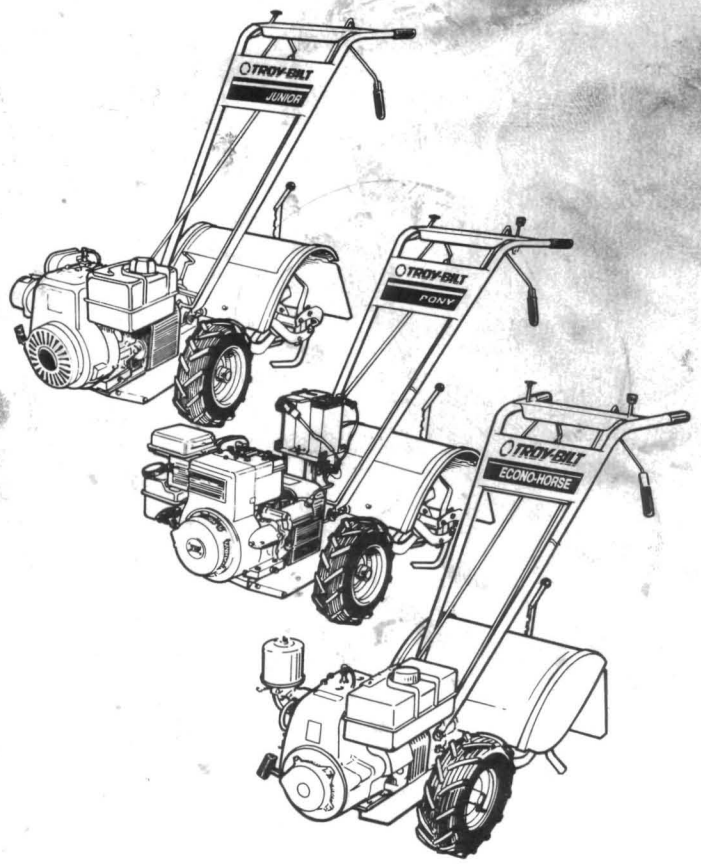
$12.50

TROY-BILT

# Technical Manual

- **JUNIOR®**
- **PONY®**
- **ECONO-HORSE™**




GARDEN WAY INC.

# TABLE OF CONTENTS

• This manual provides transmission service information for the following TROY-BILT® Roto Tiller-Power Composters built by TROY-BILT Manufacturing Company, Troy, New York:

JUNIOR® Model -- Serial Number M67999 and Up.

PONY® Model -- Serial Number S186072 and Up.

Econo-Horse ™ Model -- Serial Number E1001 and Up.

• This manual was written for and intended to be used by professional service technicians who have been trained in the proper servicing of outdoor power equipment.

• All information, illustrations, and specifications contained in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice. If you have any questions concerning the information in this manual please contact:

Technical Service Department
TROY-BILT Manufacturing Company
102nd St. & 9th Avenue
Troy, New York 12180
Call Toll-Free: 1-800-833-6990

⚠ This symbol is used to alert you to important safety messages in this manual and on decals affixed to the tiller. When you see this symbol, carefully read and follow its safety message. Failure to do so could result in personal injury or property damage.

• This manual is divided into four sections as shown in the Table of Contents. For best results, read each section in its entirety before attempting any repair work.

• This manual is designed to be used in combination with the tiller's Owner/Operator Manual. *The Owner/Operator Manual contains additional service and maintenance information that is not covered in this manual.* Refer to "Quick Reference Repair Index" in this section for a listing of the service and maintenance topics that are covered in the Owner/Operator Manual.

• Service and maintenance information regarding engines is not covered in this manual. Such information can be obtained by consulting the Service Repair Manual available from the engine manufacturer. You should, however, call our Technical Service Department with questions concerning engine replacement or interchangeability.

• Throughout this manual, you will see references to the left and right sides of the tiller. This refers to the left and right sides of the tiller as you would see them when standing in the operator's position.

## *Safety First!*

When working on the tiller or its engine, closely follow operating instructions and recommended safety practices at all times. Failure to do so could result in personal injury or property damage. Here are some basic safety precautions you should keep in mind at all times when doing repair work:

**KNOW THE TILLER AND ENGINE!** Read the Owner/Operator Manual carefully. Be sure you know what each tiller and engine control does before you attempt to operate it. Read and follow all safety rules. Never allow inexperienced persons or children to operate the tiller or its engine.

**WEAR PROPER APPAREL!** Do not wear loose clothing or jewelry that could get caught in moving parts of the tiller or its engine.

**AVOID MOVING PARTS!** Keep hands, feet, hair, clothing, and tools safely away from moving parts when the engine is running.

**AVOID ACCIDENTAL STARTING!** When servicing the machine, prevent unintentional starting of the engine by disconnecting the spark plug wire and keeping the wire away from the spark plug. Place the engine throttle control in the OFF position and disengage the Maneuvering Clutch and the Forward Clutch.

**WEAR EYE PROTECTION!** Safety goggles or a face shield should be worn whenever there is the possibility of danger to the eyes from flying parts or particles.

**PREVENT FIRES AND EXPLOSIONS!** Gasoline is highly flammable and explosive and should be used and stored with extreme caution. Keep gasoline away from open flame, sparks, and do not smoke in the vicinity of gasoline cans or fuel tanks. Do not add gasoline to a fuel tank when the engine is running or still hot. Fill the fuel tank outdoors, in a well-ventilated area. Store gasoline in a cool, well-ventilated place, safely away from any spark or flame producing equipment. Store only in a U.L. approved container and safely out of reach of children. Wipe off any spilled gasoline and move the engine away from gasoline fumes before starting engine.

Use flammable cleaning solvents only according to recognized safety practices (never use gasoline as a cleaning solvent). Oily rags and waste should be packed in a U.L. approved, covered metal safety container to prevent fire from spontaneous combustion.

# SECTION 1: General Information

**HANDLE BATTERIES WITH CARE!** Batteries contain sulfuric acid that can cause blindness, burn skin, and eat through clothing. Wear safety goggles when working near the battery or when handling battery acid. Removal all rings and metal jewelry when working on the battery or electrical system.

Batteries also produce explosive gases. Keep sparks, flames, and cigarettes away. Ventilate when charging or using in an enclosed space.

Do not cause a short circuit by touching both battery terminals at the same time with tools or other metallic objects. Also, do not allow a tool or other metallic object to touch a terminal that is not grounded and an adjacent metallic part that is grounded. A spark from a short circuit could cause an explosion of battery gases or gasoline.

**AVOID ENGINE EXHAUST FUMES!** Do not run the engine in an enclosed area. Exhaust gases contain carbon monoxide, an odorless and deadly poison. Provide adequate ventilation at all times. After running the engine, don't touch the muffler or other hot engine parts until they have cooled down.

**HANDLE PARTS CAREFULLY!** With continued use, the teeth on gears and worms may wear to sharp, knife-like edges. Therefore, when handling these parts, use care to avoid cutting yourself.

**REPLACEMENT PARTS!** Use only genuine Troy-Bilt replacement parts. Replacement parts manufactured by others could present safety hazards even though they may fit on this tiller.

## *Quick Reference Repair Index*

To obtain service information for the following topics, please refer to either this Technical Manual or the tiller's Owner/Operator Manual, as indicated in the table below.

| | TECHNICAL MANUAL | OWNER/OPERATOR MANUAL |
|---|---|---|
| Air Cleaner | | X |
| Battery | | X |
| Bearing Cap, Tiller Housing | X | |
| Bearings, Drive Shaft | X | |
| Bearings, Tiller Tine Shaft | X | |
| Bearings, Wheel Shaft | X | |
| Belts | | X |
| Bolo Tines | | X |
| Bronze Bushings | X | |
| Carburetor | | X |
| Clutch | X | |
| Cover, Transmission | X | |
| Depth Regulator | | X |
| Drive Shaft | X | |
| Eccentric Lever | X | |
| Electric Start System | | X |
| Engine | | X |
| Fuel | | X |
| Handlebar Height Adjustment | | X |
| Ignition System | | X |
| Input Pinion Shaft Assembly | X | |
| Lubrication Points | | X |
| Oil (Engine and Transmission) | | X |
| Gear Oil Level CheckPlug | X | |
| Gear Oil Drain Plug | X | |
| Throttle Cable | | X |
| Tiller Housing Cover | X | |
| Tiller Tine Shaft | X | |
| Tires/Wheels | | X |
| Transmission Gear Oil | | X |
| Wheel Shaft | X | |
| Worm, Tiller Drive Shaft | X | |
| Worm Gear, Wheel Shaft | X | |
| Worm Gear, Tiller Shaft | X | |

The following charts list the most common problems experienced with the tiller drive train. Symptoms of problems are listed along with possible remedies. If following the repair procedures does not correct the problem, call the TROY-BILT Tiller Technical Service Department at TOLL-FREE: 1-800-833-6990.

**WARNING:** When servicing the machine, prevent unintentional starting of the engine by disconnecting the spark plug wire and keeping the wire away from the spark plug. Place the engine throttle control in the OFF position and disengage the Maneuvering Clutch and the Forward Clutch.

