

## Building a better box

PART  
THE  
FIRST

**Great bikes all benefit from great gearboxes, and the Norton / AMC 4-speeder is one of the best of British. Martin Peacock shows us how to make one at least as good as new**

Photos by Martin Peacock

**A**h, the venerable AMC gearbox. More stalwart than superstar, it works well and gives years of service without complaint or need for attention. Even so, there comes a time when a strip down and overhaul is worthwhile, even if only to renew oil seals and wearing parts such as the kickstart pawl. AMC's gearbox first appeared on AJS and Matchless models in 1956. It was designed in

1953 following the AMC takeover of Norton, but its origins go back to Burman and even Sturmey-Archer gearboxes. It is simple, robust and works well. Although more than adequate for the AMC and Norton singles and twins through to the 60s, the gearbox was pushed to, and arguably beyond, its limits with the Commando range. Nonetheless, it continued in use through to the mid-70s with a left foot change version for the last of the line, the Mk III 850 Commando.

There were a few changes over the years, notably a kickstart modification in 1962. The top mounting boss was made 1/8" narrower for the Commando range to make fitting and removal easier, with the gap filled by a spacer once in place. Other changes for the Commando included strengthening the teeth and a ratio change (18/24 to 18/23 teeth) to



Early, 1961, version of the AMC / Norton box, seen here on a Matchless G80CS



Late version of the box fitted to a 1973 850 Commando Mk II

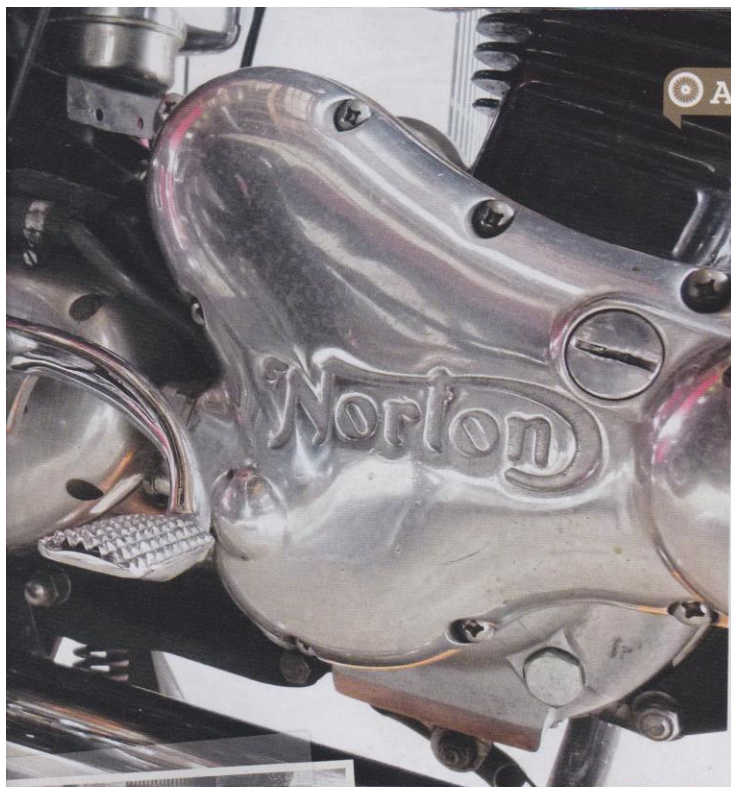
the fourth layshaft and sleeve gear pair from number 128646 on. This raised the ratios for first, second and third gears. The direct drive top gear of course remained the same at 1:1. A further change for the 850 range from number 306591 increased the ratio of the second gear pair to reduce engine speeds and help with noise regulation compliance.

