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Gearbox and Overdrive

Last updated 23-Dec-2023

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3-Synch_or_4-synch? Automatic Bell-housing_Bolts Breather Drive_Flange Clutch_Pilot_Bush Gear_Lever Gearbox_Removal How_It_Works Interlocking_Arm_Assembly Internals Lubricants Mounts_and_crossmember Oil_Change Overdrive:_D_and_LH_Type_Differences Overdrive_Electrics Overdrive_Fusing Overdrive_'Pulsing' Overdrive_Replacement Overdrive_Sequencer_Relay Overdrive:_How_many_were_there? Rear_Seal Reversing_Light_Switch Speedometers Torque_Values Links

Gasket sealants - don't use silicone-based as they 'go off' very quickly and on large areas will 'skin' before you can get the surfaces together and not spread out to an even thin coating. Use something non-hardening such as Loctite MR5922, and only a thin smear. Great gobs of it will get extruded out into the works and in the screw holes can rip paper/card/cork gaskets as they are tightened. Overtightening screws can cause covers to warp between adjacent bolt holes and leak more, check they are flat before fitting.

On the 4-cylinder 4-sync there are seven UNF bolts securing the gearbox to the engine - 'bolts' i.e. with a plain shank to give a dowelling function to correctly align the two. Different lengths for different gearboxes, more info here.

3-synch or 4-synch? *June 2020*

Originally Mk1 cars were fitted with 3-synch gearboxes, and the primary recognition factor of those is if they crunch when you try to select 1st gear when moving. Reverse will crunch on both 3 and 4-synch. Mk1 cars are most easily recognised from the tunnel, which has a hump round the gear lever whereas 4-synch tunnels are flat. 4-sync gearboxes are occasionally installed in Mk1 bodies as they are more plentiful and cheaper than 3-synch, in which case the large

removable panel on top of the tunnel has to be extended to move the gear lever hole back. However it's much easier doing that with a 5-main engine than a 3-main as described by Paul Walbran.

Automatic Gearbox *Added December 2008*

Starter inhibitor:

There is a bullet connector in the white/red between the ignition switch and the starter solenoid (68 and 69 models) or the relay (70 and later) on Mk2 CB cars, which is where the transmission safety switch/starter inhibitor wires are connected when the automatic gearbox is fitted. It's just above the bracket for the clutch pipe and hose in the tail that leads down to the starter.

Kickdown cable: André Wilding contacted me to ask if I could offer any advice in changing the kick-down cable, as the gearbox end seems to be concealed inside the gearbox, and where it goes in is concealed by the tunnel! I have no personal experience of changing one of these cables, but from the diagrams and descriptions in the workshop manual it appeared that the pan might have to be removed, which would mean draining the fluid first of course. Using that bit of information André took the plunge, and subsequently wrote back to me with the following:

> "You have to drop the pan because the cable end fixes into a cam in the gearbox and there is no other way to get to it.
>
> "The 'cut-out' modification in the transmission tunnel is essential for getting to the screw in part of the cable where it goes into the gear box. Without it I think you would have to take out the gearbox etc. Even with it, it is a pig to get at and takes ages to screw in tight! Also, the hole is handy for getting at the reverse switch if something happens to it.
>
> "Apart from that - it's an easy job!"

Bell-housing bolts:

Yes they are bolts i.e. with a plain shank for a dowelling action to endure correct alignment of gearbox to engine. Seven 5/16" UNF bolts with nuts and spring washers for both 3-synch and 4-synch 4-cylinder, the V8 is different. For 3-synch there is one short 1 1/4" bolt, two intermediate 1 7/8", and four long 2 1/2". For the 4-sync there are four short bolts at 2 3/4", one intermediate at 3", and two long at 3 1/4". Positions vary between gearboxes but with them fitted to the bell-housing there should be approximately the same amount of thread protruding from each. Where the long bolts are at the top there may not be enough clearance to fit or remove them with the engine installed, so if you have removed them with the engine out make sure you replace them before it goes back! However with the other five bolts in and the engine on its mounts it should be safe enough to lower the rear cross-member and that may tilt the engine and gearbox down enough. But leaving them in for splitting and mating means they can be used as guide pins to help get the two 'square' to each other.

V8: As well as there being eight 3/8" UNC bolts with spring washers there are two dowels for location, UNC as they screw into the alloy block (hence no nuts) so have to be accessed

from the gearbox side. Four at 2 1/4" and four at 3".

Breather

4-synch gearboxes of both types have a breather at the front left of the gearlever remote unit. 3-synch non-OD have one top centre of the tube on the back of the bell-housing which carries the gear change mechanism. However 3-synch OD don't seem to have the plastic breather, just a horizontal drilling at the right front of the gearlever remote unit.

Drive Flanges *March 2017*

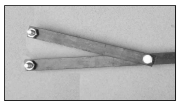
4-cylinder: The gearbox-end flange bolts cannot be removed from the drive flange (despite a flat on the OD casing which would appear to be for that purpose) until the flange is removed from the output shaft - on LH-type overdrives at least (see below) - which needs a 1/18" socket. Bolts are 5/16" UNF - standard hex head on Mk1, but on the Mk2 they are specials with a domed, round head having a flat on one side. The flat locks against the side of the flange to hold the bolt while the nut is tightened or loosened, meaning only one spanner is needed.

V8:

The V8 drive flange is larger, and that together with the flat on the OD casing allows the bolts to be removed with the flange still fitted. The V8 bolts are also larger at 3/8" UNF but otherwise have a similar domed, round head with a flat on one side.

Standard nuts and bolts on the rear flange.

All:



Before I realised I could remove the V8s bolts with the flange in position I thought I'd have to remove the flange. A pal made his own tool when changing the output shaft oil seal, but I knew that would not fit the larger V8 flange, so would have to come up with something for myself. I then suddenly realised I had made a tool to hold the cam-shafts and gears still when replacing the cam belts on the ZS, which should do the job. Made from B&Q flat steel bar (if their hardware is good enough for brain surgery it's good enough for me ...). It is a pivoting forked tool with bolts in the ends of the forks to fit holes in the cam gears, but with those bolts removed the holes are a perfect fit for two of the 3/8" bolts in the flange, to leave plenty of space for a socket on the nut. The long arm will rest against the edge of the tunnel (with protection) on the offside for loosening, and the near-side for retightening. The beauty of this tool is that it is universal, i.e. will fit any size of flange!

Gear Lever *May 2017*

Knobs
Gaiter including jumping out of OD/gear
Removal
Anti-rattle bushes

Knobs: *May 2020*
Originally a pear-shaped hard knob, solid with engraved markings on Mk1 (1G3706 with locknut). On Mk2 initially a round hard knob with engraved markings (1B3736) then flat-topped with a plastic insert (making a stiff thread so no lock-nut) with the markings in 1973 (BHH788).

And finally for 1977 a different flat-topped knob with engraved marking and the overdrive manual switch comprising knob DAM2174, cone locknut C30505 under the knob, slotted nut C30623 inside the knob, and cap with OD manual switch BHH1900. A different cap was used for cars without OD.

According to Denis Welch Motorsport's 'Big Healey' site "Early 3 synchro gearboxes featured a 5/16 UNF thread (*and a locknut under the knob*), 4 synchro (66-76) have a 3/8 UNC thread (*and a nylon insert in the knob so no locknut*), whilst late (77 on) 4 synchro gearboxes have a 7/16 UNF thread" as they have a locknut again.