## Forward and Reverse Shifting Problems

| Symptom | Remedy |
|---|---|
| **Forward Clutch or maneuvering Clutch shifting levers do not engage or disengage.** | The pivot bolt on the Forward/Reverse Idler Assembly may be:<br>• over-tightened<br>• rusted<br>• broken<br>• misaligned |

## Wheels and/or Tines Do Not Turn

| Symptom | Remedy |
|---|---|
| **Wheels turn but the tines do not.** | • The rear bearing on the drive shaft may have failed.<br>• One or both of the bearings on the tiller tine shaft may have failed.<br>• The bronze worm gear on the tiller tine shaft may be damaged. |
| **Wheels do not turn but the tines do.** | For the Econo-Horse and Pony models:<br>• The clutch cable may be frozen, broken, kinked or out of adjustment.<br>• The bolt at the end of the eccentric shaft lever may be loose.<br>• The eccentric lever may be broken.<br>• The dogs on the wheel shaft clutch may be broken or severely worn.<br>• The teeth on the wheel shaft worm gear may be broken or severely worn.<br><br>For the Econo-Horse, Pony and Junior models:<br>• The teeth on the wheel shaft worm gear may be broken or severely worn.<br>• The drive shaft worm gear may be severely worn.<br>• On the Junior model only, the wheel drive pin may not be engaged through the wheel hubs. |
| **Wheels and tines do not turn.** | • Check the tension on the drive belts (see Owner/Operator Manual).<br>• Make sure the bolt that holds the transmission drive pulley is tightened, the washer is present, and the transmission pulley key is installed. |

## Wheels and/or Tines Do Not Turn (continued)

| Symptom | Remedy |
|---|---|
| **Wheels and tines turn on top of the ground but hesitate or stop when in soil.** | • Check the tension on the drive belts (see Owner/Operator Manual).<br>• Make sure the input pinion assembly is in good condition and that all the parts are present.<br>• Check the condition of the bronze worm gear on the tiller tine shaft and the worm gear on the wheel shaft; one or both may be damaged. |

## Wheel Shaft Moves To One Side

| Symptom | Remedy |
|---|---|
| **The wheel shaft moves to one side.** | • One or both snap rings are out of the groove(s).<br>• Check for excessive play in wheel shaft. End play should be .000" to .005". |

## Noise from Rear Tiller Bearing

| Symptom | Remedy |
|---|---|
| **A growling or whining noise from the tiller housing rear bearing.** | • Inspect the drive shaft bearing and bearing race for wear or damage.<br>• Inspect the tine shaft bearings for wear or damage.<br>• Inspect the tiller shaft bronze worm gear for wear or damage. |

## Oil Leaks

| Symptom | Remedy |
|---|---|
| **Oil is leaking from the wheel shaft oil seals.** | • An oil seal is worn or damaged. Check for side-to-side and vertical play in the wheel shaft and replace seal.<br>• Give new seals time to lap in.<br>• Inspect the wheel shaft for minor damage at the oil seal location:<br>a. Inspect for corrosion, pitting, or scoring.<br>b. Use emery cloth to remove any minor defects.<br>c. Attempt to seat the seal so that it is on an undamaged part of the shaft.<br>d. Replace the wheel shaft if necessary.<br>• Be sure the transmission is filled with SAE 90 or 140 gear oil. A lighter viscosity oil will cause leakage.<br>• Make sure that a non-hardening gasket sealer was applied to the outside diameter of the oil seal prior to its installation.<br>• Make sure the housing bore has no nicks or scratches that would permit oil to seep out between the seal and the housing. |

## Oil Leaks (continued)

| Symptom | Remedy |
|---|---|
| **Oil leaks from the rear of the tiller housing.** | If the leak is from the oil seals on the tiller tine shaft:<br>• Make sure the seals have non-hardening gasket sealer around the outside edges.<br>• An oil seal is worn or damaged; replace the seal.<br>• Inspect the tiller tine shaft for minor damage at the oil seal location:<br>a. Inspect for corrosion, pitting, or scoring.<br>b. Use emery cloth to remove any minor defects.<br>c. Replace the tiller tine shaft if necessary.<br>• Check for sand holes (imperfections in the cast iron) or cracks in the housing.<br><br>If the leak is on the left side of the tiller housing:<br>• Apply non-hardening gasket sealer to each of the tiller housing cover screws and tighten the screws.<br>• Replace any worn or damaged gaskets.<br>• Make sure the housing cover bore and the housing bore have no nicks or scratches that would permit oil to seep out.<br>• Check for excessive play in the tiller tine shaft.<br><br>If the leak is from the rear bearing cap:<br>• Inspect the rear bearing cap:<br>a. Make sure the screws are the correct length.<br>b. Apply non-hardening gasket sealer to each of the rear bearing cap screws and tighten the screws.<br>• Replace a worn or damaged gasket. |
| **Oil is leaking from the oil seal on the input pinion shaft.** | • Make sure the leak is at the front oil seal. You could be seeing a leak from the air cleaner, transmission housing cover, or an engine oil seal.<br>• Check the transmission gear oil level when the unit is cold. If it is overfilled, drain it to the proper level.<br>• Replace a worm or damaged oil seal. |
| **Oil is leaking from the transmission housing cover.** | • Make sure the housing cover bolts are tight.<br>• See if the oil level is too high; if so, drain the oil to the proper level.<br>• Check to see if the threads on the plastic oil fill plug are stripped.<br>• Replace a worn or damaged gasket. |
| **Oil is leaking from the eccentric shaft (Econo-Horse and Pony models only).** | • Replace the oil seal.<br>• Inspect shaft for corrosion, pitting, or scoring. |
| **Oil is leaking from any pipe plug in the transmission housing.** | • Check to see if the plug is cross-threaded.<br>• Remove the pipe plug and apply a layer of non-hardening gasket sealer. Then reinstall the plug. |
| **Oil is leaking from the front bearing cap (older model tillers) or the transmission bore seal (newer model tillers).** | • On units equipped with a front bearing cap:<br>a. Apply a coating of non-hardening gasket sealer to each of the front bearing cap screws and tighten the screws.<br>b. Replace a worn or damaged gasket.<br>c. If oil seeps through the cap, replace the cap.<br>• On units equipped with a transmission bore seal, replace the seal. |

# SECTION 3: Pre-Service Inspection

Before you begin your repair or maintenance procedure, take a moment to perform a pre-service inspection of the following transmission parts. In doing so, you may discover additional problems that can be corrected while the tiller is in your shop.

**WARNING:** When servicing the machine, prevent unintentional starting of the engine by disconnecting the spark plug wire and keeping the wire away from the spark plug. Place the engine throttle control in the OFF position and disengage the Maneuvering Clutch and the Forward Clutch.

### Input Pinion Gear/Transmission Drive Pulley

• Check if oil is leaking from the input pinion shaft oil seal. If you see oil, make sure it is not originating from the transmission bore seal (or bearing cap on older model tillers), which is located just above the input pinion shaft oil seal. If the oil is leaking from the input pinion shaft oil seal, replace the seal.

### Wheel Shaft

• Grasp the tiller's handlebars and tilt the tiller forward so its weight is resting entirely on the wheels. Then move the handlebars from side-to-side. See Figure 3-1.

If the transmission body moves from side-to-side on the wheel shaft, it indicates that the wheel shaft needs either to be shimmed or that one or both of the snap rings has become dislodged from the snap ring groove(s).

• If oil is leaking from around one or both of the wheel shaft oil seals, replace the oil seal(s) and determine why the oil seal(s) failed.

### Tiller Shaft

Tip the tiller so that you have a full view of the tiller housing area (see Figure 3-2).

• Inspect the area around the rear bearing cap for oil leaks. If you see an oil leak, inspect the following:

a. The rear bearing cap gasket may have failed.
b. Make sure the rear bearing cap screws are the correct length and are securely tightened.
c. The washers on the rear bearing cap screws may be old or the screws may not have been coated with non-hardening gasket sealant.

• Inspect the left side of the tiller tine shaft for oil leaks. If you see an oil leak, inspect the following:

a. The tiller housing cover may not be sufficiently tightened, check all five screws.
b. The washers on the screws that hold the housing cover may be worn or the screws may not have been coated with non-hardening gasket sealer.
c. The tiller housing cover gasket(s) may have failed.
d. The oil seal in the housing cover may have failed; find out why.
e. Inspect the right side of the tiller tine shaft for oil leaks. If you see an oil leak, the oil seal needs to be replaced. Then, discover why the seal failed.

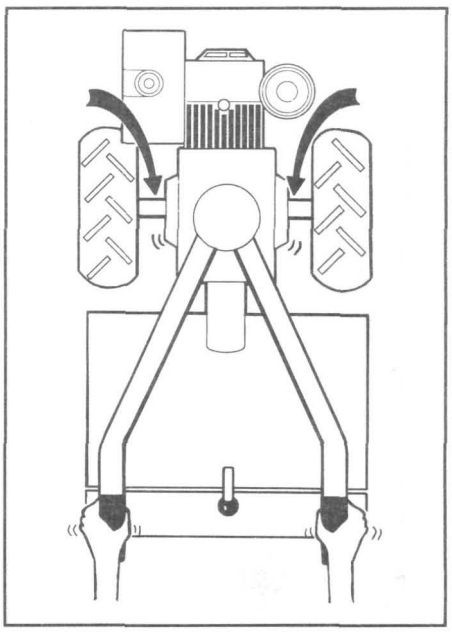


***Figure 3-1: Testing for play in wheel shaft.***

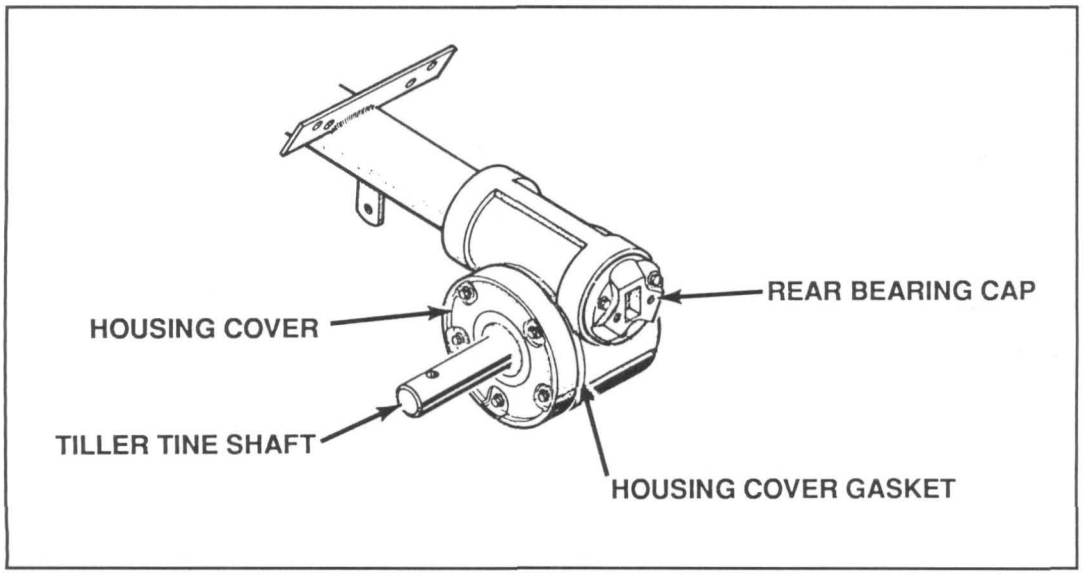



**Figure 3-2: Pre-service inspection of the tiller tine shaft area.**

• Check the tiller tine shaft for play:

