

# Checking the Reverse Disc and Testing Reverse Operation

**CAUTION:** Stop engine and disconnect spark plug wire before inspecting, adjusting or repairing machine.

## Reverse Disc Inspection

When you lift the Forward/Neutral/Reverse Lever all the way up for Reverse, it lowers the rotating rubber reverse disc (on the end of the engine pulley) until it contacts the transmission drive pulley—see Photo 6/23.

At this time the drive belt is slack, and the resultant friction between the disc and the pulley causes the transmission drive shaft (connected to the pulley) to be driven in a counterclockwise direction, as viewed from the engine end of the tiller. The drive shaft then turns all of the gears and shafts in the opposite direction of Forward.

Because it is a wearing part, the disc should be inspected after each 30 hours of operation for signs of excessive wear. As a guide to when replacement is needed, measure the width of its facing edge, as shown in Photo 6/24. The disc should be replaced BEFORE the edge is allowed to reach 1/8-inch thickness. If the disc wears further than that, then only the metal plate will remain and it could cause damage to the engine or transmission pulleys—a costly repair!

When checking for wear, also look for large cracks or missing chunks of rubber. Small nicks and gouges are usually nothing to worry about, but you should keep a close eye on them. A disc having large cracks or gouges should be replaced.

You can help extend the disc's life by always coming to a Neutral "stop" before shifting from Forward into Reverse. This pause allows the transmission pulley to come to a complete halt before contacting the spinning disc, thus reducing the amount of initial friction between them.

Also, please remember that the disc is not designed for long periods of continuous reverse operation. Always avoid prolonged use of reverse with any attachment.

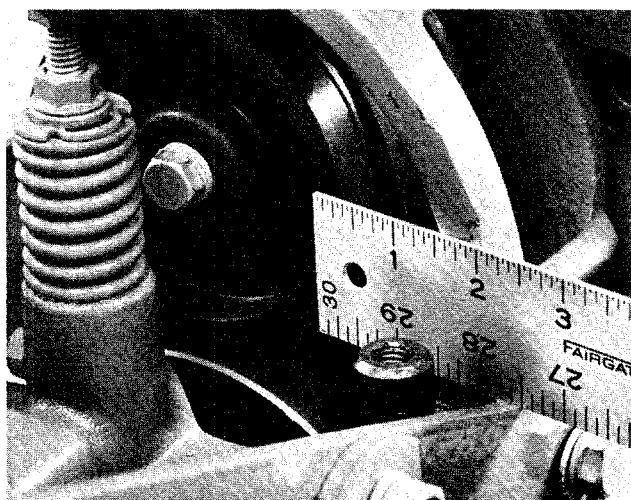
If the disc ever needs replacing, please refer to the simple instructions in Section 7.

## Testing Reverse Operation

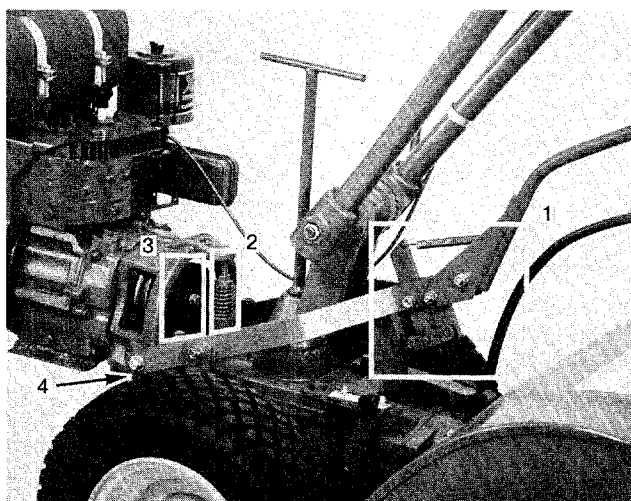
To operate your tiller in reverse, you know that you must lift and hold the Forward/Reverse Lever in an upward position. When you do, it brings into play primarily four components that control the tiller's reverse action. As shown in Photo 6/25, they are (1) the Forward/Reverse assembly, (2)



**6/23—In Reverse, rubber disc drives transmission pulley.**



**6/24—Measure disc edge for wear.**



**6/25—All of these parts affect reverse operation.**

the Reverse Spring and Plunger assembly, (3) the Reverse Disc, and (4) the Transmission Drive Pulley.

You'll note that whenever you shift up into Reverse, the engine and its mount come down to press on the Reverse Adjustment Bolt—see Photo 6/26. This action compresses the Reverse Spring and Plunger Assembly, requiring you to hold the lever up in Reverse. When you let go of the lever, the spring automatically pushes the lever back into Neutral.

The Spring and Plunger Assembly is designed to prevent the reverse disc from making contact with the transmission pulley until you decide to shift into Reverse. The lowering engine mount compresses the spring enough to “pop” the lever back into Neutral when it is released. When the lever is in Neutral, the tab on the engine mount should be resting squarely on top of the plunger bolt, or close enough to it so that you can hardly see daylight between them—see Photo 6/26.

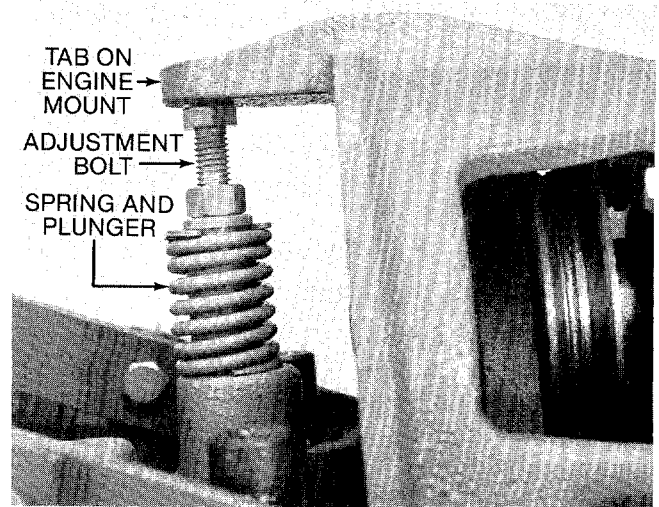
The plunger bolt can be adjusted to various heights to correct a number of reverse operating problems, as explained below.

