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Gilson[®]

Oil Bath Worm Drive Tiller Gear Case Rebuild Instructions

**The
"Iron Heart"
WormDrive**



Gilson Brothers Company
BOX 152, PLYMOUTH, WISCONSIN 53073
Printed in U.S.A.

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Preface

This document is based on a similar undated Gilson publication, likely dating back to the 1960s. Since it included a ZIP code it is post 1963. I have included many of the original illustrations and text in this rewrite. It was originally written as a guide for trained technicians working on relatively new equipment and with specialized tools. I have adapted the content to assist owners servicing these units without specialized tools after decades of use.

Variations in the assembly process are certainly possible. This document offers one order of operations, and the critical inspection and adjustment details.

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Gear Case Removal

When servicing the gear case it is usually best to remove the worm drive assembly from the machine. Removing a few more bolts will make it easier to do a really good job on the work bench.

These steps may vary with model so consider it a guide and use common sense.

1. Remove the tine assemblies The inner and outer tine assemblies are each secured with a through bolt. Slide them from the tine shaft. Remove all 4 sets.
 - a. Occasionally a machine is found with only the inner tine sets. This narrow configuration is mainly for cultivating between rows.
 - b. If you have difficulty removing the tine assemblies, corrosion, gunk, or hole deformation may be the cause. Penetrating oil, heat or carefully applied force may be needed. **This bulletin may be helpful.**
2. With the tine assemblies removed you should find a set of felt packings adjacent to the worm drive case. These serve to keep the dirt away from the delicate oil seals. More on this later. These may be a mass of dirt, clippings, dust and gunk. They may be entirely missing. They will be replaced as part of the job. Keep an eye out for a thin steel washer on each side. These must be reused or replaced as part of the project. Discard whatever else you find.
3. Roll the belt(s) off the pulleys. You may need to get them off the engine pulley first.
4. Loosen the 2 set screws that secure the lower pulley.
5. Remove the lower pulley from the shaft. This is best done with a 2-jaw puller engaging the center hub. **Do not pull against the outer diameter of the pulley, as the casting may break.** If you do not have a puller a wedge or pickle fork (tie rod) tool may work.
6. Remove the brace straps that connect the worm drive to the cast iron engine bracket.
7. Remove the 4 bolts that attach the worm drive to the engine bracket.
8. Remove the drive and take it to the bench.

END OF SECTION

Case Styles

There were several case styles used over the years which utilized many of the same internal components. While they function the same, opening and closing the case will differ in method. There were some significantly different designs used early on from 1957 - 1959 that are not shown here.

Three Bolt Cast Iron Side Cover Case



This design was widely used over the years and was carried over to the snowblowers. It utilizes a cast iron side cover, held closed by 3 bolts. On the tine shaft it may have used cup and cone roller bearings, or bronze plane bearings. The internal clearance is adjusted with gasket selection. The gasket set includes a thick gasket that is always used. Three thinner gaskets are provided to be used as needed to make the case run freely when the cover is torqued closed. This style came in 2

sides.

Screw-In One-Piece Side Cover Case



This is a transitional design used briefly in the early 1960's. The bolt and locking tab circled in blue are first removed. The side cover is now unlocked, and the cover can be unscrewed (CCW) by carefully rotating the cover. Do not use hard striking tools that might chip or break the cast iron. Brass, aluminum, and wood are safer choices. You may have some sort of spanner tool that can engage the cover. The cover includes an o-ring groove on the OD. When reassembling,

the cover is run in snug, then backed off one notch, and locked. Check that it operates freely.

Lock Ring Case



This case is used with cup and cone roller bearings and is very common. The side cover is screwed in to set the bearing clearance. There is a break in the housing's internal threads where a sealing O-ring rests. The o-ring is compressed, and the side cover is retained with a castellated locking ring. Once adjusted it is locked by a cotter pin, circled in blue.

Three Bolt Side Cover Case, with Aluminum Cover



This is a variation on the original cast iron 3 bolt cover with a few notable points. The cover is of one-piece aluminum construction. It does not utilize a replaceable bearing. Rather, the 1 inch inside diameter is a journal bearing with lubricant grooves. The oil seal is installed from the outside. Due to the mixed metal properties of the housing and cover the bolts are locked with bent up retaining tabs. These are not available as replacement parts, handle with care. The housing and other parts

are the same as the prior cast iron design.

END OF SECTION

General Tips and Cautions

The following is applicable to all, or most of the case styles and should be reviewed before servicing any of these drives.

1. Clean all external surfaces of the drive before starting. Keeping dirt from entering the process will make it easier and help ensure a good outcome.
2. Before disassembly it is important to clean and debur all exposed shafts. Use a flat file to remove any set-screw divots, knicks, burrs, or paint. Most likely there is some raised tine shaft steel where the tine assembly bolts pass through. Restore the chamfers with a rat tail or half round files. Remove any other high spots with a flat file. The objective is to have the bearings slide off the shafts without resistance. If the bearings catch, back up and further dress the shaft.
3. When removing the adjusting plug at the front (bottom of a vertical shaft drive) do not strike the plug with hard tools.



Consider making a simple tool as shown to use with an adjustable wrench. This will run the plug out and back in with ease.

4. Do not remove the shaft keys from the shafts unless worn or otherwise necessary. They generally do not wear out. Stress often marries them to the shaft with a little bit of deformation. They will never fit better than the factory

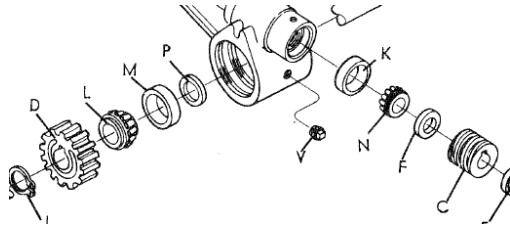
placement. Of course, worn or damaged keys can and should be replaced.



5. The larger plug is a vent plug. It has a felt element beyond the external hole to allow for lubricant and air expansion while keeping dirt out. When servicing, soak it in solvent and then blow compressed air back and forth. If you cannot see some frothing it should be soaked and retested, or replaced.

Vertical shaft models generally do not have this vent. They vent through the input wick.

6. The forward tapered roller bearing may not freely slide from the shaft. I have found that the shaft often has a small prick punch divot that raises some steel. I believe this may have been done as an assembly aid. You may need to carefully work the shaft forward to coax this bearing free.
7. Originally Gison provided a set of machined seal and bushing driver tools in a dealer kit. These no longer exist. You can make do with carefully chosen deep sockets or random lengths or round stock. Just make sure that what you choose is small enough to pass freely through any casting openings. Access to a bearing press is desirable but many make do with a good dead blow mallet.
8. When driving seals or bearings be sure to protect any machined gasket contact surfaces with wood or cardboard.