Using two hands, grasp the tiller tine shaft and rotate the shaft back and forth. You should be able to rotate the shaft slightly.

If you cannot rotate the shaft at all, it means that the side cover needs to be shimmed outward using various thicknesses of gaskets. This procedure is explained in Section 4 of this manual (see "Tiller Tine Shaft Assembly").

Being able to rotate the shaft more than a small amount means the tiller tine shaft is either shimmed incorrectly (too many gaskets) or that the bronze worm gear has worn.

• There should be no end play, vertical play or diagonal play in the tiller tine shaft. If you find such play, tighten the tiller housing cover bolts. If this does not eliminate the play, insert a shim between the gear and bearing (use an arbor press to remove the bearing) on the tiller tine shaft. The shim should be of the type used to shim the wheel shaft.

**Eccentric Shaft (Econo-Horse and Pony Models Only)**

See if oil is leaking around the eccentric shaft oil seal. If so, replace the oil seal and determine why the oil seal failed.

**Transmission Bore Seal (or Front Bearing Cap on Older Model Tillers)**

• On newer model tillers, see if oil is leaking from the transmission bore seal at the front of the transmission. If so, replace the seal and determine why the oil seal failed.

• On older model tillers, inspect the following:

a. The front bearing cap gasket may have failed.
b. Make sure the bearing cap screws are the correct length and are sufficiently tightened. Also, make sure the screws have been coated with non-hardening gasket sealer.

**Shaft Tube**

If the weld that holds the tube between the tiller housing and the transmission housing becomes loose, it must be rewound and welded at the Factory.

**Throttle Cable**

The throttle cable should move freely and should effectively control the engine speed. If it does not, the cable may be rusted in its sleeve (use penetrating oil to free the cable) or there may be some problem with the engine.

**Wheel Gear Control Lever (Econo-Horse and Pony Models Only)**

The wheel gear control lever cable should move freely, as well as effectively engage and disengage the clutch and gear. If it does not, check the cable for damage or rust (use penetrating oil if rusted), or there may be some problem with the eccentric shaft assembly.

# SECTION 4: Servicing the Transmission

This section provides instructions on how to service various subassemblies on the Junior, Pony and Econo-Horse transmissions.

**WARNING:** When servicing the machine, prevent unintentional starting of the engine by disconnecting the spark plug wire and keeping the wire away from the spark plug. Place the engine throttle control in the OFF position and disengage the Maneuvering Clutch and the Forward Clutch.

## *Transmission Housing Cover*

These instructions describe how to service the housing cover for the tiller transmission. Use Figure 4-1 as a reference for part locations in these instructions.

### Removal

1. Remove the six bolts (1) and lockwashers (if present) that hold the housing cover (2) to the transmission housing.
2. Remove the housing cover (2).
3. Remove and discard the housing cover gasket (3).

### Inspection

Inspect the housing cover for cracks and check that the plastic oil fill plug (4) is in good condition.

### Installation

1. Install a new gasket (3) on the transmission housing.
2. Place the housing cover (2) on the transmission housing.
3. Secure the housing cover with the six bolts (1) and lockwashers (if any).

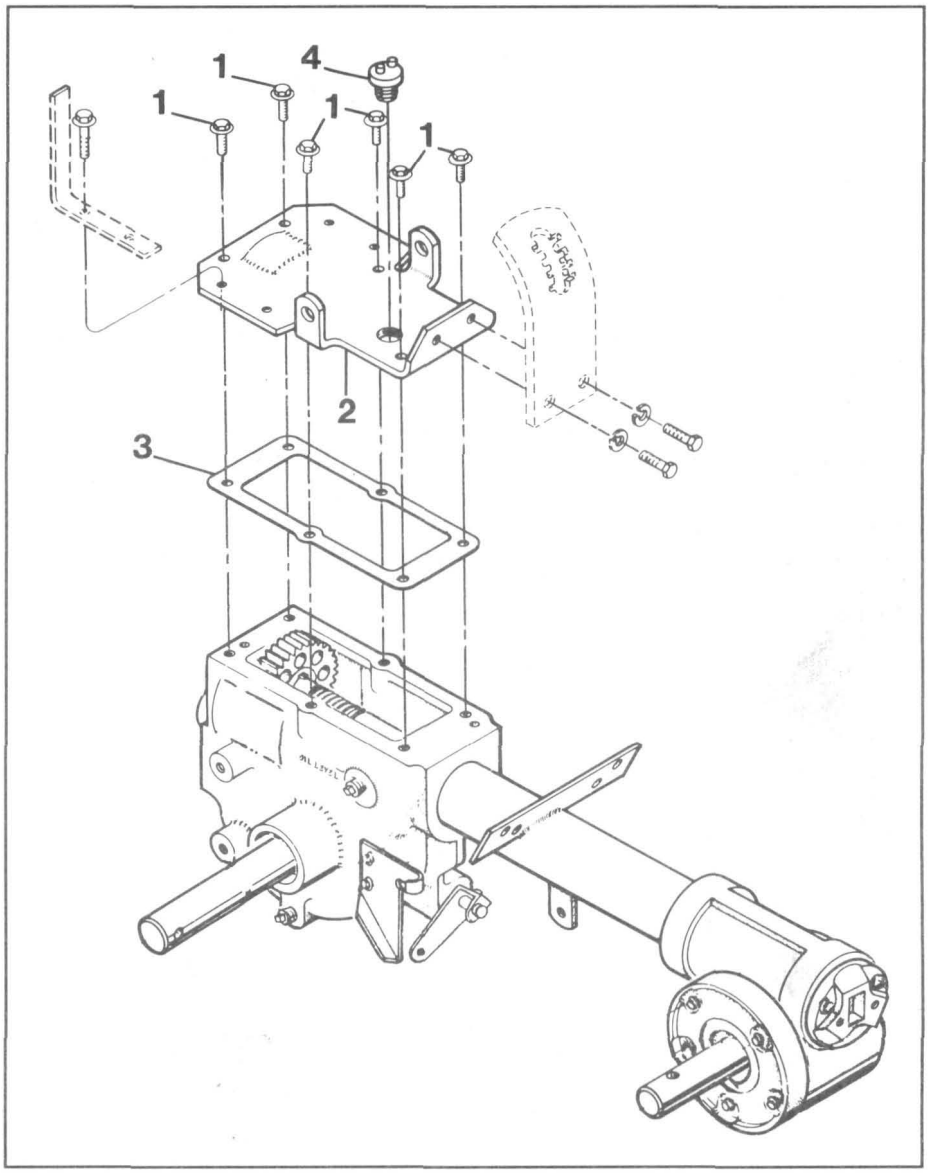



**Figure 4-1: Servicing the housing cover (Econo-Horse and Pony transmission housing shown).**

# Drive Shaft Assembly

These instructions describe how to service the drive shaft assembly for the tiller transmission. Use Figures 4-2 and 4-3 as references for part locations in these instructions.

Before you can perform these instructions you must first remove the transmission housing cover. See the "Transmission Housing Cover" removal instructions in this section.

NOTE 1: Tillers that fall within the following serial number ranges are equipped with a front bearing cap and gasket as shown In Figure 4-2, Items 3 and 4. Newer model tillers (those with serial numbers higher than listed below) have a transmission bore seal (Figure 4-2, Item 1) that requires a special snap ring (Figure 4-3, Item 16).

Junior Model: S/N M67999 - M0100969
Pony Model: S/N S186072 - S0242649
Econo-Horse: S/N E1001 - E0032773

NOTE 2: Two basic types of drive shafts may have been installed at the factory: an integral worm design (the worm gears are machined directly from the shaft material), and a welded worm design (the worm gears are welded to the shaft and can be identified by blue weld beads at either end of the worms). Each design has its own part number and requires specific related parts. Before installing a new drive shaft or related drive shaft parts, first determine which type of shaft you are working with. See the tiller parts catalog for parts ordering information.

## Removal

1. Drain the transmission gear oil by removing the oil drain plug located below the wheel shaft on the left side of the transmission. After the oil is drained, apply a coating of non-hardening gasket sealer on the threads and reinstall the plug.

2. On newer model tillers, pry the transmission bore seal (1) out and discard it. On older model tillers, remove the three bolts (2) from the front bearing cap (3) and remove the bearing cap and bearing cap gasket (4). Discard the gasket.