### **Watch Action of Reverse Disc and Pulley**

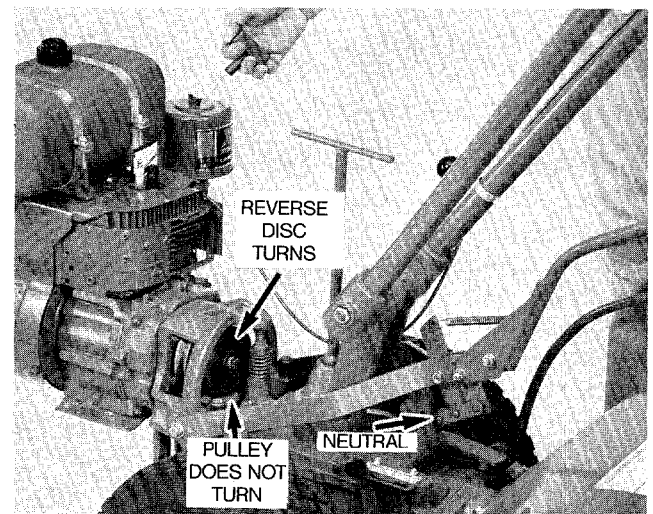
**1.** Shift the Forward/Neutral/Reverse Lever into Neutral and disconnect the spark plug wire. Now, pull the engine starter rope, briefly (Photo 6/27). As you do, the reverse disc should turn, but the lower pulley should not. When the Lever is in the Neutral position, the Rubber Reverse Disc should be located above the flat surface of the transmission pulley (see Photo 6/28)—thus preventing the reverse disc from driving the pulley. If the disc is closer than 3/16-inch, or if the disc DOES turn the lower pulley when the lever is in Neutral, then the plunger bolt should be adjusted upward, as explained in “How To Adjust Your Reverse Action”. This adjustment will also correct the problem of a tiller that goes into Reverse by itself.

**2.** Now, while the spark plug wire is still disconnected, reach under the handlebars and pull the Lever up into Reverse—Photo 6/29. As you do, the reverse disc should be lowered until it comes into contact with the lower pulley.

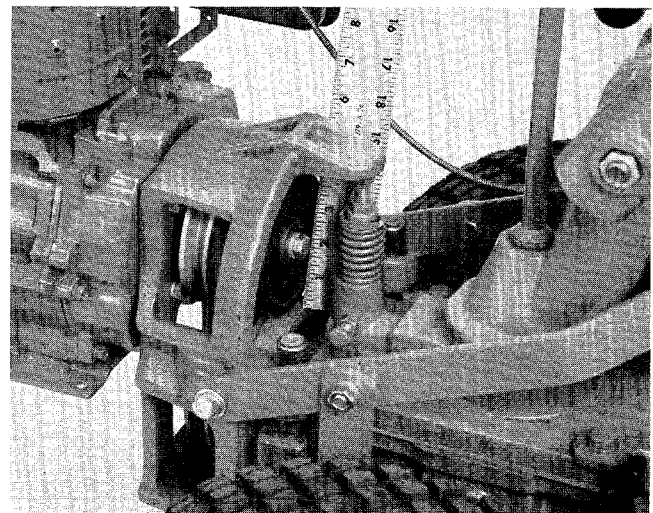
Next, while still holding the lever up in reverse, use your other hand to briefly pull the starter rope. This time, the reverse disc and the lower pulley should both turn. If they don't, or if you find it takes too much pressure to hold the lever up in reverse, then turn the plunger bolt downward. When adjusted correctly, the Forward/Reverse Lever should “pop” out of Reverse when the lever is released, but it should not require exceptional strength to hold it in Reverse.



**6/26—Engine mount tab rests on plunger bolt.**



**6/27—With Forward/Neutral/Reverse Lever in Neutral, reverse disc should not contact lower pulley.**



**6/28—In Neutral, reverse disc should be at least 3/16-inch above lower pulley.**

Please remember that whenever your tiller is in Reverse, the lever should return to Neutral when you let go! If it doesn't, raise the adjustment bolt until it does.

If adjusting the plunger bolt does not result in a properly functioning Reverse, please check these additional points:

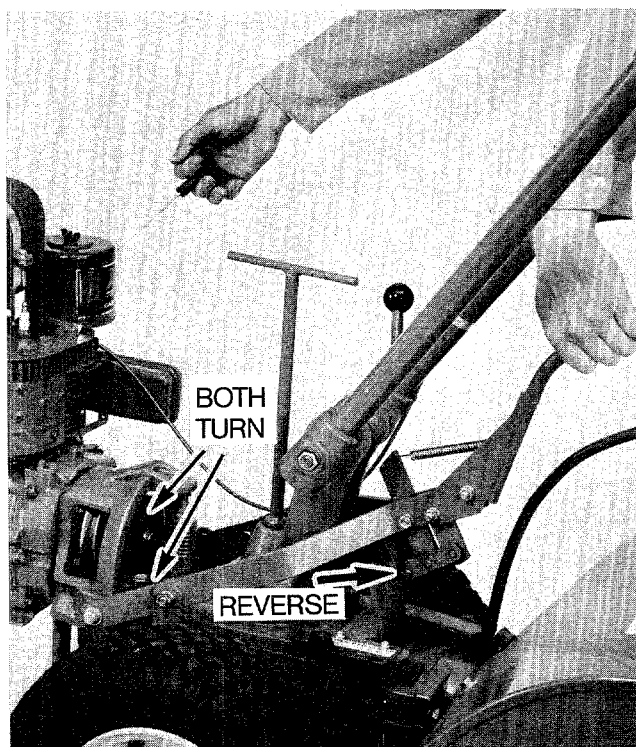
1. Make sure that the linkages for the Forward/Neutral/Reverse Lever are lubricated with oil.
2. Make sure that the engine mount bars and the belt adjustment block are greased.

