

Changing the differential thrust washers on an MGBGT V8

Dugald MacNeill went up to Norfolk recently to visit his old friend Mike Macartney and while he was there Mike very kindly offered to help Dugald change the differential thrust washers on his Factory MGB GT V8. The car had been comprehensively restored four years ago but there had been a back axle clunk for some time and Dugald had been working himself up to fixing it. Dugald took photos during the work and explains how the job was done.

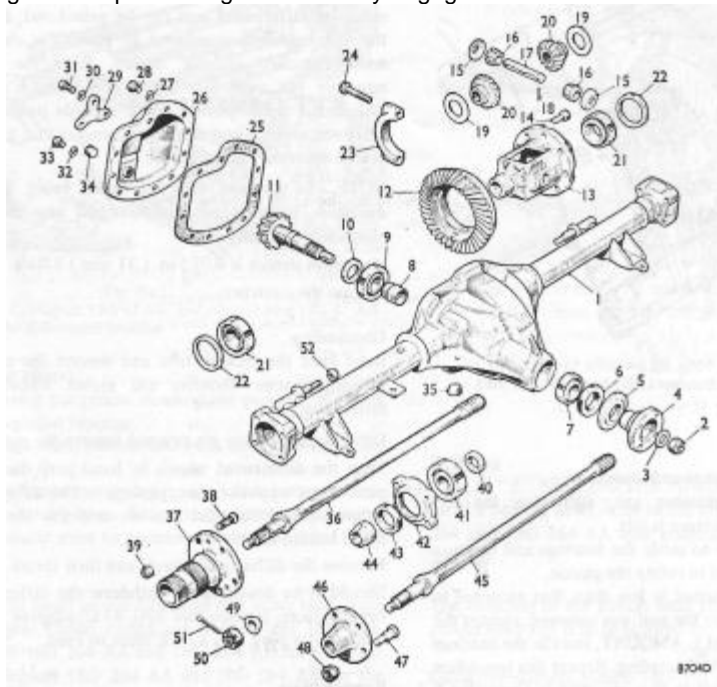
What do the thrust washers do?

Before I tell you about how we went about changing the thrust washers in the differential, perhaps I should describe what the thrust washers do and why they may need changing.