3. Remove the three bolts (5) that secure the rear bearing cap (6). Also remove the three nylon washers (7), *if present. The nylon washers are* not reusable.

4. Remove the rear bearing cap (6) and the rear bearing cap gasket (8). Discard the gasket.

5. Slide the drive shaft (9) toward the rear of the transmission just enough to force the shim(s) (10) and the rear bearing cup (11) out.

NOTE: Keep each bearing cup paired with its bearing if you intend to reuse them. Each bearing cup wears differently according to its bearing.

6. Slide the drive shaft a few inches more toward the rear of the transmission. Then reach through the top cover opening and remove the front bearing (12), front bearing cup (13), main drive shaft spur gear (14), and the drive shaft key (15).

NOTE: Keep the bearing and bearing cup together if you intend to reuse them.

7. Slide the drive shaft out through the rear of the transmission housing; it will pass over the tiller tine shaft gear cluster.

8. On newer model tillers, remove the snap ring (16) located inside the housing bore. This snap ring retains the front bearing.

9. The rear bearing is pressed-on and can be removed (if necessary) with an arbor press and a bearing puller attachment.

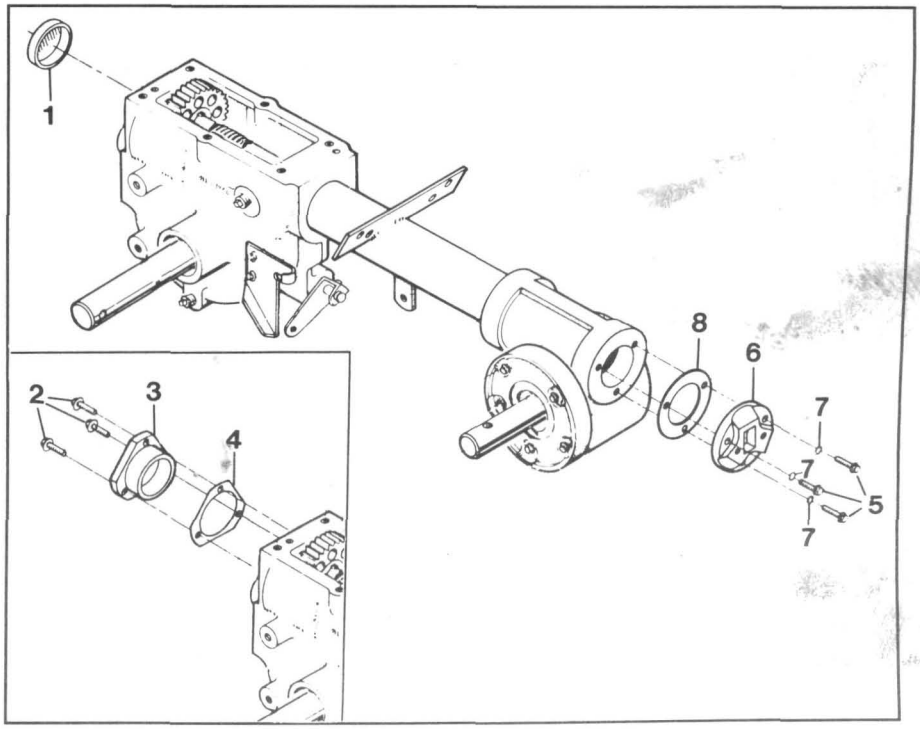



**Figure 4-2: Remove these parts prior to removing the drive shaft assembly (Econo-Horse and Pony transmission housing shown).**

# SECTION 4: Servicing the Transmission

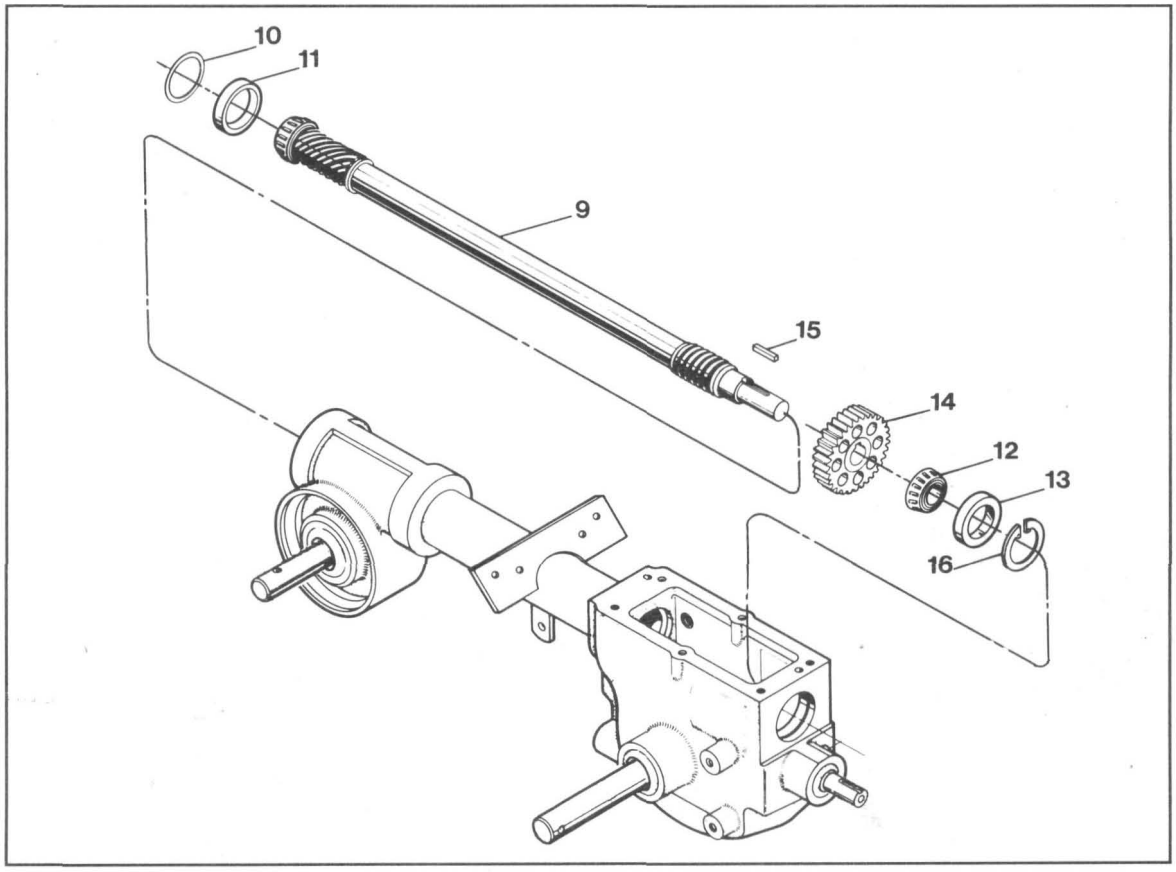



**Figure 4-3: The drive shaft assembly.**

## Inspection

These instructions describe how to inspect vital parts on the drive shaft assembly. In addition to inspecting the parts you have removed, you should also inspect any replacement parts you will use.

NOTE: Thoroughly degrease and clean all parts before inspection.

**Drive Shaft Worms** –The forward and rear worms on the drive shaft should not be excessively worn. Since only the middle segment of a worm is in contact with the cast iron worm gear on the wheel shaft or the bronze worm gear on the tiller tine shaft, you can compare the outside threads of the worm with the middle threads. If the width of the threads in the middle is half or less than the width of the threads at the ends of the worm, discard the drive shaft. See Figure 4-4.

Also, inspect the worms for heat damage. If a worm has a bluish color then proper lubrication has not been maintained and the drive shaft should be discarded.

**Bearings** – If the bearing has a bluish color then proper lubrication has not been maintained; discard the bearing and bearing cup.

Also, if the bearing is scored or excessively worn, dirt may have contaminated the housing; discard the bearing and bearing cup.

Inspect for chipped or broken roller bearings, and inspect the bearing cage for damage.

NOTE: Bearings and bearing cups must be replaced in pairs. Do not mix old and new bearings and bearing cups.

**Keyway** –The keyway should be just wide enough to fit the key. If the keyway has expanded, discard the drive shaft.

**Spur Gear** – If the gear teeth are broken or excessively worn, discard the spur gear.

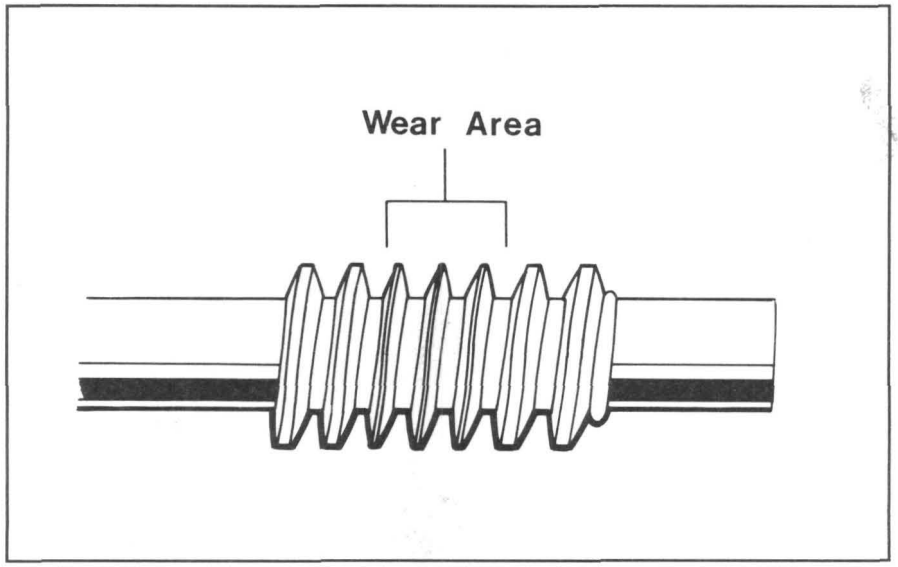



**Figure 4-4: Inspecting the drive shaft worm. If worm is worn more than 50% in wear area shown above, discard the drive shaft.**

## Installation

Use Figures 4-2 and 4-3 as references for part locations in these instructions.