Gaiter:
Originally a ribbed rubber tube (3-synch) or cone (4-synch) coming less than half-way up the chromed lever. In 1972 with the advent of the centre arm-rest and cubby it became taller covering the whole length of the (painted) lever to the underside of the knob, comprising a ribbed rubber cone inside a vinyl outer, which is stapled to the flange at the bottom of the rubber. All were retained to the tunnel with a chrome trim-ring and four screws - self tappers on 3-synch, Pozidrive on 4-synch.

Whereas 4-synch have basically a circular trim-ring for both OD and non-OD, 3-synch have an oval ring as the gear-lever is positioned further forwards on the non-OD box compared to the OD box.

October 2023: One long-held and oft-repeated fallacy is that the 4-synch trim ring has three long screws and one short one, with the short one going towards the front, as otherwise a long screw there can touch the gearbox and cause vibration and noise. That **is** how the screws should be, but the reason for the short screw at the front is that it screws directly into a welded nut under the removable panel in front of the lever **which sits on top of the tunnel insulation**, whereas the others all have to go though the tunnel insulation and tunnel to get to their nuts, so the shorter screw there doesn't need as many turns to tighten as a long screw would, and shorter screws are cheaper. For whatever reason Bee has three **short** screws and one long, with the long at the front as it happens, and it has never caused a problem with noise or vibration. Even when fully screwed directly into the access panel it's still about 1/2" short of the gearbox and after going through the trim-ring, leather and rubber gaiters and centre console it will be about 1" short of the gearbox - subject to gearbox movement when under way. Even short screws being used where long ones should be doesn't cause a problem in picking-up the nuts on Bee with cheap carpet, although thicker carpet and underlay may well need the longer ones. As well as moving the front screw even further away from the gearbox ...

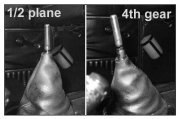
Jumping out of OD/gear: After Vee's rebuilt engine and (unmolested gearbox) went back in 2017 OD has tended to disengage on the overrun, re-engaging when the accelerator was

opened again, which it never did before. Suspecting the switch I took it out and sure enough electrical continuity was erratic as the plunger was operated. Fitted a new switch ... and it was just the same. The problem with the V8 is that OD is only available in 4th gear, and only starts closing as the lever is pulled back, whereas the 4-cylinder with it on 3rd and 4th starts closing as soon as the lever is moved across the gate towards the 3/4 plane. This means there is less travel of the mechanism inside the gearbox to operate the switch, so positioning is more critical.

As the switch is shimmed I started playing around with those - replacing the original 50 thou copper original with variously 45, 42 and 40 thou built up from a 40 thou fibre washer plus various front wheel bearing shims (which happen to be a very good fit). 40 thou ended up with the switch operated all the time i.e. in any gear which is obviously no good, 45 was the same as 50, but 42 seemed to work. However that is only 2 thou away from being on all the time, so a bit close for comfort. Along the way I discovered that if the lever were pulled back when it disengaged it would go back in, and with the thinner shims if I pulled it across the gate towards me OD would engage, even in reverse and 3rd - not right, but less of an issue than the 2 thou tolerance between working correctly and being on all the time.

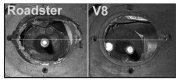
Then in slowing down and speeding up traffic on the M6 coming back from the Lake District I discovered that when it did disengage - which wasn't every time, the lever would move forwards about 1/4", and if I pulled it back it re-engaged, as it did when I opened the throttle again. This is lever movement relative to the gearbox casing, not the whole gearbox moving around, which made me wonder if it was on the verge of jumping out of gear as well, i.e. worn synchro detents!

Talking to Roger Parker he suggested removing the gaiter, which I had already wondered about. But first I put it into each gear in turn trying to feel as best as possible just how much effort was required, and noticed that 4th seemed to need more than the other gears. Comparing it with Bee (handy having two) Bee did need slightly less effort, but it needed slightly more effort than Vee to take it out of gear again i.e. Bee's detents seemed stronger than Vee's. And in fact Bee has always tended to 'hang up' coming out of 4th occasionally, needing a second harder push. But that's another story.



Next step with Vee was to remove the trim-ring from the gaiter ... and I was absolutely gob-smacked at how much easier the lever was to move in all gears, but especially 4th - 'light as a feather' springs to mind. Also the front left corner of the gaiter tipped right up in the air when 4th gear was selected, and manually trying to push it down again and pull the screw holes into line with it in 4th was almost impossible. So the gaiter is putting considerable force on the lever especially in 4th gear - so much for the age-old exhortation not to drive with your hand on the lever as it wears the linkages! The problem is that although the rubber is malleable, having the vinyl over the top means that when the lever is in (especially) 4th there is a bigger distance from just under the knob to the trim ring at front left, than when in neutral. The vinyl has no ribs and can't stretch, so it has to pull itself down the lever shaft, which means it has to push the rubber down as well. This is quite a snug fit on the lever, so doesn't slide easily. I thought about reducing the height of the rubber gaiter to something like the earlier ones with a couple of ties, but opted for some Vaseline on the shaft and inside the hole in the rubber gaiter. The result is a far lighter gear shift on Vee, especially in 4th, the top of the gaiter sliding down the shaft at least an inch. Something else Roger mentioned was that he has had the same problem when putting a 5-speed into an MGB, but put that

down to the fact it was non-standard. On Vee, over a run of a dozen miles or so, accelerating and decelerating in 4th, not only did OD not disengage, but the tendency of the lever to ease forwards in 4th is very much reduced. Still there slightly, but when it does happen it's not immediately I decelerate but a few seconds after, and not as far.



Something else I noticed comparing Vee with Bee with the gaiters off is that looking down on the gear lever, the tail of Vee's gearbox is noticeably closer to the driver than Bee's. Logic implies the middle of the H-gate i.e. the 1/2 plane should be central in the tunnel so the amount of movement of the gaiter is approximately the same in each gear, and if the knob needs to be moved relative to the driver then that is achieved by cranking the lever, as was done significantly on the 3-synch, only slightly on the painted 4-synch, and possibly not at all on the chrome 4-synch. Could be tolerance in clearances in the bolts and studs that form part of the gearbox mounting, I tried shifting the crossmember across but it made no difference. I also adjusted the engine steady bar to pull the top of the engine across to the nearside, wondering if that would pull the gearbox across a bit, but again not. That leaves the way the gearbox rubbers are attached to the gearbox and the crossmember, but short of a full hoist that's not really feasible to do anything about. I'm pondering putting a rubber bush between the drivers side of the tunnel and the tail of the gearbox! But that may generate noise in the cabin. For the moment gearbox positioning will have to stay as it is.

I'm leaving the switch with 42 thou for the moment, but because of my concerns of it being only 2 thou away from being on all the time, I moved the (PO-fitted) OD tell-tale from being on the manual switch to being on the gearbox switch, so I can see when OD is truly engaged, and not just showing that the manual switch is on, and try to remember to look at that when not in an OD gear, especially when about to select reverse. But next day I decided to go one step further and wire up a relay with a normally closed contact to the reverse light circuit, to give a second break in the OD circuit whenever reverse is selected. I'll still try and remember to look at the tell-tale when in other forward gears to check the positioning of the OD switch, give it some miles, and if it is no longer disengaging on the overrun will start upping the shims again.