If these checks have not determined a cause for your improper reverse action, please call or write our Technical Service Department for further advice.

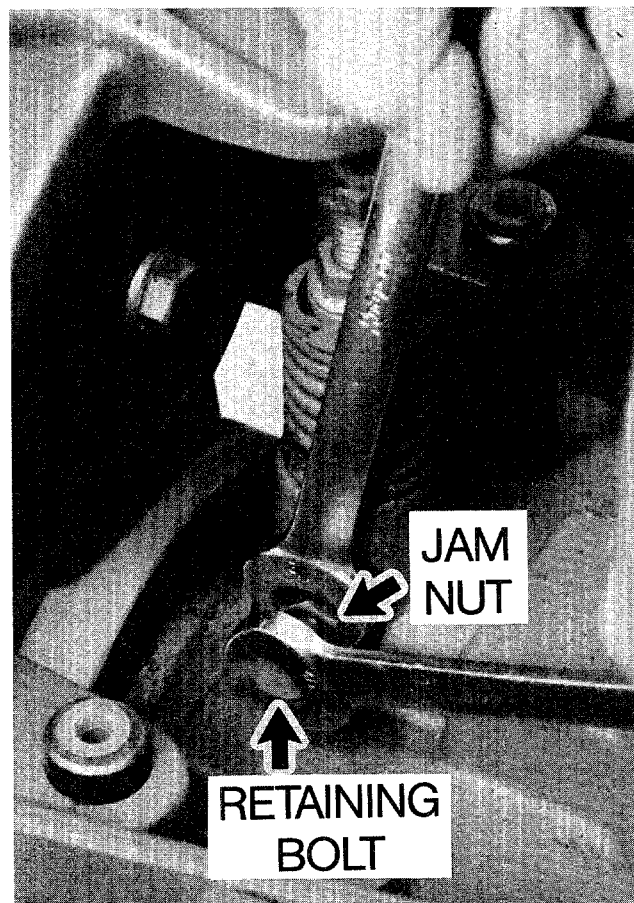
### How to Adjust Your Reverse Action

To make an adjustment (either up or down) to the neutral plunger bolt:

1. With the spark plug wire removed from the spark plug, place the Forward/Neutral/Reverse Lever in Forward.
2. While standing on the left side of the tiller, place a 1/2-inch wrench on the plunger retaining bolt and another 1/2-inch wrench on the jam nut next to it—see Photo 6/30. Now, hold the bolt steady while you loosen the jam nut by turning it counterclockwise. Unthread the jam nut until it touches the head of the retaining bolt.
3. Using your 1/2-inch wrench, turn the retaining bolt to the right, until it is tight against the plunger inside the spring. It must be good and tight to prevent the plunger from turning when you go to the next step, but be careful not to overtighten and break the bolt.
4. Using two 9/16-inch wrenches, loosen the self-locking jam nut on the plunger adjustment bolt—see Photo 6/31. Unthread the jam nut 3 or 4 turns upward.
5. Return the Lever to Neutral. In Neutral, the tab on the motor mount should be resting on top of the plunger bolt (see Photo 6/26), and the Rubber Reverse Disc should be at least 3/16-inch above the flat surface of the transmission drive pulley, as shown in Photo 6/28. If the disc is closer than that, thread the adjustment bolt up. To move the bolt upward, turn the bolt counterclockwise (while standing on the left side of tiller).
6. Check to make sure the Reverse Disc is the correct height and then use two 9/16-inch wrenches, one to hold the bolt steady in position, while you securely tighten the locking jam nut with the second wrench—see Photo 6/31.
7. Place a chalk or pencil mark at the top edge of plunger retaining bolt and use your 1/2-inch wrench to back the bolt off a full 3/4 turn to the left—see Photo 6/32. Do not exceed this 3/4 turn,



**6/29**—With the lever in Reverse, lower pulley should be turned by reverse disc.

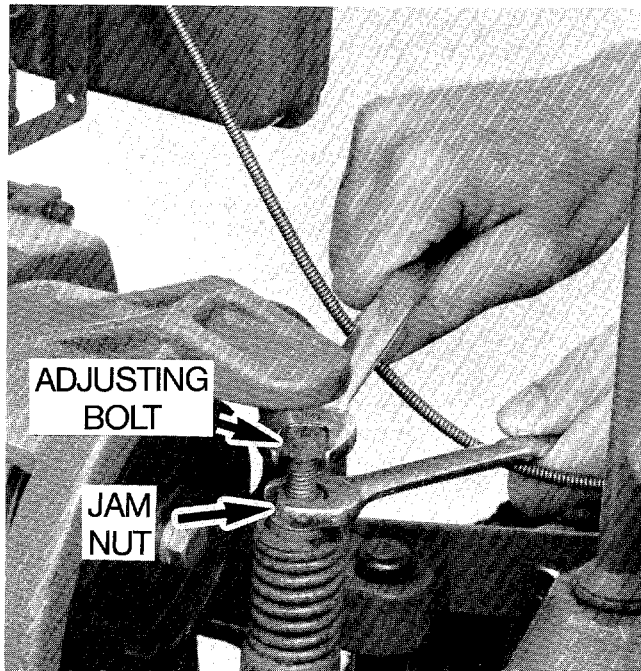


**6/30**—Use two 1/2-inch wrenches, one on jam nut and one on plunger retaining bolt.



as you could cause the bolt to disengage itself with the locking groove in the side of the plunger. Now, hold the bolt steady with one wrench, while you use your second wrench to tighten the jam nut securely against the side of the plunger housing.