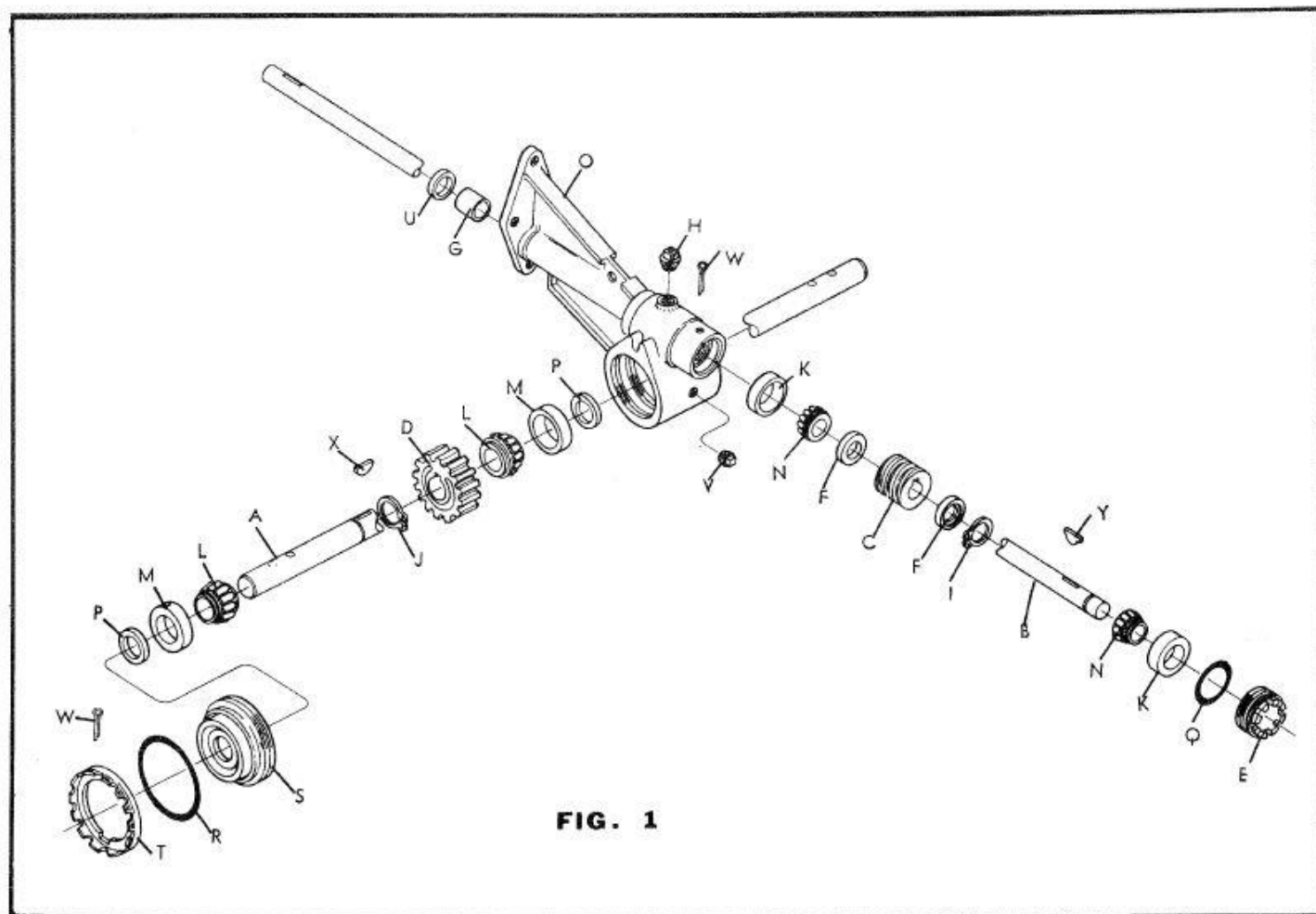
9. The terms "worm gear" and "worm wheel" are important to understand. The worm or input gear, shown as "C" is a steel screw like gear. The "worm Wheel, shown as "D" is a bronze wheel like gear that is cut to

mesh with the worm gear.

10. Oil all shafts, seals, bearings and gears prior to assembly.

END OF SECTION

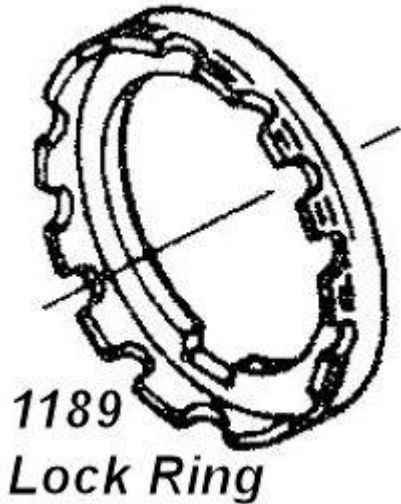
Lock Ring / Screw-in Case Cover Type Instructions



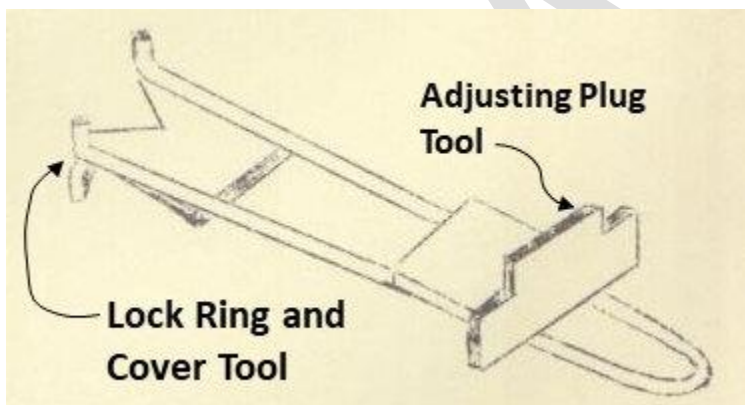
Note 1: The Gilson instructions call for removing the tine shaft/worm wheel assembly first. In my experience this is not possible. Unless the worm wheel teeth are destroyed the gears are engaged such that the tine shaft "A" cannot move laterally. Rather the input/worm gear "C" must be removed first by spinning the gear forward until it disengages from the worm wheel.

Note 2: A horizontal drive is shown here. Vertical drives are similar, and differences will be noted.

1. Remove the small level check plug "V" and let the lubricant drain out into a catch pan. Note that the original lubricant contains lead. Avoid contact and dispose of it appropriately.