But I'm also pondering mounting a micro-switch with a long flexible operating lever, on a bracket, screwed to the top of two of the lever retaining screws (drilling and tapping the heads), and using that instead of the original gearbox switch. With the switch mounted beside the lever, and angled appropriately, there should be loads of travel on the switch lever to ensure it is fully operated even when the lever moves back and fore slightly, but fully off when it is moved forward to the neutral plane.

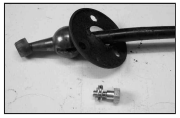
April 2022: A thread on jumping out of 3rd gear on the MGOC forum. I'd commented earlier how much easier the lever is to move with the gaiter disconnected from the tunnel, and Dennis F said doing the same thing on his 1980 'solved' the problem. I posted pictures of my levers in the tunnels, which had them aligned with the side screw holes for the trim rings but showed both being offset towards the driver and Vee's noticeably more than Bee's which would account for how hard the gaiter it trying to pull the lever forwards and towards the centre. Dennis posted his but didn't take them from above so you can't see how much if any it is offset to one side, but it is almost an inch in front of mine, hence his problem in 3rd. He wondered if the engine restraint rod could be a factor and whether it could be used to pull the engine and gearbox back a bit. Initially I was doubtful, but then wondered if it had been set incorrectly and it was actually pushing them **forward**, so

suggested disconnecting it to see if that let them sit back a bit. If so, as well as adjusting the restraint rod to get it 'right' he could also try using it to pull them back a bit more. Someone suggested engine mounts would be the cause, but whilst collapsed mounts (and more photos didn't seem to show that) would allow the front of the engine to drop, which due to the way the gearbox is supported would tend to move the lever forwards, the engine would have to drop an enormous amount to move the lever forwards by nearly an inch. Then Graeme Don said he'd had similar problems with his factory V8, tried removing the rubber gaiter but that made it far too noisy, so inverted it so the point of the 'cone' was right down at the gearbox instead of directly under the knob, which means there is hardly any flexing of the rubber cone in any of the gears and that completely solved the problem! However no help to Dennis as with a 1980 having the OD switch in the knob there is a large harmonic damper on the shaft meaning it could not be slid down the shaft to the bottom. Possibly fitted from the bottom, but would need more work, particularly with regard to the switch wiring, but I'll try it on Vee as a couple of times since the rebuild it has jumped out of 4th, although not out of OD.

A bit of a struggle but I managed it, and it does seem lighter. I also notice now that when moved to the 3/4 plane it stays there, whereas before it used to come back about half way. I can also feel mechanical things happening in the gearbox as I move the lever, which in itself would not normally be desirable, but it does indicate that the stiffness of the rubber isn't damping them now where it was before. Pulled out the staples between the leather and rubber gaiters and slotted the rubber over the lever upside down, but because Vee's gearbox is offset towards the driver's side a little it took a bit of effort to push the corrugations down inside the tunnel that side, without that the ring did not get anywhere near the centre console. Dropped the leather gaiter over and tried fitting the ring but there is so little 'surplus' leather at the bottom under the ring it wouldn't stay there, so I had to re-staple it. Without the rubber to push the leather up and out it's not as 'fat' and it shows a bit more lever than before, but for some time I've had a couple of Land Rover finger-ring protectors from a factory tour as a souvenir on the lever under the knob so that takes most of it up.

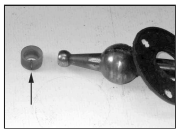
Removal:

Prior to 1972 gear levers have a gaiter that is secured through carpet to the top of the tunnel using a chrome trim-ring and four screws. From 1972 a centre arm-rest and cubby was provided and the trim ring screws go through that and the carpet into the tunnel. The 4-sync trim-ring screws have a shorter one at the front, said to avoid chattering against the remote control housing on top of the gearbox, but it's also going into a welded nut in the removable panel that sits on top of the tunnel, the other three have to go through that and some heat insulation and tunnel into welded nuts under the tunnel so the front one doesn't need to be as long as the others. Prior to 1977 the gear knob can be unscrewed and the gaiters (rubber only originally, then rubber with a leather cover) and trim-ring can be lifted off to expose the gear-lever retaining plate. From 1977 the gear knob is retained by a special nut, and cars with OD have the manual switch in this knob, with the wiring going down inside the gaiter. This wiring is prone to chafing and it is strongly recommended that a fuse is added to the circuit or severe wiring damage can result. Apparently it's not easy to loosen (or tighten, there are frequent complaints of buzzing) this nut so you may decide to deal with the retaining plate with knob, wiring and gaiters still fitted to the lever. Also on the 77 and later there is a harmonic balancer (large lump) on the shaft inside the gaiter so the retaining plate is slotted for removal from the lever.

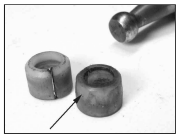


3-synch: There is a circlip that retains a cover in the remote control tower, and under the tower is a spring pressing down on the large ball on the gear lever.
4-synch: Remove the three shouldered screws (22B525) and Thackery washers (AJD7731, oddly on both my cars one of the washers was a standard spring washer).
All: Lift the lever up and out, it may need a bit of a tug to pull the lever out of an anti-rattle bush that should be there, or the bush out of the remote control shaft.

Anti-rattle bushes:
Two of these (22H 15) are fitted - one at the bottom of the cabin lever and another at the end of the remote control shaft where it connects to the gearbox shift rods. If either of these bushes is missing the cabin lever becomes sloppy and will rattle about. It was only because my roadster has both that I realised when I got the V8 that at least one was missing. With the bushes, when the gearbox is in any gear, there should be virtually no free play in the lever at all. If you have free play in a gear, then the chances are that one or both are missing. The one on the lever is easy to deal with, the one for the shift-rods less so - with the 4-synch tunnel the gearbox would have to be removed, although you may get access on the 3-synch by removing the larger access panel. Fortunately only the one on the cabin lever was missing.

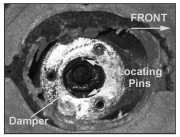


There seem to be two possible ways to fit the bush - in the socket in the remote control shaft, or on the ball at the end of the lever. The first method resulted for me in the bush being pushed straight out of the bottom of the socket when I tried to push the lever into it. The second method starts off well enough as there is a split up the side of the bush, and it goes on the ball-end of the cabin lever easily. However when trying to push the lever back into the remote control shaft socket, it either won't go, or the bush will be pushed further up the gear lever shaft! That may be the case with a new bush, if reinstalling with an old one just tapping the end of the lever with a mallet may be all that is required.



The new bush has a chamfer at the top which is presumably supposed to make this second method easier, but it is at far too abrupt an angle to help. I placed the bush chamfer end down, and used a craft knife to make a more gradual chamfer around the periphery, and it then went in.

The same bush is used inside the gearbox and can only be accessed with the gearbox removed.

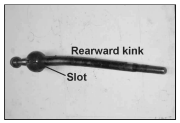


Both 3-synch and 4-synch (prior to 1977) have two locating pins screwed through opposite sides of the casing to protrude into the large socket, which engage with slots in the large ball on the lever. This allows the lever to move sideways across the gate and fore and aft into the gears, but prevents it rotating (but see below).

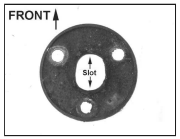
4-synch remote control towers have a sprung plunger going through the casing and pressing against the large ball on the lever. The Parts catalogue describes these as 'lever-damping'

components, but as they have a sprung plate pressing down on top of the ball I don't know why it needs this additional damping.

3-synch OD have a 'plunger' at the gear-lever end of the remote control tower, but no indication as to what it is for. They have a single large spring pressing down on the large ball, which again would provide adequate damping, one would have thought.