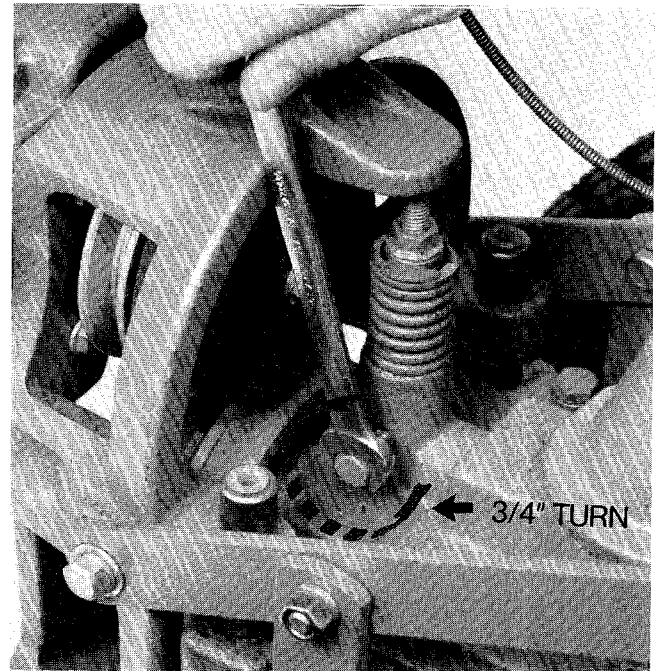
**8.** Once you have repositioned the Rubber Reverse Disc at least 3/6-inch above the lower pulley, test the action of Reverse as explained previously in the "Watch Action of Reverse Disc and Pulley" instructions.



**6/31—Loosen jam nut on plunger adjustment bolt before raising or lowering bolt.**

**IMPORTANT**

Please remember that whenever your tiller is operating in Reverse, the Forward/Neutral/Reverse Lever should return to Neutral when you let go! If it doesn't, raise the adjustment bolt until it does. **CAUTION:** When testing your reverse action with the engine running, make sure that you do so only with the Wheel Speed Shift Lever in SLOW position, and with the engine throttle set to run at a Slow Speed.



**6/32—Back off plunger retaining bolt a 3/4 turn, then tighten jam nut securely against housing.**

## Check for Gear Oil Leaks

After the first 2 hours of break-in operation, inspect the Power Unit and Tiller Attachment transmissions for any signs of oil leakage. Thereafter, check at least every 25 operating hours.

A little seepage or wetness around a shaft opening or cover is nothing to be alarmed about (just check the area occasionally to be sure it hasn't developed into a serious leak). But, if there's a heavy accumulation of oil, or if it drips while sitting overnight, then you should replace the worn seal or gasket right away (try tightening any loose screws first). This kind of leak always gets worse, and can lead to a major loss of oil.

If a leak is present, be sure to check the oil level in the appropriate transmission before operating the tiller again. If the level is low, oil should be added as explained in the "Adding Gear Oil" instructions in this Section.

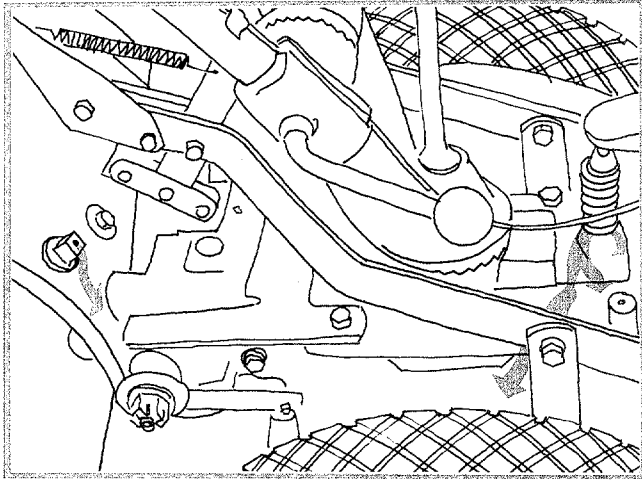
**IMPORTANT:** Do not operate your tiller if either transmission is low on oil. Doing so can result in a rapid build-up of excessive heat that can damage gears, shafts, worms, and bearings.

**CAUTION:** Stop engine and disconnect spark plug wire before inspecting, adjusting or repairing machine.

**OIL RELIEF POINTS—**During extended tiller operations, the gear oil inside the transmissions of the Power Unit and the Tiller Attachment may expand due to high temperatures (especially on hot days). To allow for this expansion, each transmission has been equipped with an Oil Relief Vent that allows small amounts of oil to seep out and thus relieve any excess pressure. As a result, some oil leakage from these two locations is normal, as long as

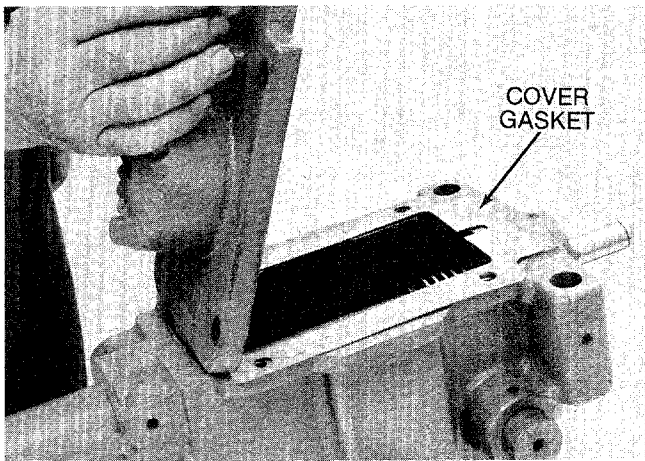
the transmissions are not overfilled.

On the Power Unit transmission, the vent is located at the bottom of the Spring and Plunger Assembly. On the Tiller Attachment transmission, the vent is a small hole located in the center of the dipstick plug. See Sketch 6/33.