These do not affect the rebuild procedure, although it is important to get the correct parts. Fortunately, this is made easier through the gearboxes being identified by stampings on the inner cover or on the top mounting lug for the Commando:

- 'M' Matchless and AJS
- 'N' Norton (MA or NA after the kickstart modification)
- Numbers 100,000 to 200,000: Commando 750
- Numbers 300,000 on: Commando 850

This guide to stripping and rebuilding an AMC gearbox does not cover all possibilities for carrying out the job or details for specific versions. You should consult the Workshop Manual for your specific model or some of the guides and diagrams to be found on the weird wobbly web. The work can be carried out by any reasonably well equipped enthusiast, but a gearbox failure is a serious thing, possibly fatal, so, if in doubt, get some expert help.



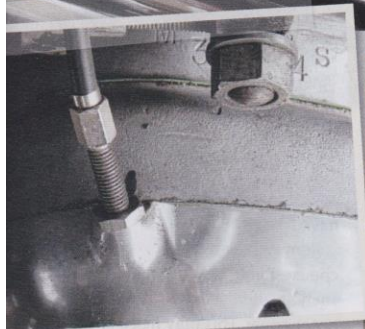


## AMC GEARBOX OVERHAUL



**Above:** Clutch operating mechanism lock ring tool. I modified this one by boring a hole in the end so I could hold the operating arm slot in alignment while tightening the lock ring

**Below:** Outer cover showing the ratchet plate, hairpin spring, pawl and gearchange shaft with quadrant. The splined shaft in the ratchet quadrant couples to the Mk3 Commando crossover shaft for the left foot change



**Marking the clutch cable entry point**

fasteners are BSF or Cycle (BSC) threads, so use Whitworth spanners to hand – including 8" W box spanner for the gearbox sprocket. The quoted torque settings are for a Commando Mk3 gearbox, these may not be correct for all variants of the AMC box. For the stripdown have three or more trays or boxes to hold the parts from the outer cover, inner cover and gearbox shell. A notebook and camera too are invaluable for documenting dismantling work to aid reassembly. Plan to replace the seals and gaskets as a matter of course. A possible exception is the camplate. This can be left in place as there is leakage from the camplate or other problem needing attention. Replacing the gearbox sprocket is also a good idea unless it is in very good condition. This is of course, an opportunity to change the all gearing if desired.



### Sprocket and Mainshaft Nuts

Removal of the sprocket and mainshaft retaining nuts can be done with the gearbox in place or after its removal from the bike. The sprocket thread is left-handed and there is a lock plate, held by a small screw, that needs to be removed first. The protruding mainshaft means using a box or ring spanner for this job. If, however, the nut is very stubborn and you need to use a socket, you can begin the stripdown and undo the nut once the mainshaft is out.



**Inner cover with kickstart shaft and quadrant arm roller in position. The boss to the right of the quadrant arm is for the left foot change crossover shaft. This normally holds a bush for the gearchange shaft**





Matchless outer cover with the ratchet plate and gearchange return spring in place. The gearchange shaft with its pawl is above the outer cover. The mainshaft bearing can be seen in the inner cover on the left.

Both the mainshaft and sprocket (sleeve gear) need to be locked to undo their respective retaining nuts. The simplest method is to select a gear, preferably top, and lock the sprocket either with the main chain and brake or a chain wrapped around the sprocket and clamped. This will allow loosening of both the sprocket and mainshaft nuts.

If you have already removed the outer cover, select a gear by carefully levering the selector quadrant with a screwdriver. Do not, even for a moment, consider clamping the mainshaft splines in a vice. You can, however, fit an old clutch centre over the mainshaft and clamp that.

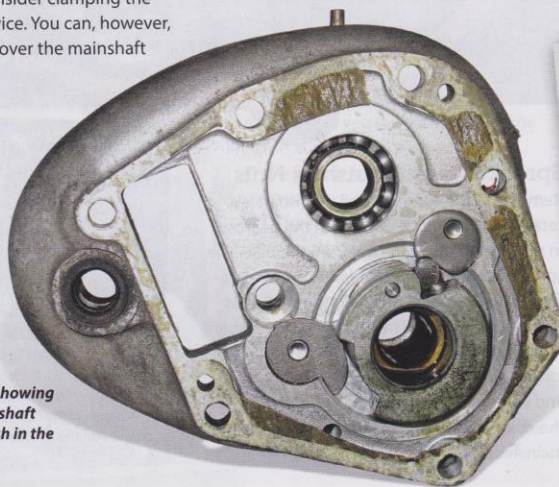
### Outer and Inner Covers

If you haven't already, drain the oil and disconnect the clutch cable. Mark the inner cover in line with the clutch cable entry point on the outer cover. This is to help align the clutch release mechanism on reassembly. Remove the kickstart and gear indicator. Note that the retaining bolt must be removed to slide the kickstart off its splines. Leave the gear lever in place to help with outer cover removal. Mk3