Because the levers have two slots it's probably possible to fit them either way round. The 3-synch lever has a double-crank rearwards so it's obvious which way round it goes. Clausager says that the 4-synch lever is completely straight, but there is a slight kink low down concealed inside the gaiter. It's less obvious which way round it goes, but it angles the lever rearwards.



The lever seating plate has three holes so conceivably could go in any of three orientations. However rather than a hole for the lever it has a slot, and this is positioned fore and aft, meaning it can only fit one way. In the other two positions the slot would be diagonal. It also has a raised portion on one side of the slot, which goes on the left.

In 1977 all cars changed to having a slider switch in the gear knob, and another sub-harness down the gear lever connecting to the gearbox harness. There have been cases of this harness chafing and shorting out with the continual movement of the gear lever. As the OD is unfused this can seriously damage the other harnesses so fusing of the OD circuit is strongly advised.

This type of gear lever has a significantly thickened section (said to be a harmonic damper but complaints of buzzing are legion) just above the retaining plate, so the plate is slotted to enable the two to be parted and reunited. Also this lever only has one slot in the large ball for location instead of one each side as previously, so only has one locating pin in the housing. At least it means you can't get it in the wrong way round!

October 2020:

Bill Etter in America has just had a UK-sourced OD gearbox fitted to his 76. Supposedly from a 76 I noticed that the gear lever had been fitted the wrong way round so that it was cranked away from the driver instead of towards. Taking that out he found a spacer nut under one of the shouldered bolts through the plate that holds the lever in the gearbox instead of a Thackery washer (which is quite likely to be the cause of the stiffness with this box he mentioned), and no bush on the little ball at the end of the lever or in the socket. I also noticed that once out the socket only has a locating pin on one side, and no damper plunger - no big deal as he has retained the non-OD gearbox so it's just a matter of using parts from that. Whilst looking into this I studied the Parts Catalogues for changes in part numbers. North America is shown as having a different housing 22H1457 - but only from August 71 to August 72, when it reverted to the original 4-synch housing 22B522, all versions staying with that to the end of production. Now it is possible that is correct, and only one location pin was used (as the catalogue states) leaving an empty hole, but Bill's housing only has provision for the one locating pin on the right, there is no hole for one on the left, so it looks like he has a 77 gearbox not a 76. No big deal, it didn't come with the lever so he can use his original. The usual suppliers only show the one housing 22B522 albeit with the number of location pins

reducing from 2 to 1 for the 77 model year, only one source states that the 77 and later housing was 22H1457. Quite possibly an error in the catalogues, but for the pre-77 catalogue to show that for 1971 then reverting for 1972, and the 77 and later catalogue still showing the original housing, is at least two if not three errors.

Gearbox Removal *December 2019*

With the possible exception of a non-OD 4-synch box (and that only with partial dismantling in-situ) you can't remove an MGB gearbox leaving the engine in place, because of the fixed crossmember under the OD (3- or 4-synch) or gearbox tail (3-synch). Some said they had seen a removable central section that looked so professional they thought it must have been factory, but if so it was certainly not used in production. I subsequently came across a couple of photos of just such a mod, although whether it is worth it given the number of times the gearbox needs to come out, or the engine to replace the clutch, is debatable. It would definitely make accessing the OD speedo cable easier though!

The most obvious way is attached to the engine through the engine bay, but that is beyond me with access limited by a folding hoist and a single-width garage, albeit double-length. I've had no problem removing the 4-cylinder engine, and I was pretty sure I'd be doing the same thing if I needed to extract the gearbox, and remove that from under the car. When Vee's gearbox started whining about a year after getting back on the road after an engine rebuild - very annoying - I didn't want to send her away after the nightmare last time, but knew removing the V8 engine is nothing like as simple as the 4-cylinder for a variety of reasons. But one of my contacts put me onto a chap who knows these gearboxes, and has a V8, and he told me how it could be done.

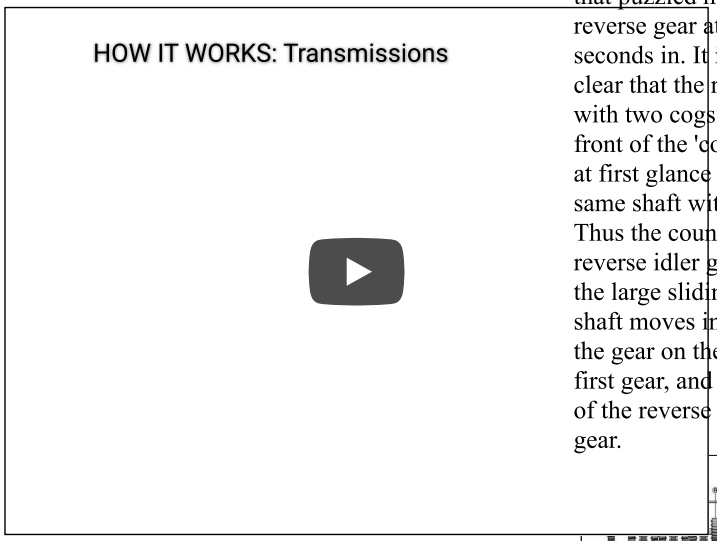
If you are going to work on the gearbox or OD and need to drain the oil do the main draining before removal, then once out stand the gearbox on its bell-housing end - on blocks of wood not the end of the 1st motion shaft, and leave it like that for a couple of hours at least with the drain plug back in. Most of what is in the OD will drain into the main casing, then lay the gearbox down, remove the main drain plug, and be prepared for almost another pint.

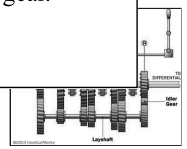
January 2020:

The gearbox comes back, and a couple of days later reinstallation commences. Five days after that all done, and a pleasure to be back driving her again.

How it works *October 2017*

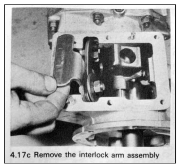
Another excellent explanation from Chrysler in 1936 of how a gearbox works, including synchromesh. It shows how 'gearing' occurs from the different distances from the centre of the gear to the tip of the teeth on each wheel, i.e. the relative lengths of two levers, the number of teeth on each gear just being a convenient way of expressing it. One thing that puzzled me for a while is reverse gear at 6 minutes and 50 seconds in. It isn't immediately clear that the reverse idler gear with two cogs is positioned in front of the 'counter' or lay shaft, at first glance it seems to be the same shaft with an extra gear. Thus the countershaft turns the reverse idler gear all the time, and the large sliding gear on the output shaft moves into engagement with the gear on the countershaft for first gear, and with the other end of the reverse idler gear for reverse gear.





It's easier to see on this drawing from 'How Stuff Works' - all the forward gears connect directly with the lay shaft, but reverse gear engages via the reverse idler gear, which being an extra 'wheel' between the input and output shafts reverses the direction of rotation of the output.