1. Insert the drive shaft (9) in from the rear of the transmission.

2. Install the key (15) in the drive shaft keyway.

3. Place the spur gear (14) on the drive shaft. Make sure the hub of the gear is facing rearward.

4. Lubricate the front bearing (12) *with #30 weight oil and install* the bearing into the transmission housing from the outside of the housing.

5. On newer model tillers, install the front bearing cup (13) into the transmission housing until it clears the snap ring groove. On older model tillers, install the front bearing cup (13) flush with the outside edge of the transmission housing.

6. On newer model tillers, install the snap ring (16).

7. On newer model tillers, apply a layer of non-hardening gasket sealer around the outside edge of the transmission bore seal (1) and install the seal.

8. On older model tillers, install a new gasket (4) on the front bearing cap (3) and seat the cap flush with the transmission housing. Apply a coating of non-hardening gasket sealer to the three bearing cap bolts (2) and securely replace the bolts.

9. Slide the drive shaft all the way forward.

10. Install the rear bearing cup (11) using the rear bearing cap (6) as a driver (a gasket should not be installed on the rear bearing cap at this time). Seat the bearing cap flush with the transmission housing.

11. Hold the rear bearing cap tightly in place with one hand and check the play in the drive shaft. There should be between .005" and .010" end play. Remove the rear bearing cap and shim (10) as necessary.

12. Place a new gasket (8) on the rear bearing cap.

13. Install the rear bearing cap and secure it with the three bolts (5) and nylon washers (if the washers are not available, apply a coating of non-hardening gasket sealer to the tip of the bolts).

14. Check again for correct end play and add or subtract shims as needed.

# *Input Pinion Shaft and Gear Assembly*

These instructions describe how to service the input pinion shaft and gear assembly. Use Figure 4-4 as a reference for part locations in these instructions.

Before you can perform these instructions you must first remove the drive shaft assembly. See the *drive shaft assembly removal instructions* in this section.

NOTE: Junior and Pony model tillers that fall within the following serial number ranges are equipped with a double groove pulley as shown in Figure 4-4, Item 3. Newer model Junior and Pony model tillers (those with serial numbers higher than listed below) have a single groove pulley (Figure 4-4, Item 4) that requires a special washer and key (Figure 4-4, Items 6 and 7):

Junior Model: S/N M67999 - M0100969
Pony Model: S/N S186072 - S0242649

## Removal

1 . Remove the bolt (1) and disc spring washer (2) that holds the *transmission pulley to the input pinion shaft.*

2. For newer model Junior and Pony tillers remove the large washer (6).

3. Remove the transmission pulley (3, 4 or 5).

4. Remove the key (7 or 8) from the keyway on the input pinion shaft.

5. Remove the support washers (9).

6. Remove the oil seal (10), taking care not to damage the input pinion shaft or the inside diameter of the housing bore.

7. Remove the drive shaft if you have not already done so.

8. Remove the set screw (17) from the left side of the transmission housing.

9. Slide the input pinion gear and shaft assembly (11-16) out through the front of the transmission housing.

10. Remove the front snap ring (11).

12. Remove the two washers (12) and the bushing (13).

13. Remove the rear snap ring (15).

14. Finally, remove the input pinion gear (16).

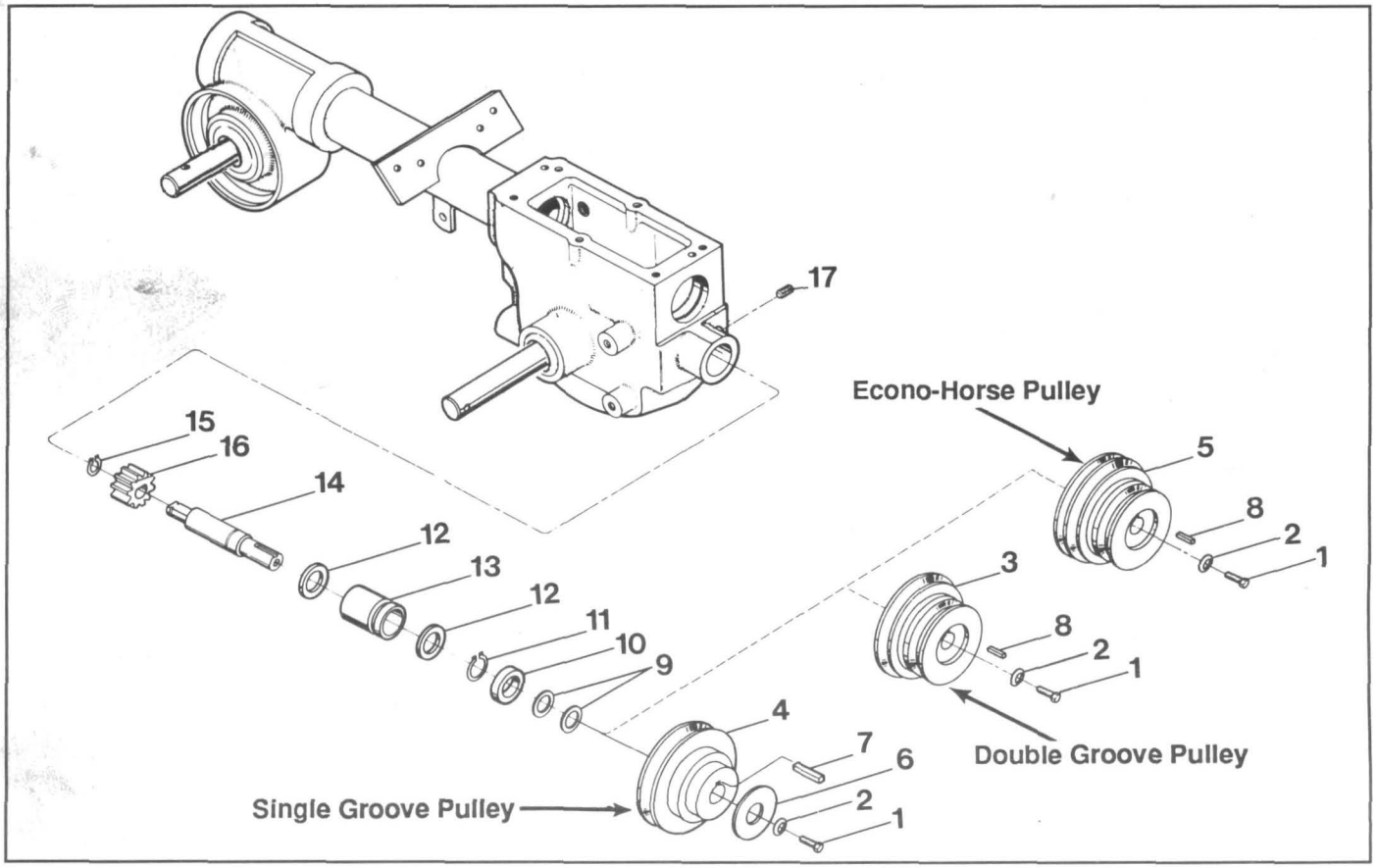



**Figure 4-4: The input pinion shaft and gear assembly.**

### Inspection

These instructions describe how to inspect vital parts on the input pinion gear and shaft assembly. In addition to inspecting the parts you have removed, you should also inspect any replacement parts you will use.

NOTE: Thoroughly degrease and clean all parts before inspection.

**Input Pinion Gear–** Make sure the gear teeth are in good condition. If they are broken or excessively worn, discard the gear.

**Input Pinion Shaft–**

• If the shaft is scored around the oil seal area, discard the shaft. If the shaft is pitted around the oil seal area, you may be able to relocate the oil seal to a smooth area. If the shaft is slightly corroded around the oil seal area, try using a #400 grit emery cloth to clean the area.

• The two snap ring grooves should be just wide enough to fit the snap rings. If the grooves have expanded, discard the shaft. Also, examine the edges of the snap ring grooves. If either the forward-facing edge on the front snap ring groove or the rear-facing edge on the rear snap ring groove are rounded off do not reuse the shaft. These are the edges that bear the force of the snap ring.

• Keyway - The keyway should be just wide enough to fit the key. If the keyway has expanded, discard the shaft.

• Threads at Front of Shaft - Check the threads at the front of the shaft. If the threads are not in good condition, replace the shaft.

**Bushing –** If the bushing is cracked, discard it.

### Installation

Refer to Figure 4-4 as a reference for part locations in these instructions.

1. Install the input pinion gear (16) on the input pinion shaft (14). The shaft and gear have flat spots that you must line up before installing the gear on the shaft.

2. Install the snap ring (15) that retains the input pinion gear to the shaft. The rounded side of the snap ring should face to the front of the transmission. Although not easy to observe, the snap ring as a rounded side and a flat side.

3. Install a washer (12) on the front of the shaft.

4. Install the bushing (13) on the shaft, making sure that the groove in the bushing is facing forward.

5. Install the second washer (12).

6. Install the snap ring (11) that retains the bushing and washers.

7. Install the assembled gear and shaft into the transmission housing.

8. Apply a drop of removable thread locking compound on the set screw (17). Slowly install the screw, checking to make sure the screw fits inside the groove on the bushing. Tap the end of the shaft with a mallet to help seat the screw and then tighten the screw (do not tighten the screw so much that you damage the bushing).