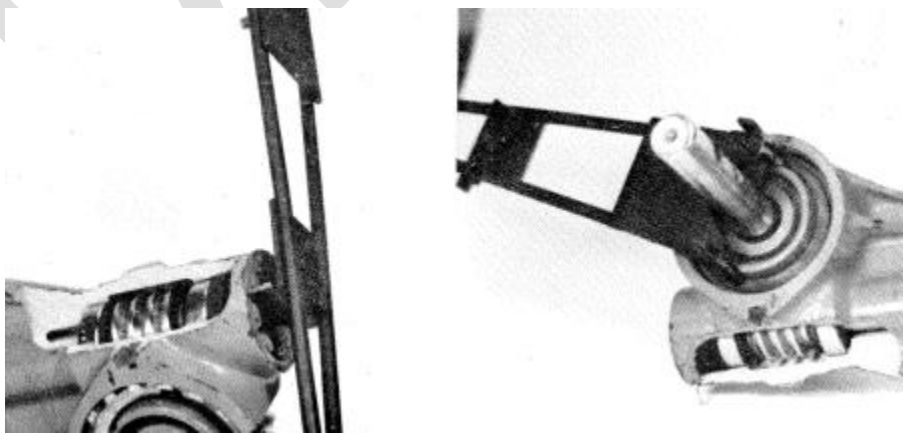


2. The most difficult task is removing the lock ring "T". Replacements are virtually non-existent so work carefully. Remove the cotter pin "W". The lock ring is threaded into place. Begin by meticulously cleaning the threads before trying to move anything. Penetrating oil, soap and water or any combination that will dislodge your unique blend of sand, soil, and clay. Flush it with fluids and compressed air. Consider letting it soak with penetrating oil. When removing always work in the 2 rectangular notches of the inside diameter. Do not touch the cotter pin notches.



You may want to make a spanner tool or have something you can use. Here is what the original Gilson Tool looked like. These are not available.

If at all possible, work with soft tools such as brass, aluminum and wood.



Rust is generally not a factor.

Attempt to unscrew the ring in a CCW direction. If it resists, consider that it is compressing a large o-ring and the rubber may have fused to the ring and housing. Applying heat with a propane torch may help.

Go back and forth with heat and escalate the driving effort. It is worth trying to screw it inward looking for that first small movement. Once you get a little motion you can rock it back and forth as you continue to flush, lube, and blow clean.

If you need to use steel tools, stay in the rectangular notches and limit the damage. The actual size of these notches is not critical. Within reason, you can square them up afterwards with a file and hide the damage.

3. Remove the remnants of the o-ring "R" and give the threads a final cleaning.



4. The lock ring was in the outer threads. The o-ring was in the smooth part. The actual side cover is threaded into the second set of threads. When removing the cover, it will jump the gap from one set of threads to the other. Take care to ensure that it does not cross-thread during this step.

5. Using soft tools or a spanner in the two holes remove the side cover "S" by unscrewing it. This part was installed relaxed and has been on the clean, lubricated side of the o-ring so it should not be a big challenge.

6. Once unscrewed you can slide it off the shaft.

7. Remove the tapered roller bearing. If it does not slide off freely, dress the shaft until it does.

8. Remove the adjusting plug "E" per the General Tips.

9. The forward bearing race "K" can be easily removed.

10. The forward bearing "N" may be stubborn due to a prick punch divot on the shaft. If it resists, leave it alone for now.

11. The next step will be to remove the input / worm shaft assembly. To do so the rear end of the shaft needs to be nicely dressed so it can pass through the input bearing. File and sand the exposed shaft as needed.

12. Work the shaft forward while rotating it so the worm gear climbs across the worm wheel. You will need to hold the rearward worm spacer "F" and bearing "N" back so they do not collide with the worm wheel. Once the worm gear is clear of the worm wheel the worm gear / input assembly shaft will exit the front hole.

13. Pull the tine shaft assembly out through the side opening.

14. Finish disassembly by removing the bearing "N", retaining ring "I" and worm spacer "F" from the front of the input shaft. The bearing "N" and spacer "F" should slide off the back end.

15. Inspect the worm wheel "D" and tine shaft "A". Unless a defect is found leave the worm wheel mounted to the tine shaft.



a. Bronze worm wheel - (Ref. D) Inspect for excessive wear on teeth. Any wear beyond a trace should be considered suspect. Compare to the typical profile of a new gear.

Check for nicks, chips, cracks, etcetera. Inspect shaft hole and keyway for wear, cracks, etc.

b. Tine Shaft-- (Ref. A) Inspect for wear and rough spots at the seal contact areas. Check for loose fit and/or wear at worm gear area. Replace shaft only if wear is apparent and cannot be corrected with emery cloth.

c. Bearings-- (Ref. "M" & "L") Thoroughly clean and inspect bearing cups and cones. Replace if rough or scored.

d. Check the retaining ring "J" alongside the worm wheel. Replace it if it is distorted or if the worm wheel and/or shaft are being replaced.

16. To remove the tine shaft oil seals "P", find a suitable driver such as a carefully chosen deep socket. Make certain that it is small enough

to pass through the housing and cover openings freely. Drive the seal into the case to remove.

17. Remove the vent plug "H" to clean and inspect.

- a. Vertical shaft models may not have a vent plug. The felt wick at the input serves as a vent.

18. Inspect the input shaft component.

- a. Worm Gear - "C" Inspect for excessive wear, chips, cracks, etc. Being harder than the worm wheel this gear is usually Okay for reuse.
- b. Spacers - "F" Inspect spacers (Ref. F) for excess wear, especially on the flat surfaces contacting the worm gear.
- c. Bearings - "K" & "N" Thoroughly clean and inspect bearings, replace if rough or scored.
- d. Retaining ring - "I" Replace if sprung, worn, or distorted.

19. Remove the input seal "U" with a seal removal tool or pry it out carefully with a small tool.

- a. Some higher HP models have a sealed ball bearing unit. This also serves as the oil seal.
- b. Most vertical shaft models will not have an input seal. There will probably be a felt wick, bushing, and retaining ring. A replacement wick is included in the appropriate seal set.

20. Inspect the input bushing "G" If it is no longer a close fit to the shaft it should be replaced. Wear is usually on the surface toward the engine due to belt tension. If the bushing must be removed, it can be split and removed with a small chisel or pointed punch. It is also possible to create an extractor with jacking screws.

- a. Some higher HP models have a sealed ball bearing unit.

21. For models with the "Screw-In One-Piece Side Cover Case" the process is very similar. Remove the bolt and retaining clip and unscrew the side cover. The drive is otherwise comparable.

