

Finding your Bearings (or How to Think Outside the (Gear)Box

By Stephen Dukoff

The Norton gearbox was the product of AMC (now, sadly, better known as a North American chain of movie theatres). The gearbox was introduced in 1956 and continued on Nortons for the next 20 years. (It was also used on the AJS and Matchless heavyweight machines, although these marques didn't stay around as long.) A point to remember is that the AMC box was originally designed for a 500cc machine of 30 bhp. The Atlas and Commando engines tend to beat it up. While the internals of Atlas and Commando gearboxes are identical (with the exception of the mainshaft, which is different on the Commando by reason of the diaphragm clutch, and improvements in materials), the cases themselves are different. The Commando mounting lugs are about 1/8" narrower at the top than the Atlas ones, and use a spacer.

The inner layshaft bearing is the Achilles' heel of the Norton gearbox. For some reason, the factory chose to use a ball bearing, when a roller bearing would have been much more sensible. As a result, failure of this bearing is not uncommon. The good news is that, when it fails, you can usually still get home and will have little trouble in 3rd or 4th gear. The bad news is that 1st or 2nd gear become intermittently or completely unavailable, and whenever you shift the kickstart lever swings backward and then slams up into the back of your calf. Be warned: even with stout riding boots, this hurts! It is clearly your Norton's way of punishing you for lack of foresight in replacing this bearing to begin with.

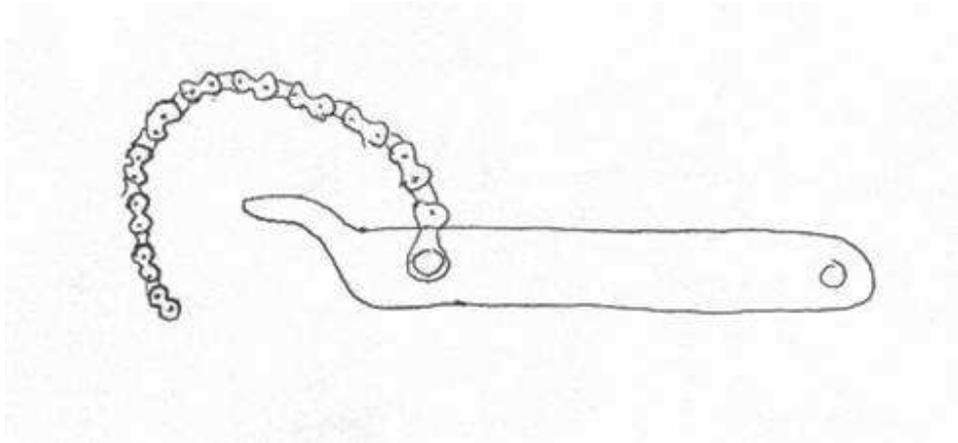
In spite of the mystique, the Norton gearbox is really quite a simple box of tricks, far less tricky than the engine. Provided you are prepared with the right tools, disassembly, inspection, replacement and re-assembly should go quite smoothly. To prepare yourself, you will need:

- a. 1/4" W (or, redundantly, 5/16" BSF) thin-walled socket, to remove the 7 nuts on the inner gear box cover. (If you haven't availed yourself of a set of Sir Joseph's tools, a 14 mm socket will fit, although it's a little large).

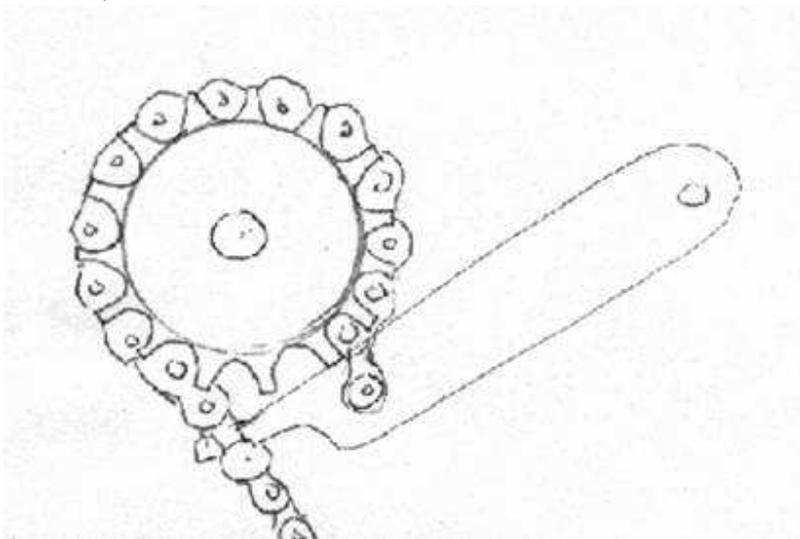
- b. a factory tool for removing the lock ring, which secures the clutch operating body (the alternative and too common use of a hammer and drift is really too crude for comment). By the way, before you remove this, use a cold chisel to put marks on the case adjacent to the slots in the clutch operating body, so that you can more easily reestablish the correct orientation during reassembly.