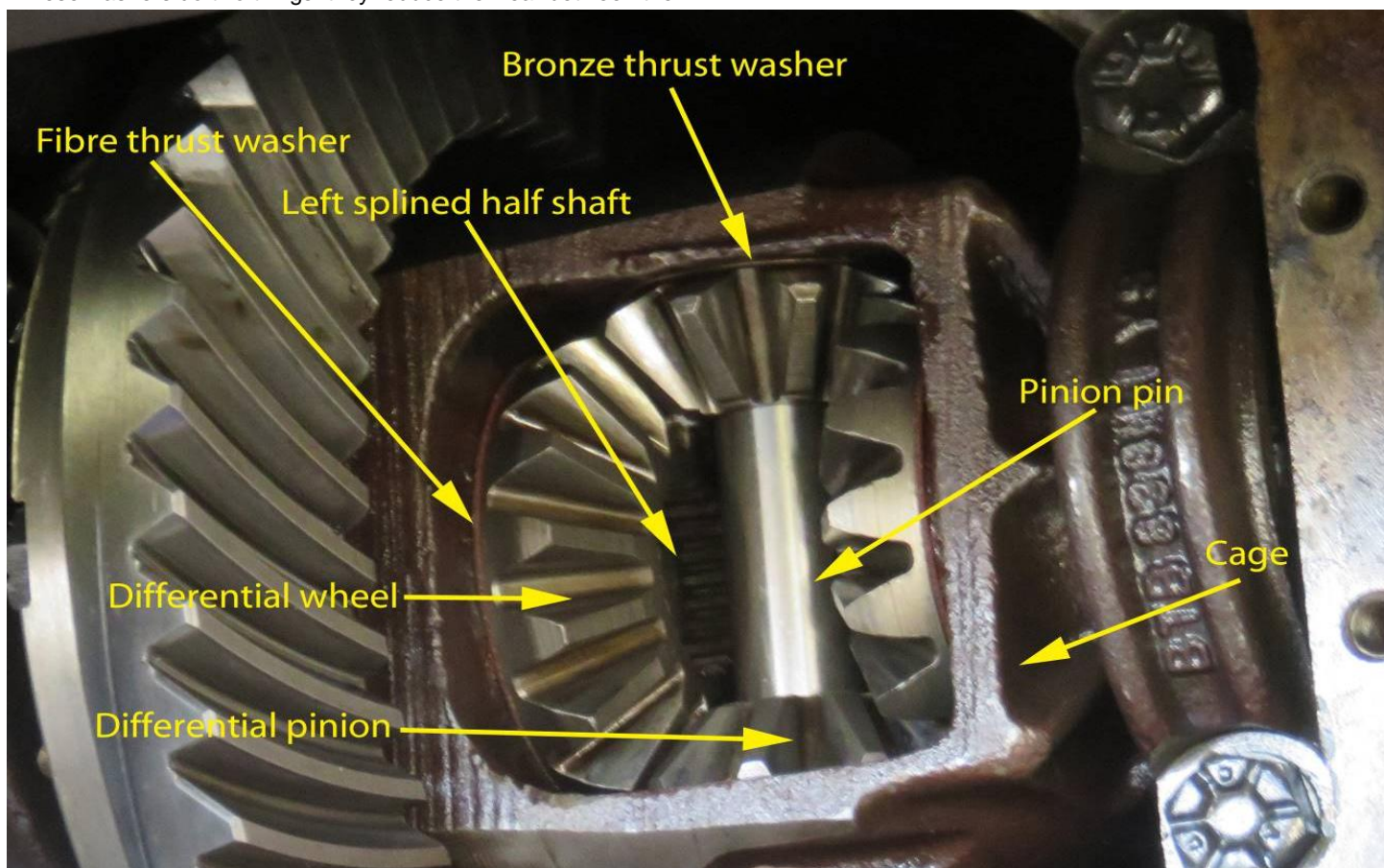
If you look at the photo below of the differential assembly in conjunction with the page from the workshop manual on the right, you will see that there are four bevel gears meshed together and all are contained within the differential cage. The two small gears (differential pinions **16**) are mounted on the pinion pin **17** and the two large gears (differential wheels **20**) are mounted on the splined inner ends of the two half-shafts **45**. Behind each differential pinion **16** is a bronze spheroidal thrust washer **15** and behind each differential wheel **16** is a flat fibre washer **19**. When power is applied most of the force from the engine is transmitted via the crown wheel and differential to the two drive half-shafts. But some of the force between the bevel gears is transmitted axially outwards on to the thrust washers – this force is trying to push the four bevel gears apart, thrusting them on to the thrust washers. That is why the washers are called thrust washers.

These washers do two things: they reduce the wear between the

gears and the cage and they act as shims to ensure that the bevel gears are pushed together and fully engaged.



The thrust washers are parts **15** (bronze) and **19** (fibre) – page Ha.3, W Manual AKD3259.



Eventually these washers wear out – 80,000 miles seems to be an often quoted figure – and, as a result, the shimming is reduced. The gears are able to move apart along their shafts and end up not fully engaged. It results in some play between the gears and this manifests itself as a clonk in the back axle whenever you put your foot on or take it off the accelerator.

The cure for the clonk is to replace the thrust washers with new ones to ensure that the bevel gears are kept fully engaged. There are reports of these washers wearing out completely to the point of disappearing, so it is also essential to put in new washers to prevent the adjoining cage and gear surfaces from being in direct contact.

Changing the thrust washers

Mike finished restoring my car about four years ago. He did not need to do very much with the differential except clean off the rust from the inside of the differential back plate and the outside surface of the cage! Two years ago, with 80,000 miles on the clock, the back axle developed a clonk which I mentioned to Mike in passing. The clonk went into the “future projects – I must get round to fixing it” tray (otherwise known as manyana). I hadn't seen Mike and Jane for about a year; nor had I seen his completed Roadster restoration and V8 conversion, so I went up in April to visit them. Mike very kindly offered to help me change the differential thrust washers while I was with them, so I gathered the parts together and took them with me to Norfolk along with a couple of jars of my home made marmalade for Jane.



First thing to do was to jack the car up onto stands which were placed under the front spring hangers to give ourselves plenty of room.



We needed to withdraw one of the axle half-shafts by a couple of inches to remove the two larger bevel gears (pinion wheels) from the cage. We decided to withdraw the left one which is on the crown wheel side. We had to get the drive shaft nut off, first marking its position on the hub for reassembly. Mike couldn't find his 1-5/16" socket and I forgot to bring mine so he used a 34mm socket which was close enough.