9. Apply a layer of non-hardening gasket sealer around the outside edge of a new oil seal (10) and install the seal.

10. Install the two washers (9).

11 . Install the key (7 or 8) in the keyway of the input pinion shaft.

12. For the Econo-Horse and older model Junior and Pony tillers, install the transmission pulley (3 or 5), disc spring washer (2), and bolt (1). Securely tighten the bolt.

13. For newer model Junior and Pony tillers, install the transmission pulley (4), large washer (6), disc spring washer (2), and bolt (1). Securely tighten the bolt.

## *Wheel Shaft Assembly*

These instructions describe how to service the wheel shaft assembly. Use Figure 4-5 as a reference for part locations in these instructions.

### Removal

1. Drain the transmission gear oil.

2. Remove the clevis pins that hold the wheels on the wheel shaft. Then remove the wheels.

NOTE: If the wheels are rusted to the shaft and you have a wheel puller, try to pull the left wheel off (the left side of the wheel shaft must pass through the housing in order to remove the wheel shaft). If you cannot pull the left wheel off, you will have to saw it off. After sawing the wheel shaft, use a file to smooth off the end of the shaft to ensure that it will pass smoothly through the worm gear clutch.

3. For the Junior model only, remove the snap ring retainer (1) from the left side of the wheel shaft.

4. Remove the oil seal (2) from the left side of the wheel shaft.

5. Remove and discard the snap ring (3) from the left side of the wheel shaft.

6. Remove the shim (4) from the left side of the wheel shaft.

7. Remove the transmission housing cover (see instructions at beginning of this section).

8. Using a soft mallet, tap the wheel shaft (7) to the right until it comes out. You may feel resistance from the oil seal on the right side of the shaft.

NOTE: The key (6) on the wheel shaft will force the right side bushing (5) out, along with the oil seal (2), snap ring (3) and shim (4). On the Junior model, it will also force out the snap ring (1).

# SECTION 4: Servicing the Transmission

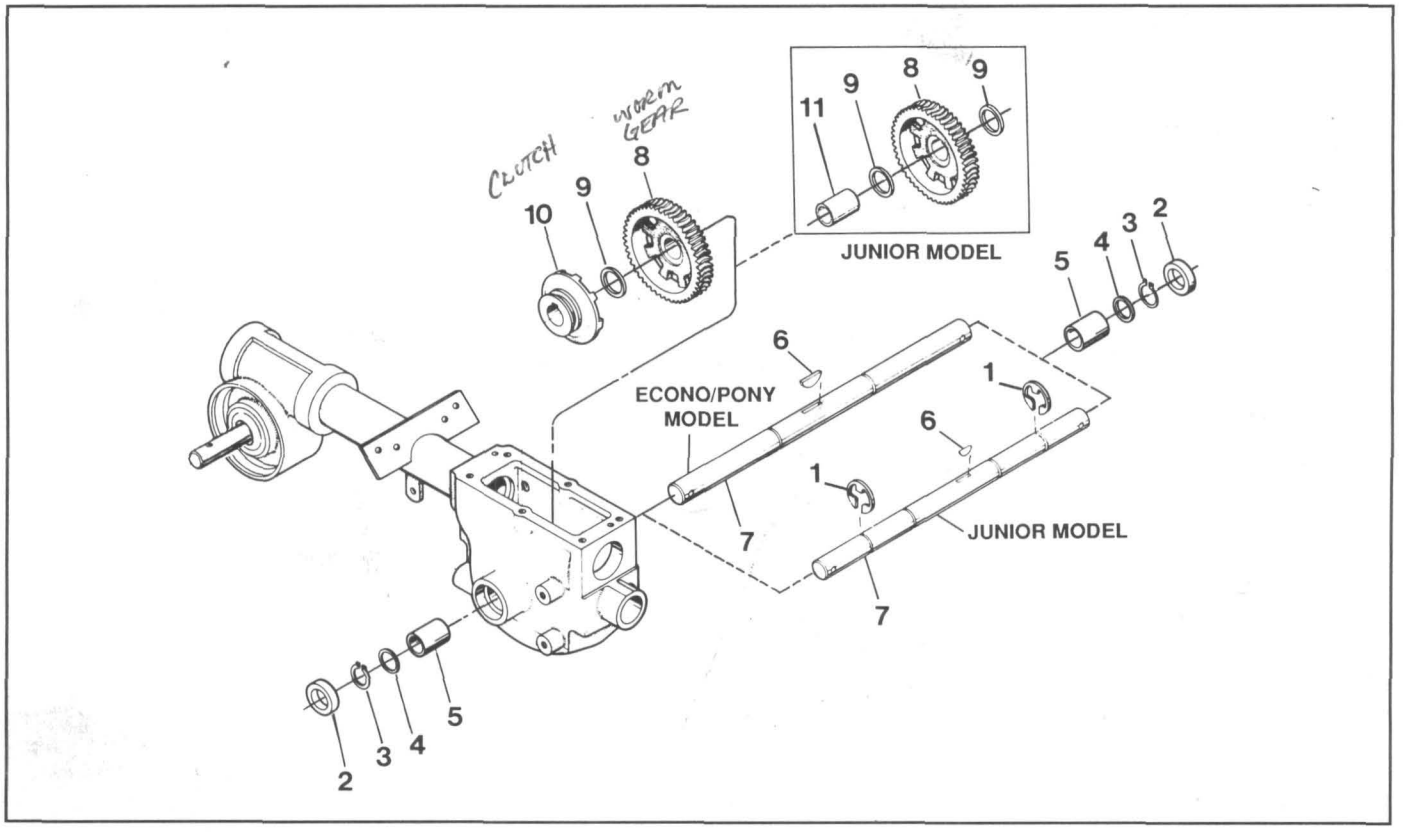



**Figure 4-5: The wheel shaft assembly.**

9. If you had to cut the wheel shaft to remove a wheel, you will have to use an old wheel shaft as a driver. (If you use this procedure, it is possible to mushroom the end of the wheel shaft, making it impossible to pass it through the wheel drive worm gear. If this happens, it will be necessary to crack the worm gear in half to remove the wheel shaft.)

10. After removing the wheel shaft, remove the hi-pro key (6).

11. For the Econo-Horse and Pony models: remove the wheel drive worm gear (8), shim (9), and clutch (10) from the transmission housing. (See NOTE below).

For the Junior Model: remove the shims (9), wheel drive worm gear (8), and spacer (11) from the transmission housing.

NOTE: To remove the wheel drive worm gear it may be necessary to first remove the input pinion shaft gear. If so, refer to the input pinion shaft and gear assembly removal instructions in this section.

12. Insert a drift pin in the right side of the transmission housing and drive the left side bushing (5) out of the housing. Be careful not to damage the inside of the housing with the drift pin.

## Inspection

These instructions describe how to inspect vital parts on the wheel shaft assembly. In addition to inspecting the parts you have removed, you should also inspect any replacement parts you will use.

NOTE: Thoroughly degrease and clean all parts before inspection.

### Wheel Shaft –

- If the shaft is pitted or slightly worn around the oil seal areas, you may be able to relocate the seals to a smooth area.
- If the shaft is badly scored or worn around the oil seal areas, discard the shaft.
- If there is corrosion around the oil seal areas, try using a #400 grit emery cloth to clean the area.

• Examine both ends of the wheel shaft for burrs or rough edges that could prevent the shaft from passing through the wheel drive worm gear (and the clutch on Econo-Horse or Pony models). Use a file or emery cloth to remove any rough edges.

• If the outside edges of the snap ring grooves are rounded, you will have to discard the wheel shaft as these edges bear the force of the snap rings. If the grooves have expanded you may be able to use shims to take up the slack (place the shims on the shaft, not in the groove). If not, discard the wheel shaft.

**Wheel Drive Worm Gear –**

• Check the bore of the gear for rough edges or burrs that could score the wheel shaft.

• If there are any broken or excessively worn teeth, discard the gear.

• For the Econo-Horse and Pony models: if the clutch dogs have worn a groove more than 1/4 through the wall of the gear (usually due to speed shifting), discard the gear.

**Clutch (Econo-Horse and Pony models only) –**

• If the clutch dogs are excessively rounded, discard the clutch.

• If any clutch dogs are missing, discard the clutch.

• If the keyway is damaged, you may be able to straighten it with a file. Otherwise, discard the clutch.

## Installation

Use Figure 4-5 as a reference for part locations in these instructions.

1. Install the hi-pro key (6) firmly in the keyway of the wheel shaft (7).

2. Make sure that the wheel drive worm gear (8) slides freely over the ends of the wheel shaft. For the Econo-Horse and Pony models, check that the clutch slides freely over the ends of the wheel shaft and over the hi-pro key .

3. Grease the center of the wheel drive worm gear (8) and press the shim (9) into the gear.

4. For the Junior model:

   • Slide the wheel shaft (7) in from the right side of the transmission housing. Note that the keyway on the shaft is not centered between the two inner snap ring grooves. You must insert the side of the wheel shaft that has the *shortest* distance between the keyway and the snap ring grooves.

   • As the wheel shaft passes through the inside of the transmission housing, install (in the following order) the wheel drive worm gear (8) and the spacer (11). Then push the shaft the rest of the way through until its ends are protruding an equal distance from both sides of the housing.

   • Insert the other shim (9) in through the left side of the transmission housing.

   For the Econo-Horse and Pony models:

   • Make sure the eccentric shaft shifting pin is facing up, or at 12 o'clock, inside the housing (If the eccentric shaft assembly has been removed, it must be installed at this time. See the "Eccentric Shaft Assembly" installation instructions in this section).

   • Gently place the wheel drive worm gear (8) and clutch (10) into the housing so that the eccentric shifting pin fits into the groove of the clutch.