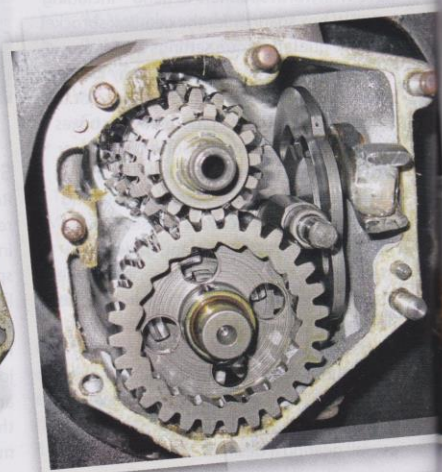
Commando owners with the gear lever attached to the primary chaincase will just have to do their best.

Remove the outer cover screws, usually cheese-head but you may find alternatives such as Allen screws. Carefully remove the outer cover. This may need application of a soft-faced hammer to release the sealant. The cover comes away with the ratchet mechanism attached.

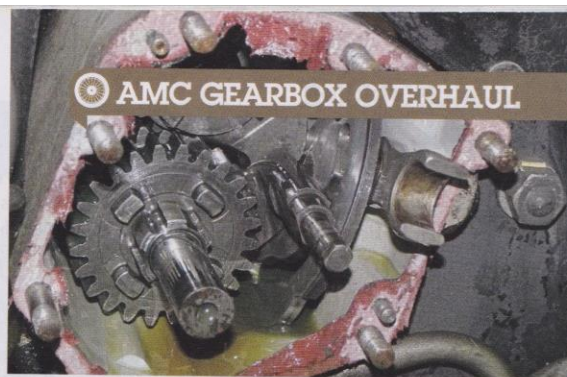
Remove the ratchet plate, hairpin spring,



Inner cover reverse side showing the kickstart stops, mainshaft bearing and layshaft bush in the kickstart shaft







**AMC GEARBOX OVERHAUL**  
Above: Matchless gearbox inner cover removed. Mainshaft removed, selector and selector shaft still in place. The layshaft second gear kickstart drive dogs are in good condition

Left: Main and lay shafts. These are from the 61 Matchless

Below: Main (left) and lay shafts from a Mk3 Commando, with selectors



Right: One worn kickstart pawl. Inexpensive and easily replaced

Below: First gear layshaft with kickstart ratchet teeth and engagement holes for the second gear dogs. The ratchet teeth are worn but not enough to spring £90+ for a new gear. A new pawl was sufficient in this case

Left: Commando box: mainshaft (upper), layshaft, selectors and camplate in place



gearchange shaft and quadrant, noting the large shim washer location. Inspect them for wear, especially the spring as this has a big effect on changing gear and the 'feel' of the gearbox. Undo the two bolts retaining the gearchange stop plate. Remove and inspect the gearchange return spring as this too needs to be in good condition. Also check the fit of the gearchange shaft in its bushes.

Undo the clutch operating lever locknut and screw, then pull the roller and operating lever out watching for the 0.5" ball bearing that bears against the pushrod. Note how these parts go together, as it is not intuitive. The kickstart spring can be removed either at this point or after removal of the inner cover. Use a screwdriver with care to lever the spring from its locating dowel in the inner cover.