It needed a quite lot of effort to undo this nut. The torque wrench setting for tightening it is 150lbf ft. Mike put a length of scaffold pole over the breaker bar to get extra leverage while I stood on the footbrake to lock the hub.



We drained the differential of oil, removed the handbrake rear assembly and the differential rear cover.

Interestingly, when we removed the rear cover we found that a split pin had been fitted inside the roll pin that retains the pinion pin. This is not a standard fitting and was not put in by Mike when he restored the car. I presume that it was put in by the previous owner before I first acquired the car in 1983. I had intended to fit one anyway while replacing the thrust washers. The split pin is supposed to prevent the roll pin from falling out. The modification was first proposed many years ago back in the 1980s and it provoked a lot of debate at the time. For a discussion, see Peter Laidler's [V8 Workshop Note 98](#).



We then went about dismantling the left brake drum and brake back plate assembly.



After taking off the brake drum, wheel hub and brake shoes, Mike put a cable tie around the pistons to retain them within the brake cylinder. We didn't want to disconnect the cylinder from the hydraulic system and have to bleed the brake cylinder afterwards. The copper hydraulic brake pipe was carefully unmounted from the axle. The brake cylinder was left attached to the brake back plate which was unbolted from the flange at the end of the axle and then carefully suspended on wire from a rebound strap mounting with the hydraulic pipe still attached.



Mike removed the bearing cap and oil seal, exposing the bearing.

Now we went on to pulling out the half-shaft. Mike made up a tool from a couple of bits of studding, several nuts and a plate.



By tightening up the hub shaft nut, the half-shaft should come out.



Oh dear, the plate has bent - it wasn't strong enough! On to half shaft pulling tool Mark 2.



Mike straightened out the plate and strengthened it by welding on a couple of side flanges.



Much better this time and, using an air driver to turn the hub nut, the bearing and half-shaft were out in a jiff!

We could now get on with dismantling the differential cage

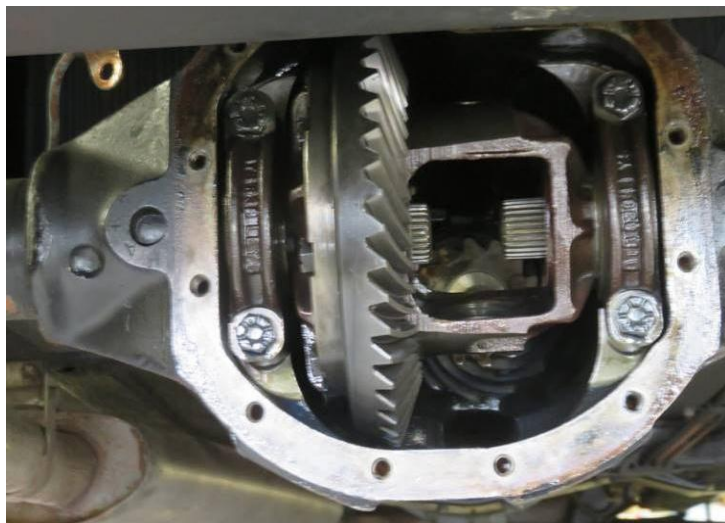


First Mike pulled out the split pin from the roll pin and then drifted out the roll pin with a pin punch. Note the paper towel positioned to catch the roll pin when it was knocked through.

Next Mike removed the pinion pin. He pulled the cage around until the opposite end to the roll pin end was facing him. The pinion pin was tapped out **JUST ENOUGH FOR THE ROLL PIN HOLE OF THE PINION PIN TO CLEAR THE CAGE**. Tap it too far and the cage can't be rotated to pull out the pinion pin from the other side.



The roll pin hole has just cleared the outside of the cage and the pinion pin can be pulled out using a suitable screwdriver or pin punch.



Once the pinion pin was out and the left half-shaft pulled out by a couple of inches, we took out the bevel gears and their thrust washers from the cage. This revealed the splined inner ends of the drive half-shafts inside the cage.

We examined the washers. The fibre washers appeared OK and we measured them to be 35 thou thick (0.035").



This tallied with the end float of the differential wheels when we did a trial assembly without one of the fibre washers. The washers were also the same thickness as the new replacements.



I started reassembling the differential with the new washers. First I lubricated the fibre washers with hypoid differential oil and placed them on the pinion wheels.



The bronze thrust washers, however, were rather heavily scored.