Interlocking Arm Assembly *Added July 2010*


4.17c Remove the interlock arm assembly

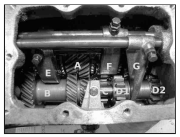
Stephen Stringer wrote to me while changing his 3-synch non-OD to OD. He had to obtain parts to build the OD gearbox up but couldn't find an Interlocking Arm Assembly. The 3-synch non-OD item is very different, the 4-synch looks similar and although it drops in the gears wouldn't select. As they selected with it **not** fitted Stephen was wondering whether he could leave it out, or if I could point him at a source for one. I don't know exactly what this part does but the word 'interlock' makes me think it is something to do with preventing two gears being engaged at once under certain conditions, which would

be catastrophic. The part also seems to be NLA. Unusually the 'official' Workshop Manual and Parts Catalogues weren't that helpful as they didn't show both 3-synch and 4-synch for comparison (and in any case are only drawings i.e. only representative) and Haynes was the best source with a couple of photos that showed the part. From these I reckoned that a 4-synch could be made to fit, and Stephen subsequently reported that this was indeed the case. He says: "It's a simple mod, cut the mounting flange along the bend, move the cut off part back 4mm and reweld, that's it."

Internals *Added January 2015*

Although the 4-cylinder and V8 casings are very different the internals are very similar. Gear-wise the first-motion shafts and laygears differ, the V8 having slightly different ratios in 1st, 2nd, 3rd and reverse (4th is straight through in both). V8 items haven't been available for decades, but fortunately the 4-cylinder items can be used once the pilot bearing shaft has been turned down to fit the V8 crankshaft. Don Hayter in his 'MGB Story' writes that in testing it was found that the 4-cylinder 1st gear wasn't strong enough for the torque of the V8 so the 17-tooth gear was changed to one with 16-teeth which makes about a 6% difference. Comparing ratios the V8 is about 9% lower in each gear (effectively giving a slightly higher gear in terms of 4th is a higher gear than 3rd and so-on) which might sound quite a bit but each succeeding gear up the box is about 37% higher than the previous one. It's interesting to note that the reverse gear ratio is between that of 1st and 2nd, so if you can't get up a hill in 1st then there is no point trying reverse! Contrary to advice often given many decades ago.

My V8 has always had this modification as the PO had the box rebuilt this way more than 30 years ago at around 100k, and I've had it done again recently after another 100k, not finding any issues in driving. Really you would need to get an unmodified V8, a modified V8, and a 4-cylinder and compare rpms at various speeds in 3rd gear to see how much difference it made on the road. Other differences are the front cover inside the bell-housing - the V8 item having a guide tube keeping the roller release bearing concentric to the first-motion shaft at all times, and the release arm is also different. The clutch slave cylinder is different (the bores in both that and the master differ to the 4-cylinder items), I don't know whether the mounting points differ. I do know that there was no problem changing the V8 flex hose with everything in-situ, whereas changing the 4-cylinder is said to be a pain, but that may be down to the position of the starter motor as much as anything else.



Michael Beswick gets hold of a spare gearbox and dismantles it for interest and information.

Lubricants *Added March 2014*

The most important thing to be aware of is the correct oil to use, as the V8 is different to the 4-cylinder, and the V8 axle is different to its gearbox:

4-Cylinder
V8
Gear oil vs axle oil

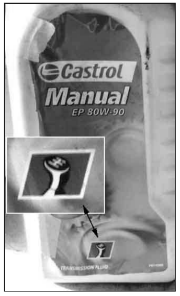
4-Cylinder: The 4-cylinder gearbox and overdrive is straight-forward as it takes engine oil of the same grade as for the engine e.g. 20W/50. However this BL Technical Service Bulletin dated April 1975 says SAE 90 gear oil supersedes engine oil, although elsewhere there are unverified statements that it was subsequently rescinded. This British Automotive article (scroll down to 'Transmission oil') also states that rubber bumper MGBs used gear oil, although references to 'brass synchro rings' and 'non-synchromesh' are variously confusing and incorrect as brass synchro rings were only in the 3-synch - not 'non synchromesh' - gearboxes that predate this change. But Driver's Handbooks for RHD rubber bumper cars of two issues - up to 76 and 77 and later - make no mention of the change. If the 'GAJ-3/19/75' at the bottom of the Technical Service Bulletin is a date, then it would be an American document as it is in the month/day/year format they use and not the day/month/year format the UK uses. That tends to confirm the change was for North America only, although why, and how, when RHD and LHD were built at the same location can only be guessed at.

The 3-synch gearbox takes 4.5 Imperial pints, 2.56 litres, 5.6 US pints and the 3-synch gearbox plus OD takes 5.33 Imperial pints, 3.36 litres, 6 US pints. The 4-synch gearbox takes 5.25 Imperial pints, 3 litres, 7 US pints and the 4-synch gearbox and OD takes 6 Imperial pints, 3.4 litres, 7 US pints. Note these are for clean and dry gearboxes, a drain and refill can be expected to take a little less than that as some oil is bound to be left behind, particularly with an overdrive.

V8: The V8 gearbox is different in that it takes gear oil instead of engine oil, to cope with the higher torque - 6 Imperial pints, 3.4 Litres. Some claim gear oil makes the V8 gear change very heavy in cold weather, but I used mine for several years in all weathers including several periods of well below freezing and didn't have any difficulties. The confusion may come from gear oil typically being SAE 80 or 90 whereas engine oil is typically SAE 20W/50, and some people describing those numbers as 'weights' which implies viscosity. They aren't, they are just arbitrary number ranges for engine oils and gear oils that don't overlap with each other. The reasoning behind this non-overlapping is to avoid confusion and people using engine oil where they should be using gear oil or differential oil which would result in rapid wear. The opposite may be equally damaging as the additives in gear and differential oils may harm the soft metals of the bearings. However it is equally important to know the difference between gear oil and differential oil, of which more later.

The actual viscosity of SAE80 gear oil is 7cSt, which falls between the viscosity of 20W engine oil at 5.6cSt and 25W at 9.3cSt. SAE90 gear oil is 13.5cSt which falls between SAE40 engine oil at 12.5cSt and SAE50 at 16.3cSt. So you can see that SAE90 gear oil is in exactly the same viscosity range as 20W/50 engine oil.

Gear oils vs axle oils:
To add to the confusion it is usual these days for manufacturers to refer to gear and axle oils by a GL number from 1 to 6. Usually GL4 and GL5 are used for passenger cars, and in most cases GL4 will be used for gearboxes and GL5 for axles, although in some modern cars GL5 is specified for gearboxes, perhaps where they contain the diff as well. GL5 oils are intended for hypoid-type applications most commonly found in axles, but a GL4 oil may be specified for axles that don't have a hypoid action. Some GL4 oils may be suitable for the rear axle, check they have statements to the effect that they are 'extreme pressure' or 'mild extreme pressure' and are suitable for hypoid axles. GL5 oils have additional anti-



wear additives that can be harmful to some of the components in a gearbox designed to take GL4. Gear and axle additives are designed to coat the metal surfaces, and are 'sacrificial' in that it is the oil coating that is stripped away (replaced when the teeth go back into the oil bath or are otherwise sprayed) during use rather than the metal being worn away. But GL5 additives stick more tightly to the metal than GL4, and if used in GL4 gearboxes, when the additive is stripped away from softer metals it sticks so well that it actually takes a microscopic layer of metal away with it, even though there has been no metal to metal contact. This gives rise to another misconception of GL5 axle oils when used in a GL4 gearbox - that they in some way 'attack' the softer metals. But it's not a chemical reaction that dissolves the metal merely by being in contact with it, but the stripping action in use as described.