**6/33—Oil relief vents.**

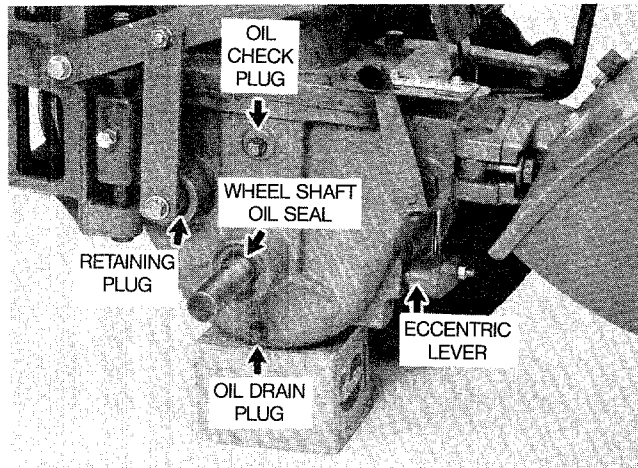
**POWER UNIT TRANSMISSION COVER**—Beneath the transmission cover (Photo 6/34) is a gasket that seals the metal surfaces between the cover and the transmission housing. A little seepage here can usually be corrected by snugging down the four screws that hold the cover in place. If the leak is serious, contact our Technical Service Department for further advice.



**6/34—Tighten four cover bolts if leakage occurs.**

**POWER UNIT WHEEL SHAFT OIL SEALS**—The left and right side wheel shaft oil seals prevent oil leaks between the wheel shaft and the transmission housing (Photo 6/35). A little wetness around the seals is not unusual. However, if the seal actually drips oil, then it should be replaced. (On a new tiller, the seal may leak until the tiller has been operating for 10 or 15 hours, during which

time the seal will have an opportunity to “lap” in). Please refer to Section 7 for wheel shaft oil seal replacement instructions.



**6/35—Plugs, wheel shaft seal and eccentric lever.**

**TILLER ATTACHMENT END CAP**—To check the end cap (Photo 6/36), gently tilt the machine forward on its engine cover. A little wetness around the cap is okay, but if there’s a heavy accumulation of oil, or if it drips oil, then check the following:

1. Three hex head screws hold the end cap in place. If they are loose, remove them and apply a non-hardening gasket sealant (available at hardware or automotive supply stores) to their threads. Replace the screws securely. If they come loose again, the problem may be a loose drive shaft that is pounding against the cap. Call our Technical Service Department for further advice.
2. If the cap and screws are tight, but you still have a leak, then the gasket beneath the cap should be replaced. Simply remove the tine hood (See Section 7 for details) and its mounting bracket and then remove the end cap. Be careful not to lose any end cap shims (they look like very thin washers) when removing or replacing the cap.



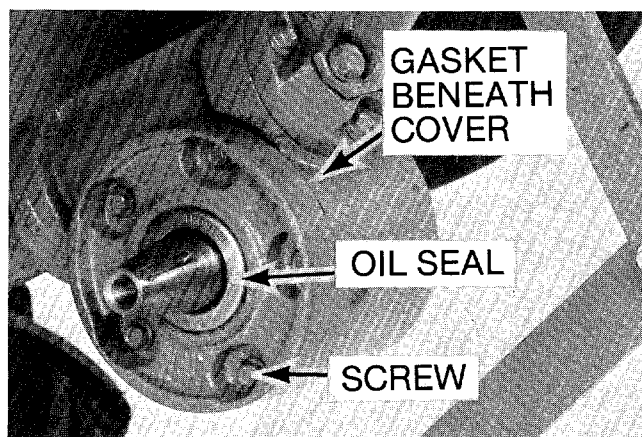
**6/36—End cap on tiller attachment.**

**TILLER ATTACHMENT HOUSING COVER AND TINE SHAFT OIL SEALS**—To examine these areas, first remove the Bolo Tines and Holders, as explained in “Cleaning the Tiller Tine Shaft” in this Section.

On the left side of the housing (Photo 6/37), an oil leak could be from the tiller shaft oil seal, from loose or unsealed screws in the housing cover, from a leaky gasket beneath the cover, or from a poor-fitting cover.

If you’re not sure, wipe off the parts and run the tiller for a short time (without the tines installed). If the seal is leaking, it can be replaced by following the directions in Section 7 of this manual. If the screws are loose, coat them with non-hardening gasket sealant and replace them securely. If the screws are tight, you may have a worn gasket, or a poor-fitting cover (rare). To replace a gasket or cover, please also refer to Section 7.

On the right side of the housing, any oil leak would have to be from the tiller shaft oil seal located there, since there is no cover or gasket on that side.



**6/37—Tiller shaft cover and oil seal.**

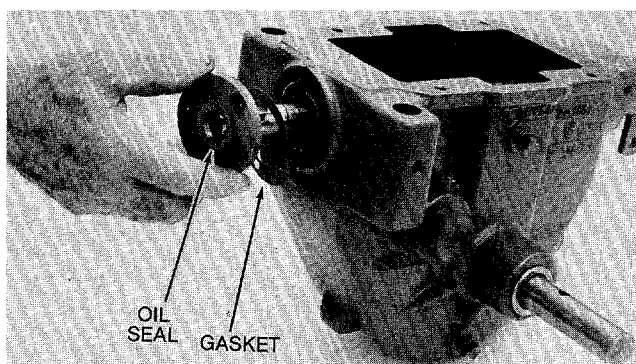
**POWER UNIT ECCENTRIC LEVER**—Behind the eccentric lever (Photo 6/35) there is an oil seal that prevents oil leaks between the eccentric shaft and the transmission housing. A little wetness here is nothing to be alarmed about. However, if there is heavy dripping, then call or write us for seal replacement instructions.

**POWER UNIT FRONT OIL SEAL**—At the front of the transmission, behind the transmission drive pulley, there is an oil seal that prevents leaks between the main drive shaft and the transmission housing (Photo 6/38). This seal is beneath the front bearing cap and isn’t visible unless you remove the engine and the lower pulley. If you suspect a leak here, check it out carefully before you go to a lot of trouble and work.

