDC:

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