The clutch operating body lock ring should be unscrewed with a special tool, but a punch or small, soft drift will do if used with care. This may be the best option if past abuse has damaged the notches for the tool. Removal of the lock ring and clutch operating body will expose the mainshaft nut (½" BSF). Remove this with a socket spanner having locked the mainshaft as described earlier. The gearbox sprocket can also be removed at this point.

Select neutral and undo the seven nuts holding the inner cover. These need both an

open-ended and socket spanner because of limited clearances in places. Hold the kickstart shaft while removing the cover, tap with a soft-faced hammer if necessary. The gearchange quadrant roller may fall out at this point, if not remove it and keep with the inner cover components. Remember that the roller can only be fitted before the inner cover is replaced.

Remove the kickstart shaft taking care with the pawl, spring and other components. Inspect the pawl for wear and replace parts if there is more than nominal wear. Check the spring free length (1.3 – 1.4") and replace it if is too short. Keep this and other small groups of parts together.

Check the two kickstart stops for burring, loose rivets or other damage. These are part of the inner cover and will require some expert repair work or replacement of the inner cover if the stops are too badly worn or damaged.

Examine the kickstart shaft for wear or cracking and check the fit in the inner and outer covers. New bushes are relatively cheap and should be replaced if there is any doubt. Similarly, check the layshaft bush inside the shaft. This is a weakness of the Commando gearboxes and should be replaced as a precaution even if there is little evidence of wear.



## RealClassic

### Gear Cluster

Remove the layshaft bottom gear. Inspect the internal kickstart ratchet teeth and engagement holes for undue wear as well as the gear teeth themselves. Unscrew the selector shaft with an 8mm spanner applied across the flats on the end. Pull it out and check that it is unworn and true.

Now pull the layshaft out complete with its gears and selector. It may require some wriggling to free it from the inner bearing or, if all else fails, heat the casing to release the bearing with the layshaft. Set it down and take the time to photograph and note the positions of the gears, selectors and other components.

Remove the mainshaft with its gears and selector. Again, note how the gears, selector and bushes are assembled on the shaft. The selectors are the same and can be swapped, but it is preferable to keep them with their respective gear trains. Check that the selector forks are straight and the tips are not worn.

Use a soft-faced hammer or soft drift to drive the sleeve gear (top gear) back into the gearbox shell. If the mainshaft bearing comes out too, it is an indication of wear in the bearing housing. If the wear is not excessive, consider using Loctite 641 (bearing retainer) or similar product to refit the bearing.

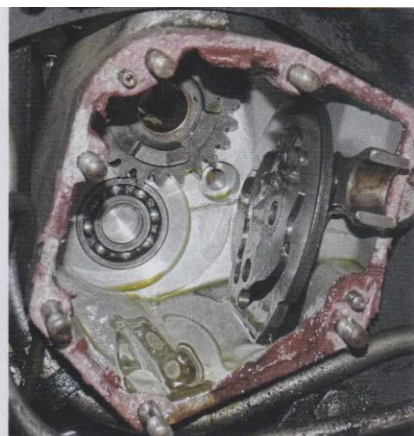
Remove the spacer from the oil seal and

then lever out the seal itself. Check the spacer for wear. This takes the form of a groove worn where it is in contact with the seal. If this is the case, replace the spacer as well as the seal.

Heat the back of the gearbox shell (no more than 100-150°C) to remove the main and layshaft bearings. These should drop out or require no more than some light taps to free them from the case. Remove the mainshaft bearing from the inner cover in similar fashion.

Check the bearings by flushing out the oil and then spinning them while listening for smooth rotation with no rough spots. Also, check for side play between the inner and outer races, this should be negligible. If in doubt, replace one or both bearings. If it is a Commando gearbox that still has a layshaft ball bearing, replace it with a new 'superblend' type as a matter of course.

Examine all the gears and dogs for wear or cracking. Take care to note which way round they fit as it is easy to replace them incorrectly. Also check that the gears are an easy, sliding fit on their bushes and are able to rotate with no resistance. The bushes are not expensive and are easily replaced if there is any doubt about their condition. If any gears need replacing because of tooth wear or damage, also replace the mating gear even if there is no apparent wear.