22. Clean all parts in solvent and perform a final part inspection.

23. Obtain needed parts and prepare for reassembly.

Reassembly of Lock Ring / Screw-in Case Cover Types

Housing preparation

1. If the input bushing "G" is being replaced, press the new bushing (or bearing) into the recess.
 - a. If this is a vertical shaft model with a grease fitting, remove the grease fitting. Drill a small hole to break through the bushing to create a grease passage. Remove any burrs or chips. Reinstall the grease fitting.
2. Press the input seal "U" into the recess. The solid surface of the seal faces outward.
 - a. On vertical shaft models without an oil seal install a new 1995 felt wick, the spacer and retaining ring.
3. Press the tine shaft seals "P" into the housing "O" and side cover "S". The solid surface of the seal faces outward.
4. If the tapered roller bearings are being replaced install the races "M" in their recesses.

Tine shaft subassembly

If the shaft and/or worm wheel are being replaced do the following, otherwise skip ahead.

5. Set the key into the keyway.
6. Install the retaining ring "J"
7. Confirm the preparation of the shaft by sliding a bearing along the length. If there are any tight spots dress the shaft with a file. Do not mar the areas where the oil seals land.
8. Align the worm wheel keyway with the key and press the shaft through the gear until the key engages and the gear makes contact with the retaining ring. The worm wheel is not directional, it can be installed from either side.

Input / worm gear shaft assembly - phase 1

9. If the tapered roller bearings are being replaced install the rear race "K" in the housing.
10. Cover the keyseats of the input shaft "B" with cellophane tape to prevent seal damage

11. Lubricate the input seal "U" with oil.
12. Insert the input shaft into the housing from the rear so the front end is visible in the gear cavity.
13. Slide the rear tapered roller bearing "N" onto the shaft.
14. Slide a worm spacer "F" onto the shaft. The flat side is to the front so it will be against the worm gear "C"
15. Install the hypro key "Y" for the worm gear "C" in the input shaft.
16. Slide the shaft rearward so the components are at the rear of the gear cavity.

Tine Shaft Installation

17. Lubricate the housing tine shaft seal "P" with oil.
18. Install the tapered roller bearings "L" on the tine shaft "A".
19. Slide the tine shaft assembly into the housing, and carefully through the housing seal. The retaining ring "J" must face the cover per figure 1.

Input / worm gear shaft assembly - phase 2

20. Slide the input shaft "B" forward about 3 inches.
21. Slide the worm gear "C" onto the shaft to engage the key "Y".
22. Carefully move the input shaft and worm gear rearward and rotate to meshes with the worm wheel. Rotate the shafts so the worm gear moves rearward into contact with the rear worm gear spacer and is centered over the worm wheel.
23. Slide a worm spacer "F" onto the shaft. The flat side is to the rear so it will be against the worm gear "C"
24. Install the snap ring "I" on the input shaft.

25. Push the shaft rearward until the snap ring "I" is nested in the worm gear spacer recess and everything is stacked solid to the back.
26. Through the forward opening slide the forward tapered roller bearing "N" onto the shaft.
27. Through the forward opening install the forward bearing race "K" in the housing. This is a close slip fit.
28. Install a new o-ring "Q" on the adjusting plug "E" and oil the o-ring.
29. Install the adjusting plug until tight.
30. Rap the housing and shaft ends to seat bearings.
31. Unscrew the plug by one plug notch.
32. Check for free rotation, and no noticeable end play.
33. Install cotter pin "W".

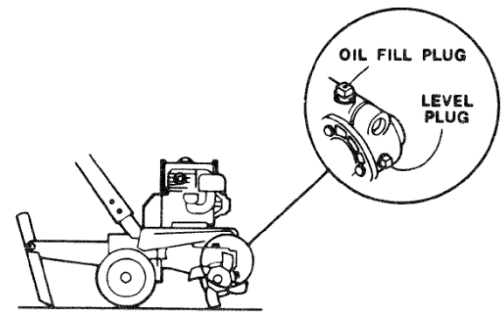
Closure and final adjustment

34. Lubricate the side cover "S" time shaft seal "P" with oil.
35. Gently ease the cover with oil seal onto the shaft and past the time bolt holes.
36. Carefully screw the cover into the housing. Transition from the outer threads to the inner set of threads. Tighten until contact is made.
37. Rap the housing and ends of the time shaft each way with a mallet to seat the bearings.
38. Check that the cover is still fully tightened then back the cover "S" out by about $\frac{1}{4}$ ". This is comparable to one cotter pin notch in the lock ring.
39. Check for free rotation by turning the input shaft and that there is no noticeable end play. Adjust if needed.

40. Lubricate the side cover o-ring seal "R" with oil and place it in the recess.
41. Thread the locking ring into the housing.
42. Tighten the locking ring to seat the o-ring without rupturing it.
43. Install the cotter pin to lock the ring.

Reinstallation and lubrication

44. Remount the drive in the machine, including any brace straps.
45. Reinstall the input pulley or vertical clutch.
46. Reinstall belts and any other disassembled components.
47. Position the machine so the drive is level, or plumb and fill with lubricant so it is up to the level check plug.
48. See the lubricant section of this document for fluid specifications.
49. Reinstall level check, and vent plugs.
50. Run with no load for 5 minutes.
51. Check lubricant level.
52. Check shafts for end play changes.
53. Check for leaks.
54. Install the tine shaft felts, see the felt section for details.
55. Install the tines.
56. Recheck end plays after first working session.





Screw-In One-Piece Side Cover Case

This case is the early version of what became the "lock ring" case detailed above. It was used for a few years around 1960.

Other than the following, service it per the preceding "Lock Ring" case style.

The entire side cover assembly is a one-piece part that carries the sealing o-

ring in a groove.

Bearing end play is set by running this plug in all the way and backing it out one notch. It is then locked with the clip and bolt. Check for free rotation, and no noticeable end play.