   • Slide the wheel shaft (7) in from the right side of the transmission housing and through the clutch and worm gear. Note that the keyway is not centered between the two snap ring grooves. You must insert the side of the wheel shaft that has the *longest* distance between the keyway and the snap ring grooves.

   • Push the shaft through until its ends are protruding an equal distance from both sides of the housing.

   • Make sure that the eccentric lever moves the clutch freely from side to side on the wheel shaft.

5. Using #30 weight oil, lubricate the two wheel shaft bushings (5).

6. Making sure the two oil pick-up grooves on the bushing are facing in, use a hammer to install one bushing about 1/8 of the way in the housing.

7. Using a rubber hammer and a driver, and making sure the oil pick-up grooves are facing in, install the other bushing so that the edge of the bushing is flush with the edge of the counter bore in the transmission housing. Then finish installing the first bushing in a similar manner.

8. Use a rubber mallet to strike down on the wheel shaft on both sides of the housing. This will loosen the shaft and make it easy to turn.

9. In one of the sides, install a shim (4) and a snap ring (3). The flat side of the snap ring (although not easy to observe, there is a flat side and a rounded side) should face the outside edge of the groove. Gently tap this end of the shaft inward so that the snap ring is flush against the bushing.

10. Go to the other side and shim (4) the gap between the bushing and the snap ring groove.

11. Install a snap ring (3). The flat side of the snap ring should face the outside edge of the groove.

12. Test for end play. There should be 0.000" to 0.005" play and the wheel shaft should turn freely. Add or remove shims (4) as needed.

13. Apply a layer of non-hardening gasket sealer to the outside edges of the two oil seals (2) and install them at each end of the wheel shaft.

14. For the Junior model: install the snap rings (1) in the outside snap ring grooves.

## *Eccentric Shaft Assembly*

These instructions, which explain how to service the eccentric shaft assembly, apply to the Econo-Horse and Pony models only. Use Figure 4-6 as a reference for part locations in these instructions.

### Removal

1. Remove the wheel shaft. See "Wheel Shaft Assembly" in this section for removal instructions.

2. Remove the hex head screw (1) that secures the eccentric lever (2) to the eccentric shaft (3). Then remove the eccentric lever.

3. Remove the eccentric shaft pin (4) from the eccentric shaft.

4. Remove the eccentric shaft (3) by pushing it toward the inside of the transmission housing.

5. Remove the oil seal (5).

6. Remove the spring (6).

### Inspection

Make sure the eccentric shaft (3) is not scored, pitted, or heavily corroded around the oil seal area. If the shaft has minor pitting, scoring, or corrosion, you may be able to smooth it with an emery cloth. Otherwise, you should discard the shaft.

### Installation

1. Install the eccentric shaft pin (4) on the end of the eccentric shaft (3).

2. Install the spring (6) on the shaft.

3. Install the eccentric shaft from the inside of the transmission housing.

4. Install the wheel shaft. See "Wheel Shaft Assembly" in this section for installation instructions.

5. Apply a coating of non-hardening gasket sealer to the outside edge of the oil seal (5) and install the seal from the outside of the transmission housing.

6. Install the eccentric shaft lever (2) on the eccentric shaft. When doing so, make sure the lever is extended to the left side of the housing and that the longer arm on the lever is closest to the transmission housing.

7. Install the hex head screw (1) that secures the eccentric lever to the eccentric shaft.

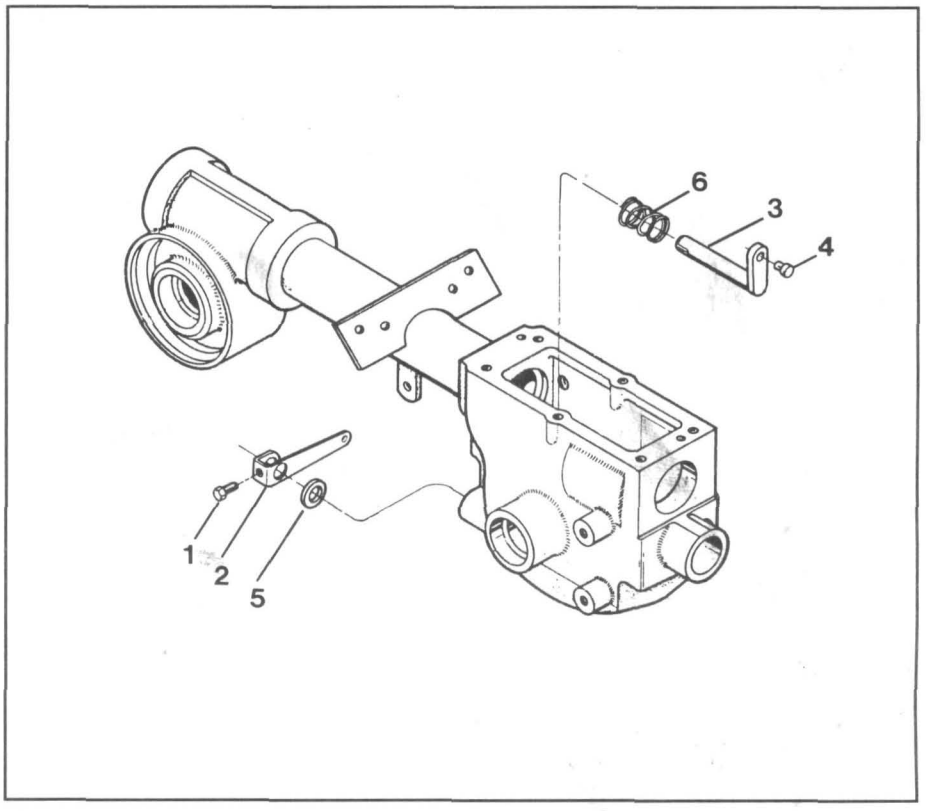



**Figure 4-6: The eccentric shaft assembly.**

# Tiller Shaft Assembly

These instructions describe how to service the tiller shaft assembly. Use Figures 4-7 and 4-8 as a reference for part locations in these instructions.

NOTE: Tillers that fall within the following serial number ranges are equipped with roller bearings that are used with the P/N 20798 tiller shaft only (see Figure 4-8, Items 8 and 6). New tiller models (those with serial numbers higher than shown below) have ball bearings that are used with the P/N 20896 tiller shaft only (see Figure 4-8, Items 9 and 7).

Junior Model: S/N M67999 - M0100969
Pony Model: S/N S186072 - S0242649
Econo-Horse: S/N E1001 - E0032773

## Removal

1. If the tine holders are rusted onto the tiller tine shaft and penetrating oil does not free them, it will be necessary to cut the holders lengthwise in two places, 180 degrees apart. Then use a chisel to break them off the shaft.

2. Remove the five bolts (1) and nylon washers (2), if any, that secure the tiller housing cover (3). Discard the washers. Have a pan ready to collect the gear oil that will pour out when you remove the tiller housing cover in the next step.

3. Remove the tiller housing cover by gently tapping the right side of the tine shaft inward with a mallet. Remove and discard the housing cover gasket(s) (4).

4. On newer model tillers (those equipped with ball bearings instead of roller bearings on the tine shaft), the main drive shaft must be repositioned slightly in order to remove the tine shaft. Follow Steps 4a–4c:

a. At the rear of the drive shaft transmission tube, remove the rear bearing cap and any shims. Then, place your hand over the bore opening to prevent the drive shaft from slipping backwards out of the transmission tube (which could cause the front drive shaft bearing to fall down inside the transmission housing).
b. Insert a screwdriver through the tine holder mounting hole in the tine shaft and carefully rotate the shaft clockwise until the rear bearing cup on the drive shaft is flush with the transmission bore opening.
c. Apply tape over the bore opening to prevent the drive shaft from slipping backwards and proceed to Step 5.

5. To remove the tiller shaft assembly, first use a soft mallet to strike downward on the right side of the tiller tine shaft. This will collapse the right side oil seal (5) and help the tiller cluster to come out. Remove the tiller tine shaft (6 or 7) and the attached worm gear (11), bearings (8 or 9), and woodruff key (12).

6. Place the tiller housing cover (3) on an open vise so that the outer edges are supported. Tap out the oil seal (5), being careful not to scratch the inside of the cover (or the bearing race that is used with older model tillers).

7. Remove the oil seal (5) from the right side of the transmission housing. As in the previous step, be careful not to damage the inside of the cover (or the bearing race on older model tillers).