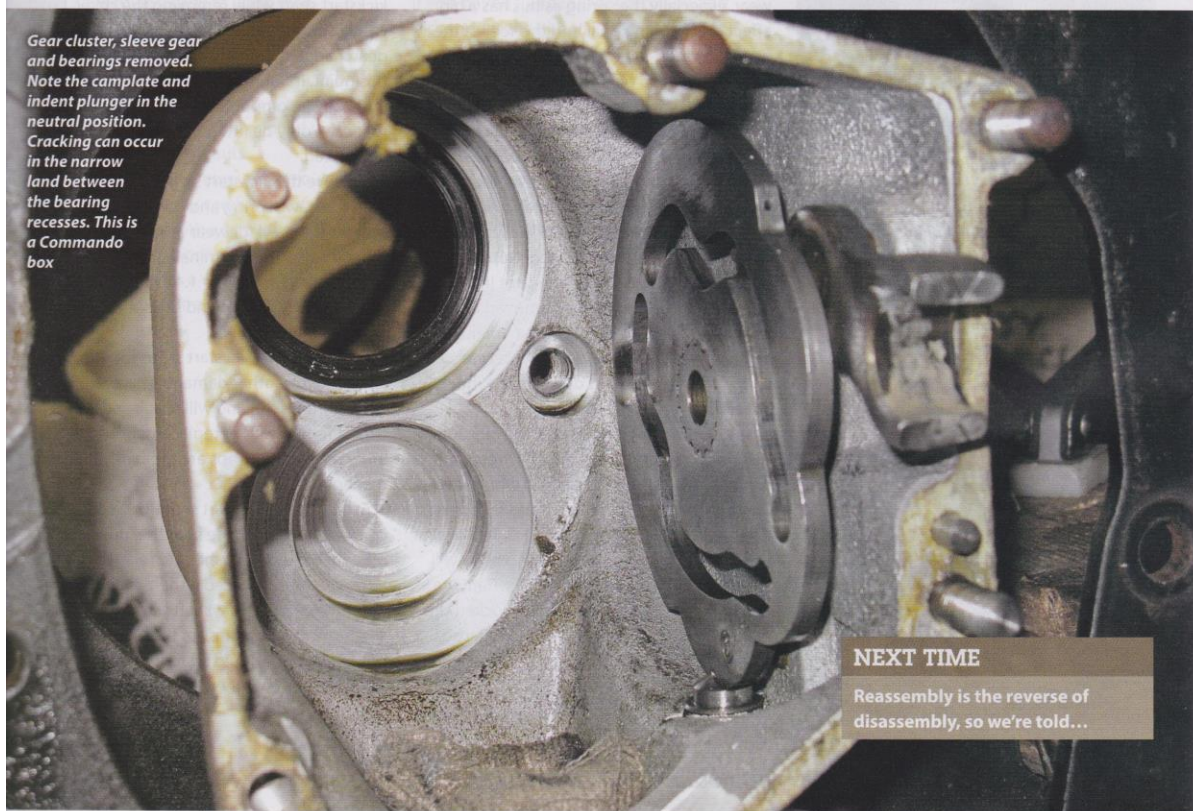


**Gearbox cogs removed. Layshaft bearing, sleeve gear and camplate still in place. Matchless gearbox with layshaft ball bearing**

Inspect both the mainshaft and layshaft for wear or damage to the splines, threads and bearing surfaces. Also check that they are straight. Clean out the gearbox casing and check it for damage, especially cracking in the narrow land between the mainshaft and layshaft bearings. Also check this area from the outside.

As already noted, the camplate and its indent plunger can stay in place unless there is a suspected problem with them. If this is the case, check the camplate for wear or damage and remove the plunger and its spring for inspection. **Rc**

**Gear cluster, sleeve gear and bearings removed. Note the camplate and indent plunger in the neutral position. Cracking can occur in the narrow land between the bearing recesses. This is a Commando box**



### NEXT TIME

Reassembly is the reverse of disassembly, so we're told...