END OF SECTION

Three Bolt Cast Iron Side Cover Case Type Instructions

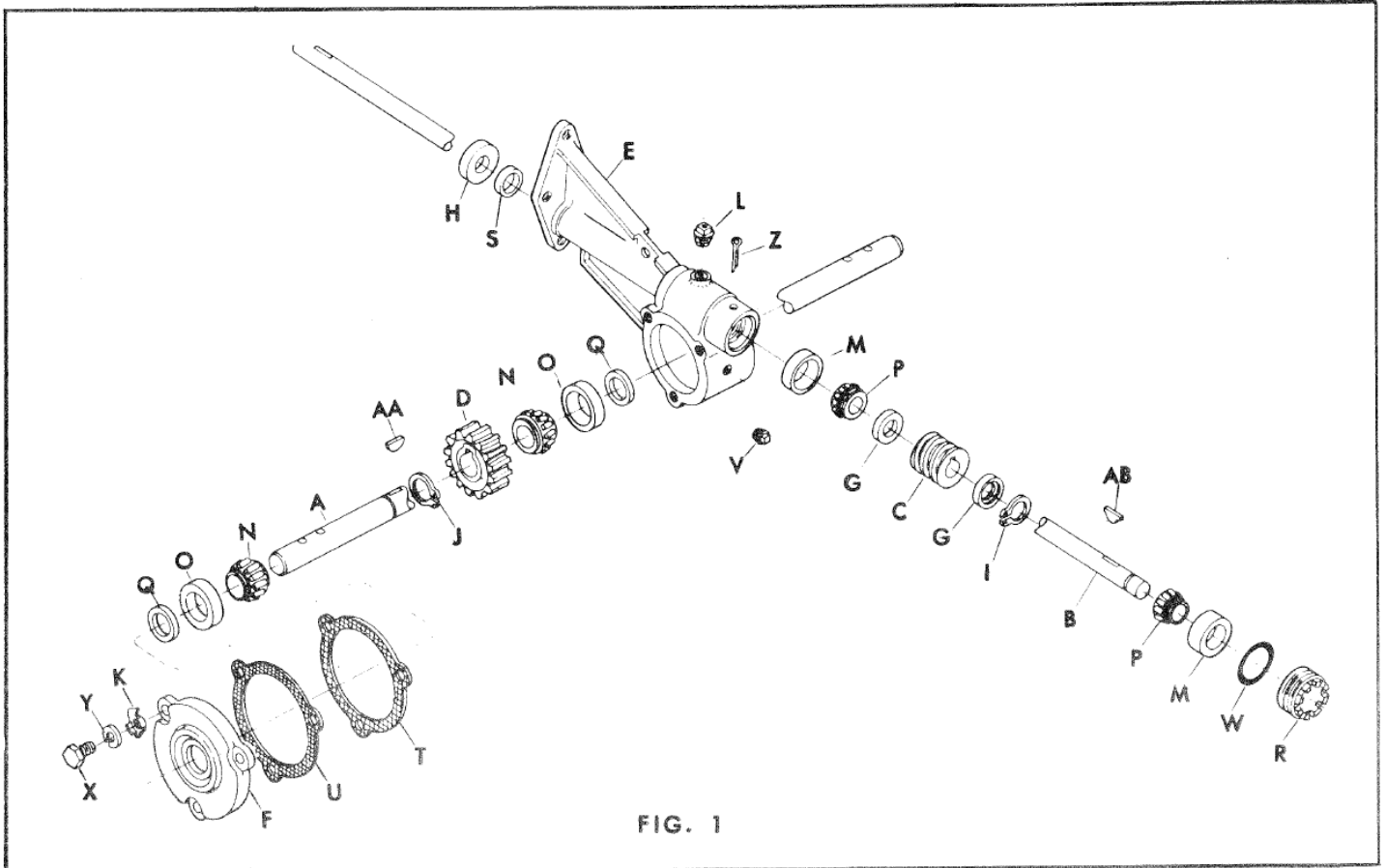


FIG. 1

Note 1: The Gilson instructions call for removing the tine shaft/worm wheel assembly first. In my experience this is not possible. Unless the worm wheel teeth are destroyed the gears are engaged such that the tine shaft "A" cannot move laterally. Rather the input/worm gear "C" must be removed first by spinning the gear forward until it disengages from the worm wheel.

Note 2: A horizontal drive is shown here. Vertical drives are similar, and differences will be noted.

1. Remove the small level check plug "V" and let the lubricant drain out into a catch pan. Note that the original lubricant contains lead. Avoid contact and dispose of it appropriately.
2. Remove the 3 bolts that secure the side of the case.

3. Free the side cover. The side cover gaskets often adhere tightly to the castings. Try knocking a bolt lug of the cover with a soft mallet to get movement. If that does not work, look for a spot where the cover extends beyond the housing and tap that shoulder with a soft punch.
4. Once free, Remove the cover "F". Then you can slide the exposed tapered roller bearing "N" off the shaft. (See the next step for plane bearing models.)
5. Remove the cover / plane bearing assembly. If it does not slide off freely, dress the shaft until it does.
6. Remove the adjusting plug "R" per the General Tips.
7. The forward bearing race "M" can be easily removed.
8. The forward bearing "P" may be stubborn due to a prick punch divot on the shaft. If it resists, leave it alone for now.
19. The next step will be to remove the input / worm shaft assembly. To do so the rear end of the shaft needs to be nicely dressed so it can pass through the input bearing. File and sand the exposed shaft as needed.
9. Work the shaft forward while rotating it so the worm gear climbs across the worm wheel. You will need to hold the rearward worm spacer "G" and bearing "P" to the back so they do not collide with the worm wheel. Once the worm gear is clear of the worm wheel the worm gear / input assembly shaft will exit the front hole.
10. Pull the tine shaft assembly out through the side opening.
11. Finish disassembly by removing the bearing, retaining ring and worm spacer from the front of the input shaft. The bearing and spacer should slide off the back end.
12. Inspect the worm gear and tine shaft. Unless a defect is found leave the worm wheel mounted to the tine shaft.



a. Bronze worm wheel - (Ref.
D) Inspect for excessive wear
on teeth. Any wear beyond a
trace should be considered
suspect. Compare to the

typical profile of a new gear. Check for nicks, chips, cracks, etcetera. Inspect shaft hole and keyway for wear, cracks, etc.

- b. Tine Shaft-- (Ref. A) Inspect for wear and rough spots at the seal contact areas Check for loose fit and/or wear at worm gear area. Replace shaft only if wear is apparent and cannot be corrected with emery cloth.
 - c. Bearings-- (Ref. N & O) Thoroughly clean and inspect bearing cups and cones. Replace if rough or scored. If the machine is equipped with solid plane tine shaft bearings they should have minimal play. If they are worn out of round or have notable slop they are suspect.
 - d. Check the retaining ring "J" alongside the worm wheel. Replace it if it is distorted or if the worm wheel and/or shaft are being replaced.
13. To remove the tine shaft oil seals "Q", find a suitable driver such as a carefully chosen deep socket. Make certain that it is small enough to pass through the housing, and cover openings freely. Drive the seal into the case to remove.
- a. If the machine has plane bearings you will be driving the seal and bearing inward. The Plane bearings are intended to be removable for service and have a light press fit. A hydraulic press is desirable. A large arbor press or even a dead blow mallet will get the job done.
 - b. When driving seals or bearings be sure to protect any machined gasket contact surfaces with wood or cardboard.
14. Remove the vent plug "L" to clean and inspect.
- a. Vertical shaft models may not have a vent plug. The felt wick at the input serves as a vent.
15. Inspect the input shaft components.
- a. Worm Gear - "C" Inspect for excessive wear, chips, cracks, etc. Being harder than the worm wheel this gear is usually Okay for reuse.
 - b. Spacers - "G" Inspect spacers for excess wear, especially on the flat surfaces contacting the worm gear.
 - c. Bearings - "M" & "P" Thoroughly clean and inspect bearings, replace if rough or scored.
 - d. Retaining ring - "I" Replace if sprung, worn, or distorted.