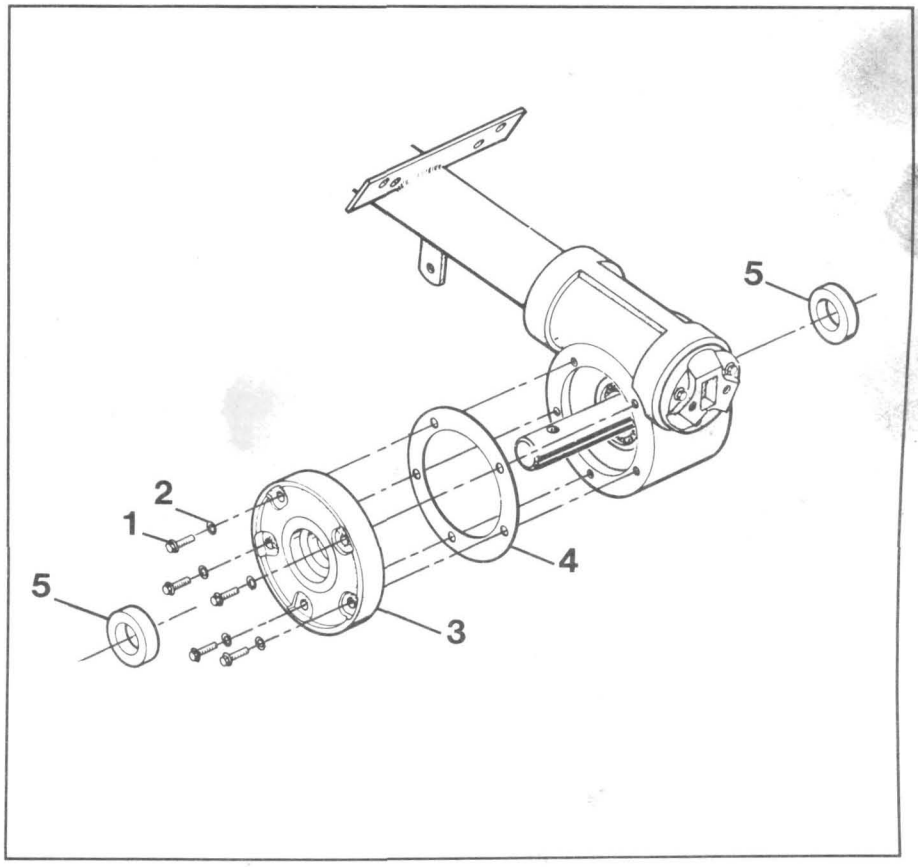



Figure 4-7: The tiller shaft housing cover.

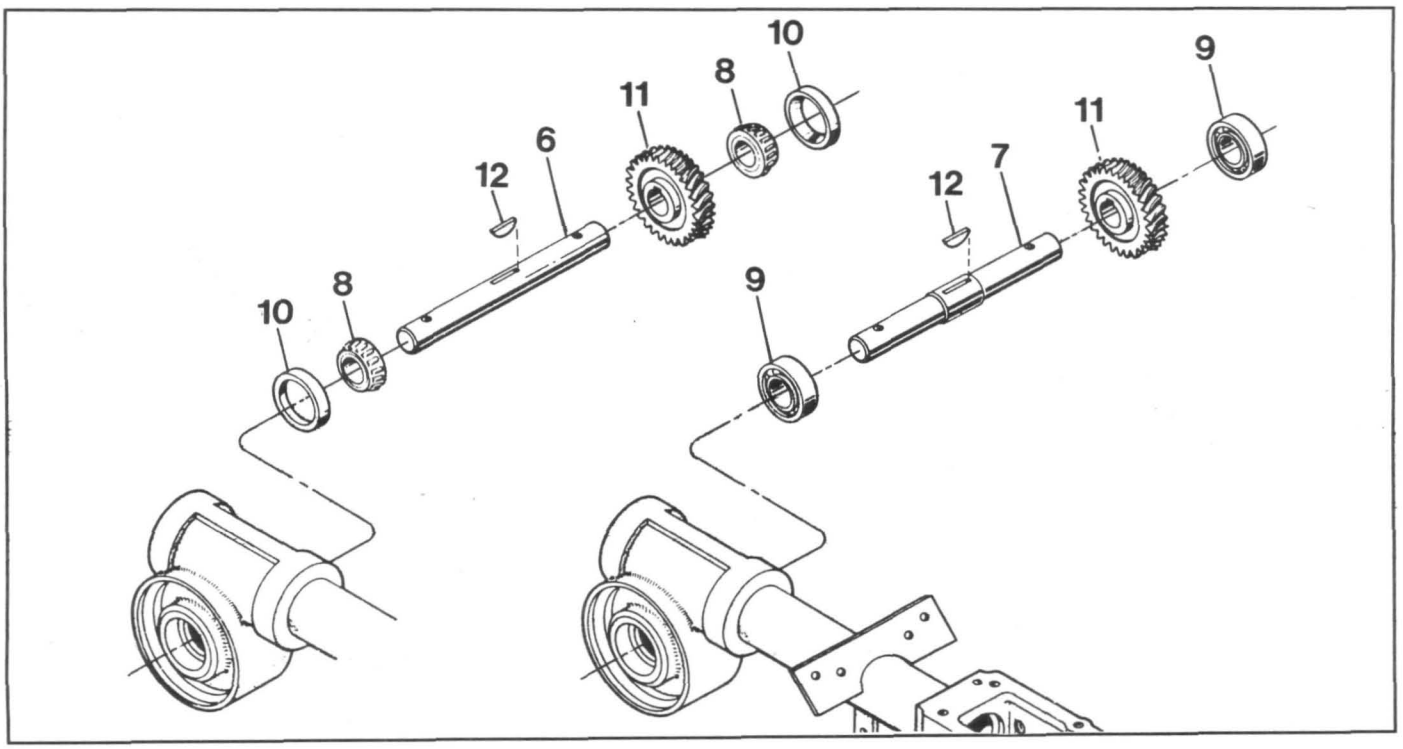



**Figure 4-8: The tiller shaft assembly.**

8. On older model tillers, remove the bearing cups (10) from the housing cover and from the right side of the transmission housing. Be careful not to scratch the inside of the cover or the transmission housing when removing the cups.

NOTE: You only need to remove the bearing cups if you will be using new roller bearings. If you replace a bearing you must also replace the cup. Keep each cup paired with its bearing if you intend to reuse them. Each cup wears differently according to its bearing.

9. To disassemble the gear and bearing assembly:

a. Place the tiller tine shaft assembly on an arbor press.
b. Force the shaft down. This will dislodge one bearing.
c. Turn the shaft assembly 180 degrees and use the arbor press to dislodge the other bearing.
d. Slide the worm gear (11) off the shaft.
e. Remove the woodruff key (12).

## Inspection

These instructions describe how to inspect vital parts on the tiller shaft assembly. In addition to inspecting the parts you have removed, you should also inspect any replacement parts you will use.

NOTE: Thoroughly degrease and clean all parts before inspection.

**Tiller Tine Shaft –**

• The shaft should not be scored, pitted, or corroded in the areas where the oil seals are located. If the shaft is scored, pitted, or corroded, try using an emery cloth to clean the area. If the scoring, pitting, or corrosion is too extensive (which would result in an oil leak), discard the shaft.

• Remove any burrs or rough spots on the ends of the shaft that could cut the oil seals when they are installed.

• The keyway should be just wide enough to fit the key. If the keyway has expanded, discard the shaft.

**Worm Gear –** If the gear teeth are damaged or excessively worn, discard the gear.

**Bearings –**

• If the bearing has a bluish color then proper lubrication has not been maintained; discard the bearing and bearing cup.

• If the bearing is scored or excessively worn, dirt may have gotten inside the housing. If so, replace the bearing and bearing cup.

• If a bearing makes a growling noise or does not spin freely, discard the bearing.

### Installation

Use Figures 4-7 and 4-8 as references for part locations in these instructions.

1. On newer model tillers (those equipped with ball bearings instead of roller bearings on the tiller tine shaft), the drive shaft inside the transmission tube must be repositioned slightly before the tiller tine shaft can be installed. Follow the procedure outlined in Steps 4-a through 4-c of the previous tiller tine shaft removal instructions.

2. Install the woodruff) key (12) in the tiller tine shaft (6 or 7).

3. Slide the bronze worm gear (11) on the shaft. The worm gear should be centered over the woodruff key.

4. Use an arbor press to install the bearings (8 or 9) flush against the bronze worm gear. While doing so, make certain that the bronze worm gear is centered over the woodruff key.

5. Use an emery cloth to clean the tine shaft, especially around the oil seal locations.

6. On older model tillers, install a bearing cup (10) in the housing cover (3) by using a piece of wood as a driver to seat the cup. Make sure the tapered bearing cup is correctly oriented to receive the bearing. Also make sure the bearing cup goes fully inside the cover; no metal should be visible between the bearing cup and the inside edge of the cover. Use the same technique to install a bearing cup (10)) in the right side of the tiller housing.

7. Insert the tiller tine shaft assembly in the tiller housing. Make sure the side on the bronze worm gear whose gear edges are the sharpest is facing towards the rear of the machine.

8. Install a new gasket (4) on the tiller housing cover (3). As you begin the shimming procedure, start with the thinnest gasket, which is 0.010" thick. Do not install the oil seals (5) at this time.

9. Temporarily secure the cover in place using two bolts (1) about 180 degrees apart.

10. Using the right side of the tiller tine shaft, check the shaft for play:

a. Using two hands, grasp the shaft and rotate it back and forth.
b. You should be able to rotate the shaft slightly. This means the tiller tine shaft is shimmed correctly.
c. If you cannot rotate the shaft, remove the 0.010" gasket and install a 0.030" gasket. If necessary, begin using gaskets in pairs to gradually increase the thickness of the gasket. For example, if a 0.030" gasket is insufficient, use a 0.030" and 0.010" gasket together. If this combination is not sufficient, use two 0.030" gaskets, etc., until the shaft is shimmed correctly.
d. There should be no end play, vertical play or diagonal play in the tiller tine shaft. If you find such play, tighten the two housing cover bolts. If this does not eliminate the play, insert a shim (use the same shim as used on the wheel shaft – using the thinnest shim first and then switching to thicker shims as necessary) between the worm gear and the bearing on the tiller tine shaft.

11. Repeat steps 9 and 10 until you obtain the correct amount of play in the tiller tine shaft. Then remove the two bolts from the housing cover.

12. Using new Nylon washers (2), bolt the cover in place with all five bolts (1). Note that the Nylon washers function as oil seals. If the washers are not available, coat the tips of the bolts with non-hardening gasket sealer.

13. Apply a layer of non-hardening gasket sealer to the outside edge of an oil seal (5). Then install the oil seal on the right side of the tiller housing so that the seal is flush with the housing.

14. Install another oil seal (5) in the tiller housing cover.

# INDEX

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