Both V8 gearbox and rear axle oils are typically based on SAE90 for temperate climates, but with the different anti-wear characteristics as described above, and different manufacturers describe their products in different ways. For example the Workshop Manual specifies Castrol Hypoy for the gearbox but Castrol Hypoy B90 for the axle i.e. 'Hypoy' in both cases. Esso equivalents are GP90 and GX90, but Mobil specifies GX90 for the gearbox and HD90 for the axle, so you can't rely on the letters to tell you whether they are for gearbox or axle. At the time of writing Castrol products are labelled a bit more clearly, as 'EP-90 Manual Transmission Fluid' and 'GL4' for the V8 gearbox and 'EPX 80W-90 Differential Oil' and 'GL5' for the axle in both V8 and 4-cylinder cars. Additional confirmation of application is that the label includes a drawing of either a gear change or a rear axle respectively.

Corrected May 2016: ~~The final differentiation between gear and axle oils is one of smell - GL5 oils i.e. for MGB axles have a very distinct, sulphurous, smell whereas GL4 oil for the V8 gearbox is very similar to engine oil.~~ Both GL4 gear and GL5 axle oils have the distinctive sulphurous smell, with GL5 perhaps a little more than GL4. It's engine oil as used in 4-cylinder gearboxes that does not have this smell.

Mounts and crossmember *Added January 2011*

Restraint Rods
Earth Straps

Michael Beswick tackles replacement of the gearbox mounts on his 69/70 and has documented in great detail the trials and tribulations at getting at all the nuts and bolts, and making the oft-discussed modification to the crossmember to make the job easier.

However with the gearbox in the car I have been able to access all the nuts and bolts without a hole in the crossmember, which pulled off the mount studs with a good yank and went back with a good shove, with the car on a hoist at any rate. Subsequently with new mounts which were harder than my old ones and the gearbox out of the car (so nothing to hold it steady) just leaving one of the mount to gearbox bolts out allowed that mount to twist far enough to get the crossmember on both studs - 'static' one first then the other, then the 'twisted' mount could be repositioned and the final bolt fitted, very easy.

December 2019:

With Vee's engine and gearbox out as part of work on both I had the opportunity to investigate this aspect in the 'open air' so to speak. It's said that there are at least 16 ways of installing the crossmember components, and maybe 32! John Twist has an eight minute video where he discusses the differences between the crossmembers and restraint methods over the years. However he's not clear when he is talking about 3 sync and 4-sync, at various points he questions himself (3.50), corrects himself (4.00), contradicts himself (4.20 and 4.41), in one aspect (3.55) I'm convinced he is simply wrong. However careful consideration can eliminate most if not all of the incorrect options, and the following relates to 4-synch OD both for 4-cylinder and V8:

1. The first is which way round the crossmember goes. It seems there is always a dip on one face and that faces forwards - 2 ways. However Bee has hers installed the wrong way round, but without a forward-facing restraint rod the only effect is to put the tapped hole for the speedo cable clip on the wrong side. But both Bee and Vee came to me with the cable above the crossmember, which to me reduces the risk of damage from objects on the ground.
2. The first change in crossmember shown in the Parts catalogue is with the change to Mk2 and 4-synch. It's clear Mk1 only had one hole in the crossmember bracket for the rubber mount stud, but Mk2 cars have two, which changes the fore and aft position of the crossmember relative to the gearbox. On 4-sync cars the correct position is the front-most hole - so now we have 4 ways. John Twist says at 3.55 that the front holes are for non-OD and the rear for OD when showing a 1974 on crossmember, hence 4-synch. But that can't be right as the 4-synch gearbox casing is the same both with and without OD, and to move the crossmember relative to the rubber mount and the gearbox would affect how it lined up with the chassis rail holes.
3. Next, crossmembers on other than Mk1 roadsters have a vertical restraint pin. The upper yoke that holds the pin and is bolted to the gearbox with the rubber mounts can go either way round. Several drawings show this part for the Mk1 GT i.e. 3-synch as symmetrical so can go either way round, but the 4-sync item (a different part number) is asymmetric. On 4-sync OD boxes the correct way has the 'flat' side of the yoke facing forwards - 4 ways. John Twist says it goes this way round for OD as it gives more space to get the rear mount-to-gearbox bolts in past the OD, and that I can see. But although it fits either way round I can't see any reason why it needs to be the other way round for non-OD boxes as John Twist says, as the space at the front is the same for both OD and non-OD.
4. Finally the yoke under the pin can rotate on the pin to be either way round. Again the Mk1 GT is symmetric so can go either way round, but the Mk2 has the welded nuts off-set which changes their position relative to the holes in the crossmember. With the upper part orientated for OD boxes the correct way is with the welded nuts behind the pin - 16 ways. Which ever way round the upper part goes, the lower part is turned to line up the nuts with the holes in the bottom of the crossmember.
5. Did I say 'finally'? Another 'twist' is that some replacement rubber mounts instead of being rectangular are 'Z'-shaped, and depending on which way up they are fitted they can be in either shear (bad) or compression (good). But that is obvious from ... observation, and increases the possibilities to 32!

Testing the various options for 2, 3 and 4 showed that the only way that everything lined up was when things were assembled as described, and the upshot is that the mounts end up

centrally on the crossmember, with the nuts on the lower yoke lining up with the holes in the crossmember, and the crossmember lining up with the holes in the chassis rails.

That still leaves two sets of tapped holes in the chassis rails to mount the crossmember. Clausager shows a 1964 i.e. 3-synch on page 82 with what looks like the same unused mounting holes as on later cars about an inch in front of the crossmember. This is a non-OD, and prior to the auto, are they for the 3-synch OD gearbox? Or maybe an option for the unused V4 engine and gearbox? Which to use is determined once the gearbox and engine are joined together and the engine has been fitted to its mounts. However if the gearbox and the engine are installed separately then for 3-synch non-OD and 4-synch gearboxes at least use the rear-most mounting position.

It's further complicated on the V8 by the mounting plates for the engine mounts being handed but capable of being installed on either side. When on the wrong sides the engine is about 1/2" forward of where it should be, and the gearbox crossmember is between two sets of chassis rail holes. When the V8 came to me it was like that and I found the crossmember had been fitted in one pair of holes one side and another pair on the other side! Swapping those plates over with everything in-situ was a real challenge. Amusingly, shortly after that the Classic Car Show at the NEC featured the first re-shell of a V8 ... and they had the plates on the wrong sides.

The first time I refitted the crossmember was with the mounts on the gearbox, the gearbox back in the car, and the car on a full-height ramp, so getting the crossmember back on the mount studs was the next challenge. Some have slotted the crossmember holes but mine aren't. Slackening the mount to gearbox bolts made it easier, but then retightening the mount to gearbox bolts with the crossmember on was not possible for a reason I can't recall. In the end I found that with one side hooked over its stud, the other side popped in when given a hearty upwards shove of the crossmember. Of course it went in the wrong hole, but a firm pull downwards got it off again, and another shove got the stud in the right hole. The next challenge was to get the lock-washers and nuts on the mount studs, for which some have drilled holes in the bottom of the crossmember to take a socket extension at the appropriate angle, fitting the socket to the end afterwards. But I found that with the original rubbers it's not difficult to twist the crossmember first one way then the other, and use an offset ring-spanner which allowed me to tighten them half a flat at a time. Potentially time-consuming and patience-testing, but if you have new mounts/nuts or thread-chase old ones you should be able to get them finger tight first, which should only need a few operations of the spanner. Of course getting old nuts off may be more challenging, in which case as a last resort I'd chisel the rubbers off. I was warned not to replace the rubber mounts unless I needed to, as new ones are much harder than old, and presumably it's much harder to get the stud in the crossmember, as well as tighten the nuts. Having said that one would expect the 'Z' mounts to be more compliant than rectangular. All this was made easier by standing under the car on a full-height ramp, maybe not so easy with the car on low-level ramps/axle stands. This was all for the V8 of course, other gearboxes may vary.