16. Remove the input seal "H" with a seal removal tool or pry it out carefully with a small tool.
 - a. Some higher HP models have a sealed ball bearing unit. This also serves as the oil seal.
 - b. Most vertical shaft models will not have an input seal. There will probably be a felt wick, bushing and retaining ring. The wick is included in the appropriate seal set.
17. Inspect the input bushing "S" If it is no longer a close fit to the shaft it should be replaced. Wear is usually on the surface toward the engine due to belt tension. If the bushing must be removed, it can be split and removed with a small chisel or pointed punch. It is also possible to create an extractor with jacking screws.
 - a. Some higher HP models have a sealed ball bearing unit.
18. Clean all parts in solvent and perform a final part inspection.
19. Obtain needed parts and prepare for reassembly.

Reassembly of 3 bolt Case Cover Types

Housing preparation

21. Completely remove the gasket(S) from the cover / housing surfaces. Sometimes the gasket will be so compressed and oil impregnated that it appears to be part of the case. Carefully lifting with a razor blade or plastic gasket scraper will clean it up.
22. If the input bushing "S" is being replaced, press the new bushing (or bearing) into the recess.
 - a. If this is a vertical shaft model with a grease fitting. remove the grease fitting. Drill a small hole to break through the bushing to create a grease passage. Remove any burrs or chips. Reinstall the grease fitting.
23. Press the input seal "H" into the recess. The solid surface of the seal faces outward.
 - a. On vertical shaft models without an oil seal install a new 1995 felt wick, the spacer and retaining ring. These parts may vary on older models.

24. Press the tine shaft seals "Q" into the housing "E" and side cover "F". Press them until they lightly bottom out. The solid surface of the seal faces outward.
25. If the tapered roller bearings are being replaced install the races "M" in their recesses.
 - a. If equipped with solid plane bearings install them. The bearings have internal oil grooves. These grooves must be oriented to the inside so oil will flow into the journals. Press them until they are flush to the housing bores.

Tine shaft subassembly

If the shaft and/or worm wheel are being replaced do the following, otherwise skip ahead.

26. Set the key into the keyway.
27. Install the retaining ring "J".
28. Confirm the preparation of the shaft by sliding a bearing along the length. If there are any tight spots dress the shaft with a file.
29. Align the worm wheel "D" keyway with the key "AA" and press the shaft through the gear until the key engages and the gear makes contact with the retaining ring. The worm wheel is not directional, it can be installed from either side.
30. Models with plane bearings will have a large flat washer on each side to be in contact with the plane bearings / housings. See part "3" in figure 3 below.

Input / worm gear shaft assembly - phase 1

31. If the tapered roller bearings are being replaced install the rear race "M" in the housing.
32. Cover the key seats of the input shaft "B" with cellophane tape to prevent seal damage.
33. Lubricate the input seal "H" with oil.
34. Insert the input shaft into the housing so the front end is visible in the gear cavity.
35. Slide the rear tapered roller bearing "P" onto the shaft.

36. Slide a worm spacer "G" onto the shaft. The flat side is to the front so it will be against the worm gear "C".
37. Install the hypro key "AB" for the worm gear "C" in the input shaft.
38. Slide the shaft rearward so the components are at the rear of the gear cavity.

Tine Shaft Installation

39. Lubricate the housing tine shaft seal "B" with oil.
40. Install the tapered roller bearings "N" on the tine shaft "A".
41. Slide the tine shaft assembly into the housing "E" and carefully through the housing seal. The retaining ring "J" must face the cover per figure 1.

Input / worm gear shaft assembly - phase 2

42. Slide the input shaft "B" forward about 3 inches.
43. Slide the worm gear "C" onto the shaft to engage the key "AB".
44. Carefully move the input shaft and worm gear rearward and rotate to mate with the worm wheel. Rotate the shafts so the worm gear moves rearward into contact with the rear worm gear spacer and is centered over the worm wheel.
45. Slide a worm spacer "G" onto the shaft. The flat side is to the rear so it will be against the worm gear "C".
46. Install the snap ring "I" on the input shaft.
47. Push the shaft rearward until the snap ring "I" is nested in the worm gear spacer recess, and everything is stacked solid to the back.
48. Through the forward opening slide the forward tapered roller bearing "P" onto the shaft.

49. Through the forward opening install the forward bearing race "M" in the housing. This is a close slip fit.
50. Install a new o-ring "W" on the adjusting plug "R" and oil the o-ring.
51. Install the adjusting plug until tight.
52. Rap the housing and shaft ends to seat bearings.
53. Unscrew the plug by one plug notch.
54. Check for free rotation and no noticeable end play.
55. Install cotter pin.

Closure and final adjustment

56. Place the thick case gasket on the mounting surface.
57. Lubricate the side cover "F" tine shaft seal "Q" with oil.
58. Gently ease the cover with oil seal onto the shaft and past the tine bolt holes.
59. Tighten the three-case cover mounting bolts. Check freedom of rotation of the input shaft as you go. If the worm wheel gets pinched, stop to add a shim gasket.
60. Rap the housing and ends of the tine shaft each way with a mallet to seat the bearings.
61. Rotate the input shaft, checking for free rotation or binding.
62. Add thin shim gaskets as needed.
63. When the input shaft can be freely turned with the 3 case cover bolts tightened, and the tine shaft has no noticeable end play the adjustment is correct.