- c. a 7/8" W socket or box-end wrench for removing the LT-HAND nut which secures the main shaft on the countershaft sprocket. (I came up with a little ditty to help remember this: "The countershaft nut has a left-hand thread: if you put it on wrong you might end up dead." Alternatively, "The countershaft's nut must turn to the left; you'll need Arnold Schwartzegger to give the right heft.") As this is a really honking big piece of fastener, the right tool is essential

- d. Some means of spragging the countershaft sprocket to prevent it from turning whilst removing the fore-mentioned LT-HAND nut. A chain wrench can be manufactured to this purpose from an old 12" crescent wrench and a length of old rear chain. (See diagram below).



(Above: the chain tool. Note the masterful command of technical drawing.)



(Above: the chain tool wrapped around the countershaft sprocket. On the Atlas, I can tuck the end under a bolt going through the frame, so it holds solidly whilst I lunge repeatedly against the wrench on the nut.)

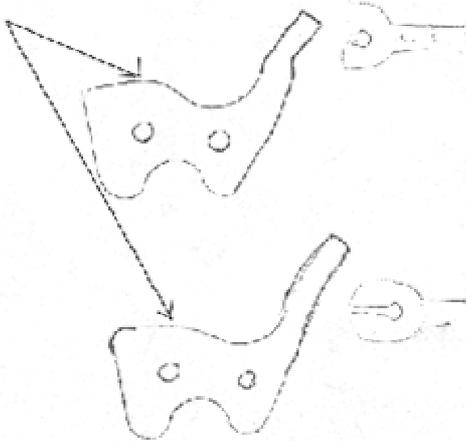
After removing the screws which secure the outer cover, and removing the kickstart lever and gearshift lever, I find that the cover can be broken loose by using an aluminum drift from the opposite side of the bike (i.e., looking through from the primary case side) and judiciously tapping sections of the outer cover that project beyond the gearbox case. Much neater than forcing a screw driver in between the outer cover and the inner cover, and wiggling away (which, from what I've seen from bikes that I've acquired, does nothing nice to the mating surfaces.)

The recommended replacement for the inner layshaft bearing is SKF # NJ203-C3. When I ordered this from Canadian Bearings, they substituted FAG NJ203E.TVP2.C3. The bearing was made in India, and all of the major bearing manufacturers apparently have factories all over the world, so it's the luck of the draw where your bearing comes from. In any event, the cost of the bearing was approximately \$42, not too hard on the pocketbook.

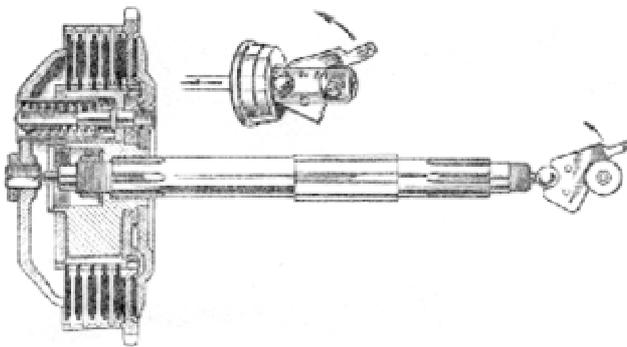
It is sometimes necessary to gently heat the area where the bearing will seat, as the bearing is supposed to be an interference fit. You're supposed to be able to do this by sticking rags soaked in boiling water into the end of the case (and throwing in a small lobster if you're doing this before dinner). Alternatively you can stick the nozzle of a propane torch into the gearbox shell, except that it eats up the oxygen rather quickly, and tends to put the flame out. No big deal, just be prepared for this to happen, and keep your striker handy. In my case, the outer race had obviously spun in its bore so, while it was a close fit, it was no longer an interference fit. That's what Loctite was made for—just make sure to keep it out of the bearing!