Restraint Rods: See also Engine Mounts and the section on restraint brackets there.

Don Hayter in his 'MGB Story' writes that the American Government Department bought and tested a 1975 MGB and used it in a 5mph barrier test which it failed, to such an extent that the engine had moved forward during impact and the fan had damaged the radiator, potentially causing a leak, despite similar factory testing not showing up the problem.

Nevertheless they had to do something about it "so moved the radiator forward to the 'C' and V8 position with electric fans, thus obviating the old engine-mounted fan, and we added an engine restraint bar from the gearbox bellhousing bottom to the chassis crossmember for all future cars". But that doesn't tie-in with the Parts Catalogue information on restraint rods, and the radiator wasn't moved forwards until the 1977 model year.

Mk 1 roadsters had a crossmember with welded nuts at the rear for a restraint rod bracket. A short rod passed through the crossmember and brackets and was retained by a nut. The front of the rod has a 'U'-bracket that goes around a protrusion on the bottom of the gearbox casting close below the speedo cable, and a special pin goes through the bracket and protrusion with rubber bushes between them.

Mk 1 GTs and initially all Mk2 cars don't appear to have the restraint rod, until 1974.

In Feb 74 (still chrome bumper) a new restraint rod was added to North American cars. This used a welded bracket on the front face of the crossmember, and a longer rod going all the way to a bracket that attaches to the two bottom bolts that secure the bell-housing to the engine. Other markets got this arrangement at the start of rubber bumpers.

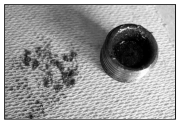
The V8 never had a restraint rod.

And in case you wondered what the crossmember bolted up to - a tapped plate in a cage, so it can move around to accommodate some dimensional differences.

Oil Change

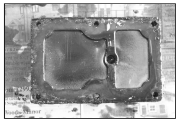
For what oil to use see Lubrication.

Take the car for a run of 10 miles or so to warm things up and allow the old oil to run out a little easier, especially the gear oil in the V8. **Make sure** you can remove the filler/level plug or dipstick before draining the oil. You can live with not changing the oil for a bit while you ponder how to shift it, but not if you have already drained the oil and can't refill it. I had the front of the car up on ramps and the rear on axle stands so I could do both gearbox and rear axle together, and the car was relatively level making refilling with the correct quantity easier.

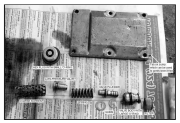


The drain plugs (I did both cars) came undone easy enough, although I found a 3/4" spanner and socket were just a bit too big for the roadster (fine for the V8) so used an 18mm socket instead, and left that to drain while I got on with refilling the diff. The drain plug on both the roadster and V8 are hollowed-out and although at first it didn't look like there were any bits in the hollow, when I stuck a screwdriver in there I did get some bits out. The largest was about

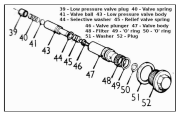
1mm in size, the rest much less than that, I suppose it is inevitable in a manual gearbox but I'd rather not have seen it.



When the dripping had slowed I replaced the drain plug and started on the OD sump/filter. The bolts came undone easily, slackening each bit by bit like head bolts/nuts to avoid the chance of warping. Free the sump with at least two of the bolts on opposite sides or ends still loosely fitted so it doesn't fall away all at once. I had to use a bit of gentle leverage to get the sump parted from the OD body, there is a handy tab on the sump adjacent to the large hex plug for the relief valve expressly for this purpose, it seems. Be ready for more oil to drain out once you have broken the sump seal, quite a bit more comes out here, I left that to drain rather than try getting the sump completely off at that point and fill my sleeves with oil. With the sump off the V8 there was a slight tear in the gasket/filter across the middle bar so I decided to replace it, I had bought one at Stoneleigh last month. The old one took quite a bit of scraping to get off the sump, in hindsight it would probably have been OK to put back as the outer ring was fine. The filter and sump were as clean as a whistle, but got a wash in petrol anyway. The roadster sump came off without any tearing of the gasket, and I decided to leave it stuck to the sump and not clean underneath as any bits should have been on top of the screen. The little specks in this photo are globules of oil or petrol, not bits as I first thought. Touching the screen made some vanish and other appear. I did pour some petrol into the sump through the screen, gave it a good swill and poured it out again, hopefully that should have washed out any fine sludge, it looked clean enough in there from peering through the screen.



The hex plug for the relief valves also came free easily, a little more oil draining out. Be careful not to lose the little O-ring between it and the valve or any of the other bits inside. Whereas on the roadster it was in a groove in the end of the hex plug and didn't come free in washing, on the V8 as I recall it was loose on top of the hex plug i.e. there was no groove. Careful teasing with a pair of long-nosed pliers got the cylindrical filter out together with the valve assembly. Quite a few bits involved here (13 on the roadster!) so be careful to note what order you find them in - and which way round they are - and not to lose any.



Whereas the V8 was similar to the drawing in the Workshop Manual the roadster seemed a bit different having a very coarse screen round the upper part of the valve which isn't shown in the drawing, and a large spring above the valve plunger which is shown much smaller in the drawing. I didn't find any of the 'valve ball, valve spring or low pressure valve plug' on either car. The larger O-ring should be in the groove in the relief valve body so shouldn't come free. The roadster had three shims between the valve plunger and the spring (not shown in the manuals) which sets the hydraulic pressure - more shims sharpens engagement, less shims softens it, I didn't find any on the V8. I had to replace the filter/gasket as it ripped on removal. The new one didn't leak, but several people replacing them much later said theirs did, it seemed to be coming from the edges of the gasket and might have been from the ends of the mesh wires.

While you are away from the car put a clean empty container under the OD to catch any bits (e.g. the 'valve ball, valve spring and low pressure valve plug' which I didn't find) as they might be there and fall out as the OD cools. If you don't they might roll away or not be noticed on a driveway until too late. Again the filter and valve components were as clean as

a whistle, but got rinsed in petrol before replacement in the correct order. On the V8 the new OD sump gasket got a smear of Hermetite Red (non-setting) on both sides, I tightened the sump bolts bit by bit in a logical sequence to avoid warping. I haven't seen a specific torque figure for these bolts, but the standard figure for 1/4" UNC/UNF is 6-7 ft.lb. (8-10 NM) so I wouldn't go above that or you could strip the threads or warp the sump. On the roadster I just put the sump and gasket/filter back as it came off, no Hermetite this time, we shall see if it leaks or not (it didn't).

Filler access

There have been two questions recently about where to find the chrome bumper dipstick and filler, so here they are. Note the access hole and rubber bung were still fitted to rubber bumper cars, and I found that the easiest way to refill the V8 with the side-fill gearbox was with the tubing down through the access hole and into the side-fill hole. However it appears that 77 and later cars had a different console that may have to be pulled towards you i.e. rearwards to access the bung - not a trivial task particularly with the two heater cables. *March 2021:* Two people have stated on the MGOC forum that theirs do not have the bung, but three others have confirmed that theirs do including a reshell.