This seemed to be because their seats in the cage were also scored. We don't know why the cage seats for the bronze washers were scored. Perhaps the cage was poorly machined when it was originally manufactured or the seats had been damaged in the distant past through a lack of lubrication or from excessively worn or even missing washers.

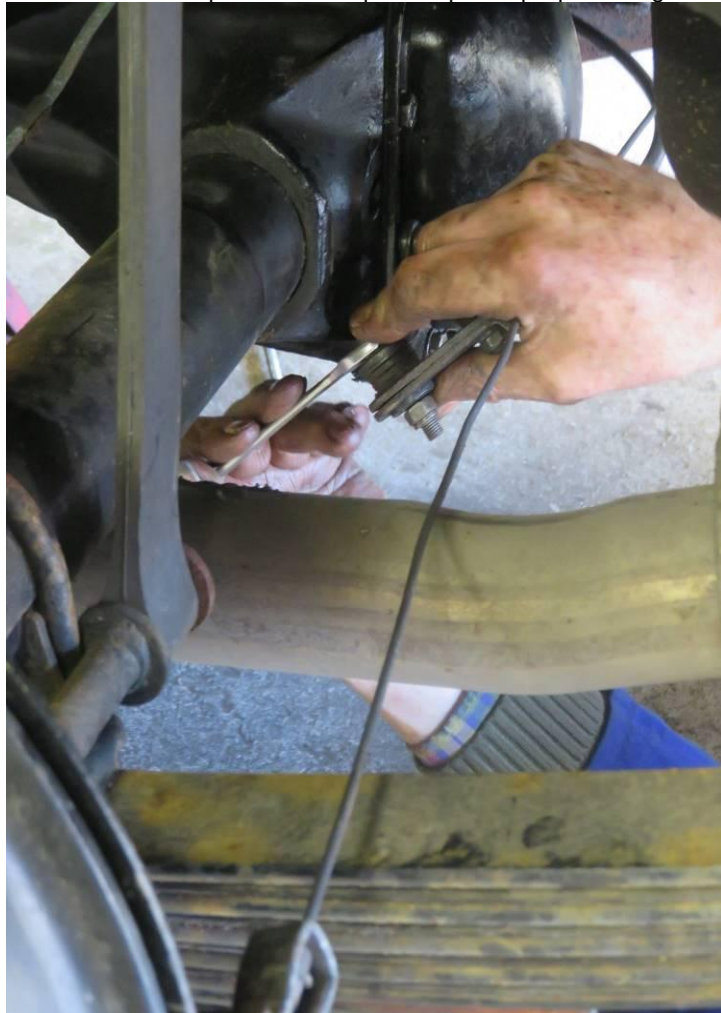


Then I slipped the pinion wheels onto the half shafts inside the cage and put in the first of the smaller bevel gears and its bronze washer which I had also lubricated.

Putting in the second small bevel gear was a little trickier. I had to move the first gear out of its seat by rotating one of the big bevel gears, turn the cage round to the other side and place the second small gear in position and then rotate the bigger gear back until the small gears were aligned with the pinion pin holes. It's a little fiddly but not too difficult. Then I slid the second thrust washer into place.



I used my little finger as a podger to finely align the gears with the washers and pinion hole and then I pushed in the pinion pin. All that remained was to tap in a new roll pin and put a split pin through it.



We put the differential back cover on with a new greased up gasket. Mike reinstalled the handbrake cable assembly.

He also pressed the axle bearing and half shaft back into position by using the bearing cap and tightening up the four nuts and bolts to push the bearing and half shaft back in place. Mike decided to reuse the old oil seal which he had fitted new when he restored the car because it was still in good condition, rather than use a new seal. Mike pressed the seal back in the bearing cap.

He reassembled the brake shoes, wheel hub and drum and re-secured the copper brake pipe to the axle. It wasn't necessary to bleed the brake cylinder as it hadn't been disconnected. Mike tightened up the drive shaft nut, aligning it with the split pin hole and inserted the big split pin.

Finally, I filled the differential up with 0.8 litre of hypoid EP oil.

Well, that's what a couple of old septuagenarians (alongside) look like after a job like that! In Gaelic we would be called *bodachs*. We headed to the pub straight afterwards for some much needed R&R. Still, the job went well and changing the thrust washers worked.

Clonk gone!

I am very grateful to Mike for helping me to get this job done and giving me such a fun time. He was probably right when he told me I wouldn't have got it done at home in my single car garage.

Two weary mechanics longing for a pint or maybe two!



Mike Macartney



Dugald MacNeill