Reinstallation and lubrication

64. Mount the drive in the machine.
65. Reinstall the input pulley.

66. Reinstall belts and any other disassembled components.

67. Position the machine so the drive is level, or plumb and fill with lubricant so it is up to the level check plug.

68. See the lubricant section of this document for fluid specifications.

69. Reinstall level check, and vent plugs.

70. Run with no load for 5 minutes.

71. Check lubricant level.

72. Check shaft end plays.

73. Check for leaks.

74. Install tine shaft felts, see the felt section for details.

75. Install the tines.

76. Recheck end plays after first working session.

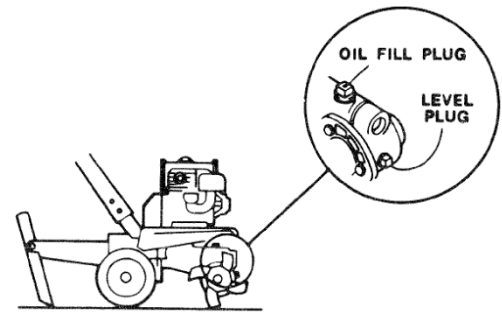
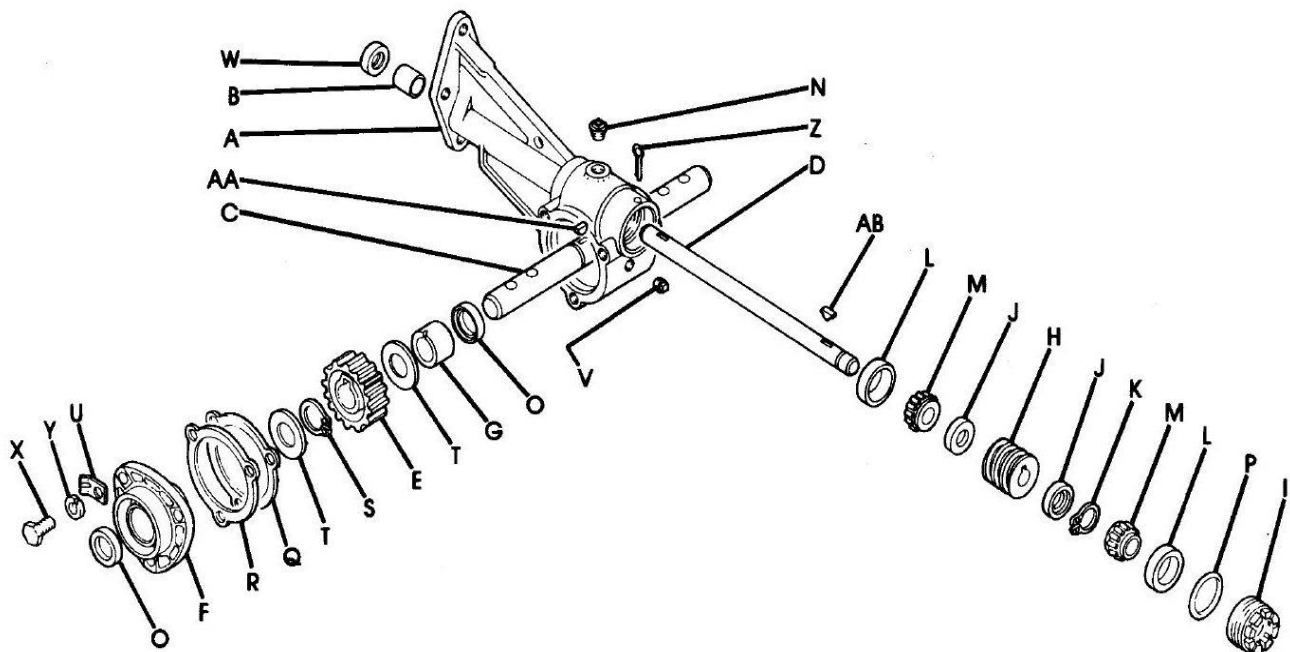


Figure 3
Aluminum Side Cover / Plane Bearing



Aluminum Side Cover Case

This case shown in figure 3 is the late version of the 3-bolt side cover case.

In the latter years as an apparent cost reduction, the cast iron cover was replaced with an aluminum part "F". Instead of the bronze plane bearing, this cover has the shaft journal machined into the part, including the lubricating oil groove. The original bronze plane bearing

"G" remains on the case side.

Things to know:

The side cover seal "O" is removed and replaced from the outside.

Due to the mix of steel and aluminum, and to avoid over torquing the aluminum cover, the three bolts are equipped with locking tabs "U". They are bent up to prevent loosening once correct bolt torque is established.

The original worm wheel "E" (#33566) in this case design is 7/8" wide at the shaft hub. It steps down to 5/8" wide up to the teeth. This is another apparent cost reduction. The replacement worm wheel is the full 7/8" width original #1004 worm wheel.

Other than these items, the parts are the same as the earlier design.

END OF SECTION

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Lubrication

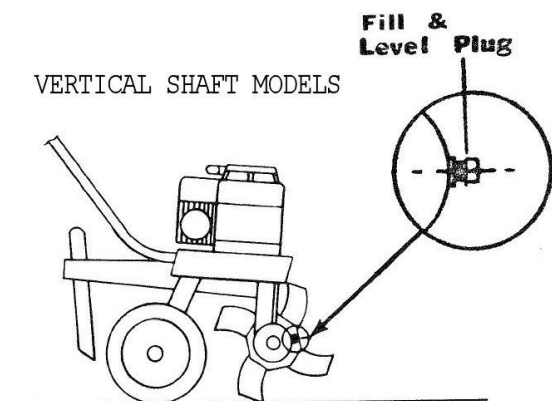
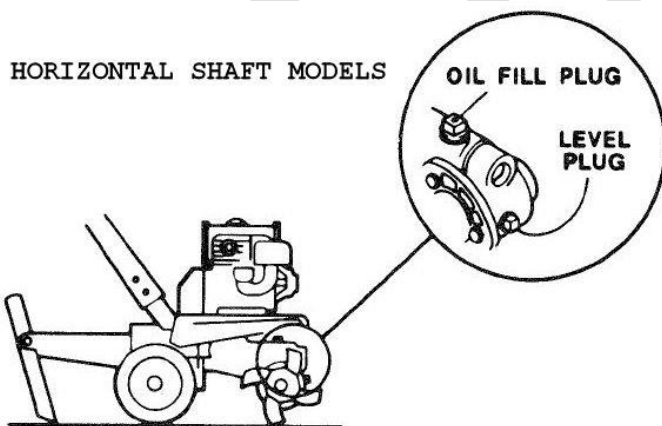
The original Gilson lubricant was lead based SAE 140 EP fluid and it was discontinued many years ago.

NOTE: Oil bath snowblowers use SAE 30 non-detergent motor oil.

Today's Options

As far as I know lead-based lubricants were phased out decades ago. Meanwhile synthetic lubricants have become commonplace. The properties of synthetic lubricants may make up for the lack of lead. Here are some options.