First, check to make sure the oil isn’t coming from the vent in the Reverse Spring & Plunger Assembly (Sketch 6/33) and running down the

front of the housing when you tilt the tiller forward. Also, check that the oil isn’t coming from the front of the transmission cover (Photo 6/34). Finally, make sure the oil isn’t coming from the engine oil seal located behind the engine pulley (see “Checking Engine Oil Leaks” in this Section). If this seal is leaking, have an authorized engine service dealer replace it for you.

If those areas are not leaking, then you will have to remove the engine and the lower pulley (call or write for instructions). It may be that the screws in the front bearing cap are loose, or that the gasket or oil seal needs replacing.

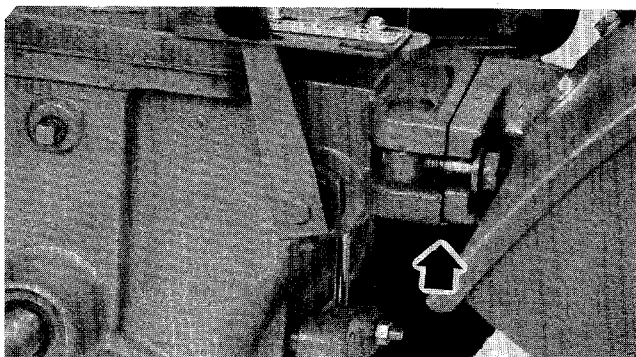


**6/38—Remove engine and lower pulley to repair front oil seal or gasket.**

**POWER UNIT SIDE AND PIPE PLUGS**—Photo 6/35 shows the locations of the Pinion Bearing Retaining Plug (side plug) and two pipe plugs. An oil leak at either the left or right side retaining plugs is usually due to a damaged or misfitting O-ring on the plug. Write or call us for O-ring replacement instructions.

A leaking pipe plug usually just needs a little tightening. If that doesn’t work, remove the plug (be prepared for gear oil to flow out) and coat its threads with non-hardening gasket sealant.

**TRANSMISSION COUPLING**—Some oil wetness where the two transmissions couple together (Photo 6/39) is not unusual. However, if there is a dripping leak, then call or write us for advice.



**6/39—Coupling point of Power Unit and Tiller Attachment transmissions.**



## Adding or Changing Transmission Gear Oil

At every 30 hours of operation you should check the gear oil levels in the transmission housings of the Power Unit and the Tine Attachment. Serious damage can be caused to the transmissions if they are allowed to run for even a short time without the proper amount of oil.

If either transmission is low on oil, you will have to add SAE #140 or SAE #90 weight transmission gear oil (the transmissions were filled with SAE #140 gear oil at the factory). You can use the SAE #140 weight oil at all times, except in temperatures below 32°F. Then, it is best to switch to SAE 90 weight oil as it will flow easier at colder temperatures. The SAE 90 weight oil can be used year-round.

The Power Unit transmission holds approximately 86 ounces (128 ounces = 1 gallon); the Tine Attachment holds approximately 16 ounces (32 ounces = 1 quart).

Gear oil should be available at well-stocked automotive service stations or supply stores. If not, take a clean container to a farm supply store, or to a tractor, truck, or heavy equipment sales and service garage. They'll usually sell you the amount you need.

**IMPORTANT:** Always use straight SAE 140 or SAE 90 gear oil. Never use multi-viscosity gear oil, motor oil, or automotive automatic transmission fluid.

Regular changing of the transmission gear oil is not required. Do so only if you know, or suspect, that it has become contaminated with dirt, sand, or metal particles.

**IMPORTANT:** The Power Unit transmission and the Tine Attachment transmission must be coupled together when checking or adding gear oil.

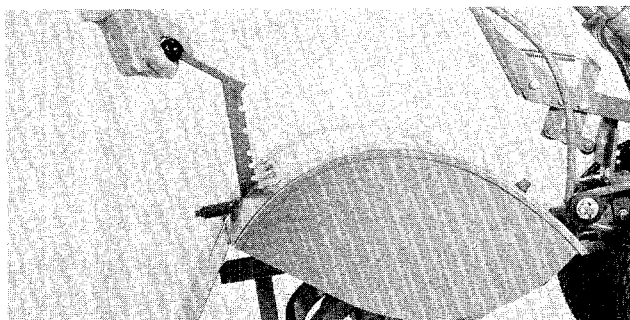
**CAUTION:** Stop the engine and disconnect the spark plug wire before checking, filling, or draining the gear oil.

### To Check the Power Unit Gear Oil Level:

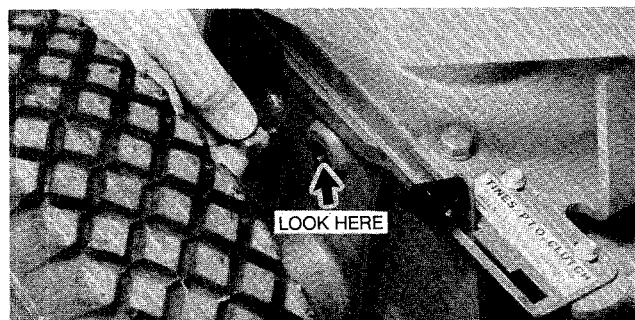
1. Start with the machine on LEVEL ground. Then, pull the Depth Regulator Lever back and then UP until the tines are on the ground—see Photo 6/40.
2. Using a 3/8-inch wrench, remove the Oil Level Check Plug from the left side of the housing (just above the wheel shaft)—see Photo 6/41.
3. If the oil level is correct, oil should start to seep out of the hole when the plug is removed. If it does, securely replace the plug. If there is no sign of oil, then add oil as described next.