You need to examine all of the pinions and dogs to ensure that there is no significant wear. A good manual will show you pictures of what you shouldn't see. I usually find that there is minor pitting on the pinion surfaces, and this doesn't bother me. I've put many miles on gears with this condition and have never had any problem. Anyway, that's my opinion on a pinion. Refitting all of the gear clusters and shifter forks is obviously a reverse of what you've done to get them all out. Be very careful to ensure that the gears are replaced in exactly the same orientation, paying special attention to any gears with raised bosses. It is possible to make mistakes (I have), so it's always wise to first fit the inner cover without any gasket cement, bolt it down, and see if you can index all of the gears when rotating the rear wheel. If not, you've done something wrong and you'll need to go back in and find out what it is. Before you finally install the inner cover, though, make sure that you've inserted the roller in the knuckle pin roller in the quadrant assembly. The roller won't fit into the knuckle once the inner cover is on, which will mean removing the cover and gasket, cement and all.

Once the inner cover is on, have a look at the clutch-actuating lever. It's function is indicated in the diagram below:



Heinz Kegler (an expert on this topic) advised me to replace the stock Atlas lever with one from a Commando. Digging through my dragon's lair of parts, I found that there was indeed a difference. In the diagram below (based on tracing actual parts), you can see (following the arrows) that there is much greater curvature on the bearing surface of the Commando lever (top) than the Atlas lever (bottom). This undoubtedly contributes to a greater ramping effect, necessary on the Commando to lift the powerful diaphragm spring. This change in profile also benefits the Atlas, which, even though it uses three conventional coil springs, used to require a gorilla grip to pull the clutch before I made this change. While you're appreciating the beauty of this piece, also check the operating roller (the metal disk around which the lever pivots) for concentricity, as flats can wear on it after prolonged use. Don't discard the old one—they make lovely earrings or necklace pendants for the girlfriend. Also check the straightness of the pushrod by rolling it on a flat surface. I keep an old piece of plate glass around for this purpose. If it's bent, replace it. Also check the ends of the pushrod—if they're discoloured, you (or some previous owner) has not kept the required amount of clearance at the clutch lever, which has overheated the pushrod and caused it to lose its temper on the ends. Again, buy a new one.



It's important to ensure that the lock ring holding the clutch operating body is lined up so that the clutch cable has a straight pull on the operating lever. It can take a bit of playing around with the various pieces, as I find that when I tighten the locking ring, the clutch operating body tends to creep clockwise, getting out of alignment. So, it's best to hold the clutch operating body so that the slot is slightly counter-clockwise from where it should be (using the chisel marks suggested earlier as reference marks), to tighten the locking ring finger tight, and then to use the tool to fully tighten it in place, which will pull the clutch operating body into position. It's also a good idea to use loctite on the locking ring, as it can work itself loose again in spite of your best effort, which you'll feel as sloppy clutch action. Looking in through the inspection cover, it's never nice to see this mechanism wobbling around.

Fitting the outer case can be a source of endless entertainment. Getting the boss on the ratchet gear assembly to fit into the bushing while simultaneously lining up the pin with the hole in the knuckle pin roller requires a steady hand, the ability to see through metal, and the power to move matter with your mind. Sadly, these skills have been in decline since the demise of the British motorcycle industry. You can try to engage the kickstart pawl in the ratchet so that it's approximately lined up, and then to "offer" it to the inner case, but almost always the pawl will release the ratchet, the pin will drop out of alignment, and you'll be left chuckling again and again as you ineffectively wiggle the outer case up and down in the hope that something magical will occur. It's possible to spend the better part of an afternoon engaged in this form of amusement. However, if time is a consideration, a much better suggestion, offered in the INOA Tech Digest, is to attach the gear indicator to the ratchet gear assembly, so that you can use the indicator as a lever to move the ratchet up and down until the pin locates properly.

So there you have it. Accomplish this task and you can proudly accept the high token of esteem and admiration conveyed when your friends or family members call you a "gear head."