- 1) This is what LawnBoy/Toro is able to offer today. [#4890 \(LawnBoy/Toro# 703281\), Lubricant, 1 Pint](#) (Provided by M&D Mower)
- 2) SAE 140 synthetic and conventional lubricant is available. You may need to buy a quart or gallon, but it's out there. Visit your local auto parts store or start on Google.
- 3) Many GL fluids are not safe for use with yellow metals, including the bronze worm wheel. The sulphur content can be corrosive to yellow metals. GL-4 is generally safe. GL-5 may be safe. **Look for a product that states it is safe for use with yellow metals.**
- 4) Some owners report using readily available multi viscosity SAE 85W-140 lubricant. Multi-viscosity is never the best choice for the harshest applications, but I have not heard of problems.



END OF SECTION

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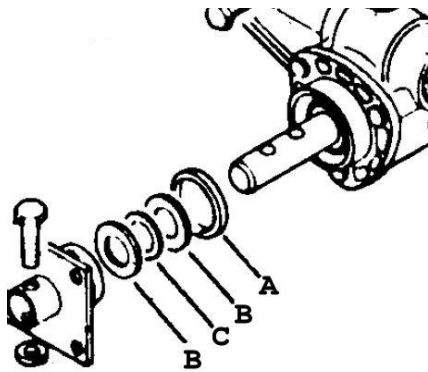
TINE SHAFT FELT SEALS

Between the gear case and tine assemblies there are sets of felt washers that serve to keep soil, clippings, roots and so forth away from the delicate oil seals. Keeping the oil seals clean is critical to long life.

Replacing felt seals will not resolve a lubricant leak. Oily felts usually mean that the oil seals have failed, and service is due.

Felt seals should be inspected and perhaps replaced any time the tine assemblies are removed. It is also wise to remove the tine assemblies from time to time simply to inspect / replace the felt seals.

There were several felt configurations used over the years. The diagram below illustrates the most common arrangement. It also serves to illustrate the common operating principle.



Felt "A" is commonly called the intermediate felt seal. It tucks into a recess in the case. When the tines are installed the cup that is part of the tine hub will press into this felt, creating a primary seal.

Felts "B" are the inner felt seals. There are usually two of these, separated by a steel washer "C". The washer allows these felts to spin against each other, so they remain stationary against the oil seal and tine hub respectively.

The arrangement will be repeated on the other side.

Felts are always installed dry. The wool is self-lubricating, you do not want to attract / retain dirt with oil.

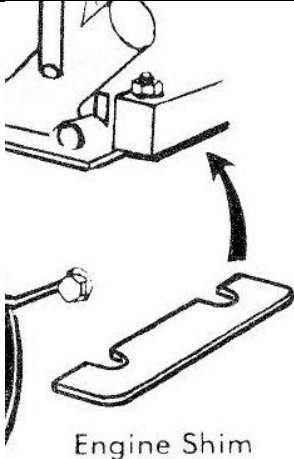
A video explaining all of this in detail can be viewed on our website.

END OF SECTION

TILLER GEAR CASE TROUBLE SHOOTING GUIDE

Problem or Failure	Probable Cause	Corrective Action
Oil leak at tine shaft	Faulty seals - old, hardened, cracked, damaged	<p>Replace seals</p> <p>Note: If the unit has been idle for an extended period the seals may have taken a set. Make sure lubricant level is correct. With the tines off the ground, run with the tines engaged for 15 minutes. If leak persists, replace oil seals.</p>
	Incorrect gear lubricant	Replace with fresh lubricant per the lubricant section of this document.
	Excess oil in gear case	Level the tiller and let excess lubricant escape through the level check plug.
	Breather hole in fill plug is blocked	Remove plug. Soak in solvent. Blow compressed air through plug, look for bubbles / foaming. If it remains clogged replace.
	Tine shaft has excessive end play	Adjustable side cover: adjust the cover / lock ring for no noticeable end play and free operation per rebuild procedure.
		3 bolt side cover: Open case to inspect for worn parts and service per rebuild procedure.

Problem or Failure	Probable Cause	Corrective Action
	Tine shaft is worn or scored in seal area	Replace tine shaft and seals
	Case cover o-ring or gasket has failed.	Replace o-ring or gasket. Lubricate o-ring liberally before installing.
Gear case cover overheats and turns black. (It is normal for the gear case to be too hot to touch after working)	Improper oil level	With the gear case leveled, add or drain to match the level check plug.
	Incorrect gear case lubricant	Replace with fresh lubricant per the lubricant section of this document.
	Improper bearing adjustment	Adjustable side cover: adjust the cover / lockring for no noticeable end play and free operation per rebuild procedure.
		3-bolt side cover: Open case to inspect for worn parts and service per rebuild procedure.
Tines do not turn or stall when engaging ground.	Belt(s) is wrong	Obtain and install a correct belt
	Belt(s) is broken	Replace belt
	Belt(s) is stretched	Install the 1/16" thick engine shims to take up slack. Remove shims when replacing the belt.
	Vertical shaft clutch is worn	Replace or get it resurfaced
	Tine hub bolt(s) are broken	Replace with heat treated bolts

Problem or Failure	Probable Cause	Corrective Action
 <p>Engine Shim</p>	Drive pulley key sheared or missing.	Replace
	Idler is not applying adequate tension.	Check idler bushing, spring, alignment, and general condition. Repair as needed.
	Internal gear case damage	Disassemble to inspect and repair
	Obstruction between tines and gear case	Look for a stone, wood or other obstruction wedged between tines and the gear case or dirt shield and remove obstruction.
Worm shaft bearing plug has a hole	Incorrect bearing adjustment	Replace the plug and adjust per service procedure
	Worm gear / input shaft retaining ring has failed	Gain access to the snap ring location, inspect and repair as needed.
Bronze worm wheel fails prematurely (Nearly all worm wheel failures are the result of low or improper lubricant)	Incorrect lubricant level	Repair the case. With the gear case level, fill to the level check plug with the correct fluid per the lubricant section of this document.
	Excessive end play of tine shaft	Adjustable side cover: adjust the cover / lockring for no noticeable end play and free operation per rebuild procedure.
		3 bolt side cover: Open case to inspect for worn parts and

Problem or Failure	Probable Cause	Corrective Action
		service per rebuild procedure.
	Worn tine shaft plane bearing(s)	Check bronze tine shaft bushing or aluminum cover journal (if so equipped) for noticeable wear.
	Idler spring mounted to wrong side	The spring on 1 and 2 speed models belongs on the left-hand side (from the operating position). Some models use a torsion spring around the engine mounting bolt. Four speed models are sprung from the left.
Input shaft has radial free play	Replace the bronze bushing, or ball bearing if so equipped.	On vertical shaft models, drill a new grease passage hole in the new bushing through the grease fitting port, into the bore.
Note: Whenever tine hubs are removed, install fresh felt seals with specified washers to keep dirt from entering the rubber seal area.		

END OF SECTION