### To Add Gear Oil to the Power Unit:

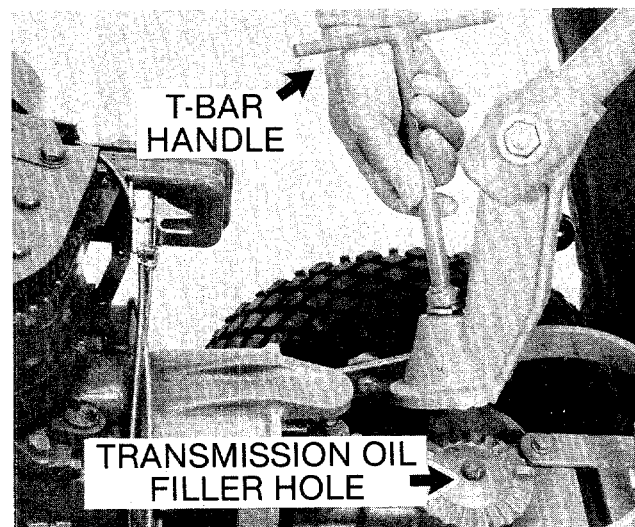
1. Begin with the machine on LEVEL ground. Then, pull the Depth Regulator Lever back and then UP until the tines are on the ground (see Photo 6/40).
2. Using a 3/8-inch wrench, remove the Oil Level Check Plug from the left side of the housing (see Photo 6/41).
3. Unthread the T-Bar Handle and remove the Handlebar Base and T-Bar, as shown in Photo 6/42. Set these parts on a clean surface so they won't pick up any dirt that could enter the transmission when they're replaced.



6/40—Move lever up to place tines on ground.



6/41—Oil should seep out of hole when level is correct.



6/42—Remove T-Bar and handlebar base.

4. Place a clean funnel inside the Oil Fill Hole of the handlebar base—see Photo 6/43. Slowly pour oil into the hole as you carefully watch the oil level check hole on the left side. Stop pouring when the oil just starts to seep out of the check hole—indicating that the level is correct.

5. Securely replace the Oil Level Plug, followed by the Handlebar Base and its T-Bar.

### To Drain the Power Unit Gear Oil:

1. Place a shallow pan beneath the Oil Drain Plug—see Photo 6/44. NOTE: In the photo we removed the wheel for clarity. You do not have to remove the wheel.

2. Using a 3/8-inch wrench, remove the Oil Level Check Plug (shown in Photo 6/41). This vents the transmission and speeds up the draining time.

3. Using a 3/8-inch wrench, remove the Oil Drain Plug, as shown in Photo 6/44. The gear oil drains slowly, so be patient. After about 2 quarts have drained out, gently tilt the tiller forward so the oil will also drain out of the transmission tube.

4. After draining the oil, clean the two Plugs and replace them securely. It's a good idea to first apply some Non-Hardening Gasket Sealant to the threads of the drain plug before replacing it.

### To Check the Tine Attachment Gear Oil Level:

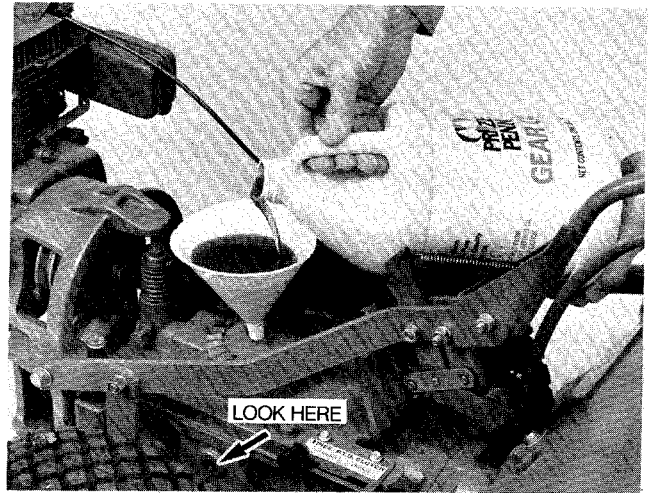
1. With the tiller on LEVEL ground, lower the Depth Regulator Lever all the way down until the tiller is resting on the drag bar that is beneath the tines. NOTE: If taking a "Cold" reading (as explained in Step 4 below), the drag bar must next be raised approximately 3½" off the ground by propping up the drag bar with a board or brick.

2. Let the tiller rest in this position for at least two minutes (or much longer, if air temperature is below 40°F).

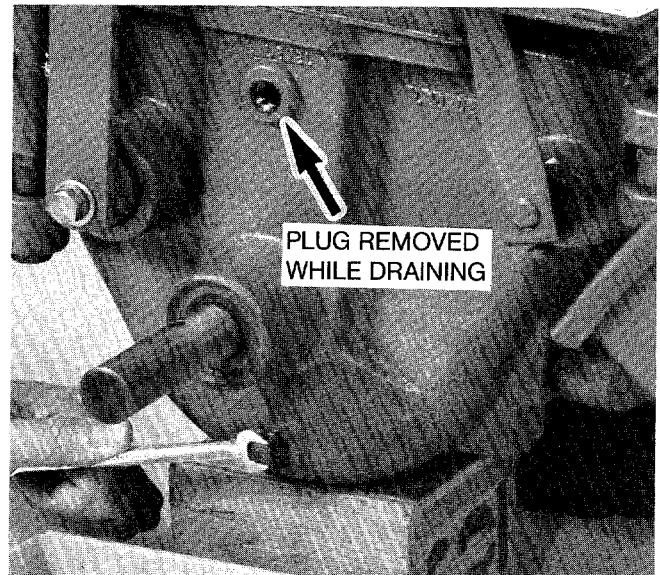
3. Using a 9/16" wrench, remove the dipstick at the front of the tine hood—see Photo 6/45. Before removing the dipstick, always clean off area around plug to prevent dirt from entering transmission.

4. Wipe off the dipstick with a clean rag and note the markings on the one side. The "Cold" range marking is for use when the machine has not been operated within the last hour. The "Hot" range (checkered pattern) is for use if you have just completed, within the last hour, at least 1/2-hour of operation.

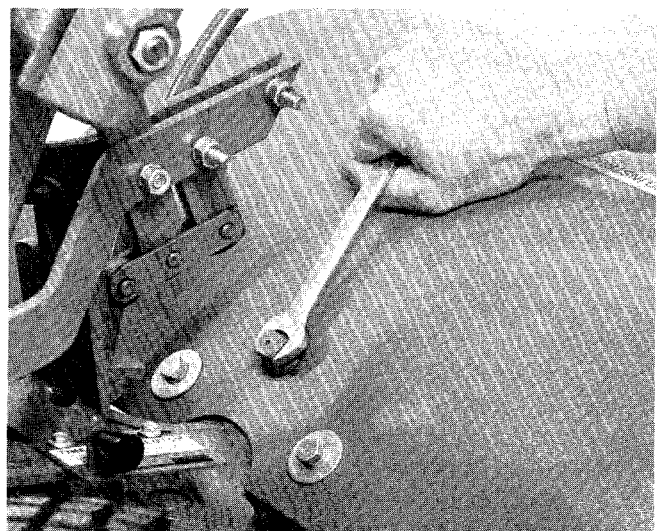
5. Hold the dipstick so that the side with the MARKINGS on it faces to the REAR of the tiller. Then while holding it STRAIGHT UP AND DOWN, lower it gently into the sump hole until the end touches the drive shaft inside the housing—see Photo 6/46.



6/43—Pour gear oil slowly into Power Unit fill hole.



6/44—Remove lower plug to drain gear oil.



6/45—Remove dipstick to check oil level.



**IMPORTANT:** Do not force, or try to thread the dipstick into the hole. Doing so will bend the dipstick and result in an incorrect reading.

**6.** After waiting a few seconds, carefully remove the dipstick and look at the markings. When taking a “Cold” reading, the oil level should be anywhere within, or above, the “Cold” range. For a “Hot” reading, the level should be anywhere within, or slightly above, the “Hot” range.

**7.** If the oil level is okay, then securely replace the dipstick. If it is low, then add oil as explained next.

### To Add Gear Oil to the Tine Attachment

**1.** Select the correct Depth Regulator setting as described below:

- If you are filling an EMPTY transmission, then you must make certain that oil gets to the rear of the unit to lubricate the tiller gear and shaft located there. To do so, raise the Depth Regulator Lever all the way UP, so that the tines are on the ground.

- If you're just adding oil to bring a low level up to the correct height, then the Depth Regulator should be all the way DOWN, so that the tines are off the ground and the machine is resting on its drag bar.

**2.** Gear oil is added through the dipstick hole, as shown in Photo 6/47. Use a clean funnel and hold it upright to avoid spillage. Pour the oil slowly, adding just ½-ounce at a time (to avoid overfilling transmission). Take dipstick readings frequently, as explained in the previous “Checking Oil Level” instructions.

**3.** When the oil level reaches the “Cold” range marking, stop pouring. Replace the dipstick securely.

### To Drain the Tine Attachment Gear Oil

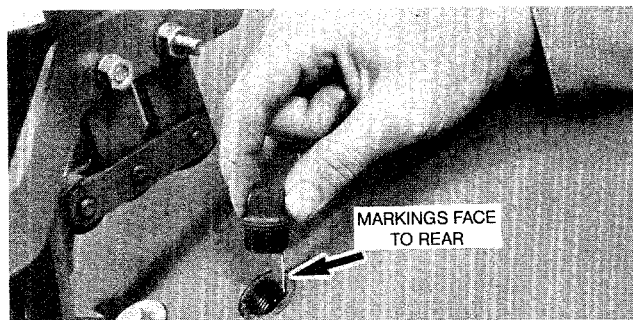
The Tiller Attachment transmission housing is not equipped with an oil drain plug. To drain just a small amount of oil, you can remove the dipstick from the tine hood and tilt the attachment forward (after first uncoupling it from the Power Unit).

To completely drain the oil, you will have to take off the housing cover (held on with five screws) from the left side of the tiller shaft (see Photo 6/48). It is possible to remove and replace the cover without damaging the oil seal inside it, but you must work carefully.

Follow the cover removal and replacement instructions in Section 7, but ignore the steps about removing and replacing the oil seal. However, before taking off the cover, remove the metal key from the shaft's keyway and carefully inspect the keyway in the tiller shaft to make sure there are no burrs or sharp edges that could cut the seal. File the keyway lightly, if necessary, being careful

to avoid the seal area. Then clean off any dirt or metal particles from the shaft. When the cover is removed, the oil will flow out (to speed up the draining, first remove the dipstick from the tine hood).

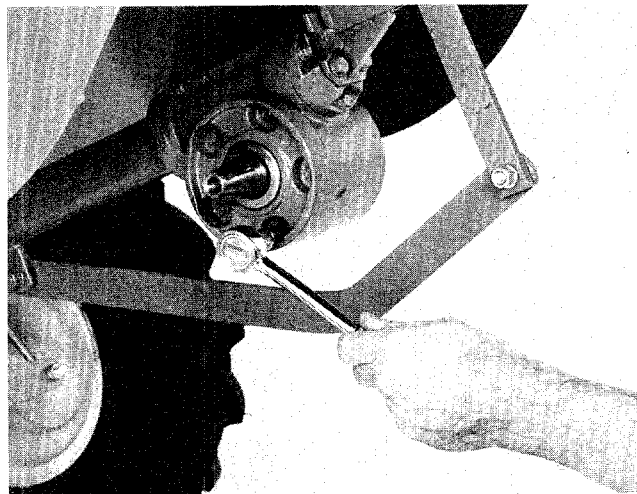
When replacing the cover, protect the seal from being cut by first wrapping the shaft with a piece of thin, flexible plastic, or even letter paper stationery. Also, be sure to replace the correct number of gaskets (one or more) and to tighten the five screws securely.



**6/46—Hold dipstick straight up and down.**



**6/47—Adding oil to Tine Attachment transmission.**



**6/48—Remove housing cover to drain Tine Attachment.**