Whilst side-fill is easy to clean around the filler hole and get the end of the tubing into it without picking up any dirt, top-fill needs a bit more care. I loosely inserted the dip-stick to stop any dirt falling in, then from underneath wiped round the dipstick and the top of the casing. I'd seen recommendations to use a long length of plastic tubing up from the filler hole (top or side) into the engine compartment so one can refill in relative comfort, but opted to do the V8 from the right-hand footwell instead. I used a short length of tubing just smaller than the filler hole via the grommet hole in the transmission tunnel (although originally for the dipstick/filler hole on chrome bumper cars it is present on all cars) even though it is a side-fill gearbox. The gear oil for the V8 gearbox comes in 1 litre squeezy bottles and the nozzle of these fitted neatly into the end of the plastic tubing, and I had enough room to empty each bottle in turn even with the steering column on that side of RHD cars. The 4-cylinder uses engine oil in the gearbox and OD, the 1-litre bottles of this don't have the nozzle like the gear and diff oil bottle do, so you will need a funnel in the end of the tubing for either 1-litre bottle or 5-litre can. I also did the roadster from the footwell and rather than try to wield a 5-litre can in the limited space decanted 1 litre at a time into an empty diff oil bottle so I could use the same method as for the V8. Squeeze for a few moments then release and wait a couple of seconds, and the oil in the tube will drain down and air come back up to replace it and expand the bottle again. Much easier than trying to squeeze a litre in all in one go.

It will take time for the oil to flow everywhere so don't pour in the whole of the recommended amount in one go or it will probably overflow. Even though a dry-fill with OD takes 3.4 litres a basic drain and refill will leave almost a pint in the OD etc., and in the roadster I found that after just 2 litres I was having to pull the tube up a little bit to get any air back up the tube into the bottle. Testing with the dip-stick showed it was just above the MIN mark even through there wasn't much more than half the quantity in yet. With the V8 I was able to get about 2.5 litres in without the same effect, for some reason. At this point I ran the engine on both cars in 3rd and 4th (I had the rear of the car raised to do the rear axles as well, remember) switching OD in and out to distribute the oil. While the V8 was fine OD on the roadster wouldn't engage, which concerned me a bit. However when I

removed the tube and checked again with the dipstick it was now off the bottom. I put another litre in (making 3 litres so far) and tried again, this time it was OK - phew! **MAKE SURE** it is supported safely, don't be underneath the car with the engine running, and make sure there is some run-off room in front of the car. Recheck the level and top-off as required, then replace the filler plug/dipstick and check the drain plug is tight before taking it for a run of a few miles. On your return check the level again on a flat and level surface, and check it again when cold after leaving it overnight, rechecking the drain and level/filler plugs are tight. After the next decent run check the level and the plugs again to give you confidence there are no leaks, then you should be fine to leave it the normal service intervals.

Overdrive: D and LH Type Differences

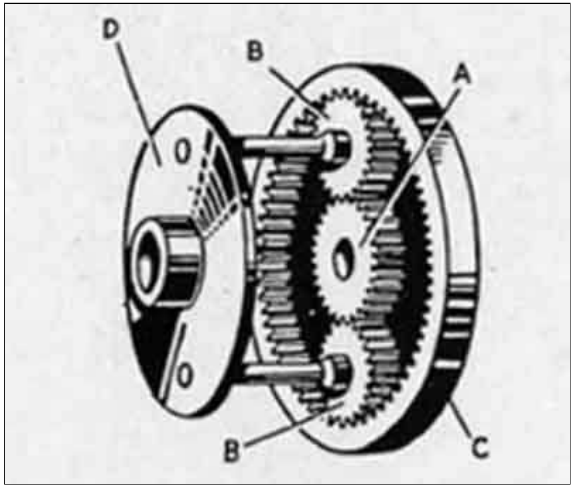
Fault diagnosis

There are both ratio and electrical differences between the early and later ODs fitted to the MGB. The earlier D type has an OD 3rd ratio that is closer to 4th than the LH type - 73% as opposed to 65%. Thus the LH type has closer to a '3rd and a half' ratio than the D type, but both offer a useful mid-way point between 3rd and 4th for spirited twisty bits or a long steepish climb. In theory that should mean that the D-type has a higher road speed for a given rpm than the LH, and indeed it does at 22.3 mph in OD 4th at 1000 rpm compared to 22 mph exactly for the LH. But it has a fractionally **lower** road speed in straight 4th at 17.9 mph compared to 18 mph for the LH. How can that be when they both have the same diff and in 4th the gearbox ratio is 1:1? Maybe down to the different tyres.

The D type is not as strong as the LH and has a vacuum switch and relay to prevent the driver from disengaging OD under certain conditions - high revs and no throttle - which could overstress the unit. The wiring and a description of this circuit can be found here  . The Service Instruction Manual for the D-type as fitted to Standard-Triumph vehicles can be found here.

Although specific to the D-type OD the above document contains this very clear description of how the Laycock overdrive switches ratios, which also applies to the LH-type:
The gear train consists of a sun wheel (A), planet wheels (B), planet wheel carrier (D), and annulus or ring gear (C). The input is via the planet carrier, and when the sun gear is locked to the ring gear the whole unit rotates as a single unit to give direct drive. But if the sun wheel is locked to the casing so it cannot rotate, when the planet carrier is rotated the ring gear is 'overdriven' at a higher speed than the planet carrier to give the overdrive ratio. Believe it or not this is exactly the principle used by the Sturmey Archer 3-speed hub dating from 1902 that many of us will have been familiar with when we were in short trousers. How does that give three gears? The Laycock unit always applies the input to one of them (the planet carrier), and either locks the sun wheel to the ring gear or to the casing to give either direct drive or the overdrive ratio. The Sturmey Archer does basically the same, but can reverse the input and output so that the ratio difference can either be used to gear the output down i.e. for first gear, or to gear it up for 3rd gear, with direct drive for second gear. Lots of videos and descriptions online, with varying degrees of complexity and confusion!

Also complex is understanding what determines the OD ratio, and comparing the drawing above with endless descriptions of epicyclic gearing is no help. The ratio for the simple



system drawn above is determined by the number of teeth in the ring gear, divided the number in the ring gear plus the number in the sun gear. The number of teeth in the planet gears has no effect. But the Laycock planet gears have two diameters - the larger engaged with the sun wheel and the smaller with the ring gear and now the planet gear tooth count **does** have an effect ... and makes the calculation a lot more complex!

Updated December2016: There were three types of LH OD for the MGB - chrome-bumper 4-cylinders cars had one with a black (but see below) Laycock label, 4-cylinder rubber-bumper cars had one with a blue label with a different speedo drive ratio. The V8 was different again in that it operates at a higher pressure, although the speedo drive ratio on all V8s is the same as the chrome bumper 4-cylinder. The MGC also had the LH OD, details unknown. Speedos have the turns per mile (tpm) stencilled on the dial - 4-cylinder chrome-bumper cars have a 1280 tpm speedo and all V8s have a 960tpm speedo, whereas 4-cylinder rubber-bumper cars have a 1000 tpm speedo. On the face of it the V8 should have different speedo gearing to the chrome-bumper 4-cylinder, but they have different axle ratios as well which also has to be taken into account. The 4-cylinder ratio is 11/43 and the V8 14/43 i.e. 27% lower prop-shaft rotation of the V8 for the same road speed. But the V8 speedo would over-read by 25% with the same turns of the drive cable, so they almost cancel each other out, bar 2%. Another factor is the wider 175 tyre of the V8 but the same profile, which results in a 2.5% reduction in wheel and hence prop-shaft rotation for the same road speed. This seems to be resulting in an overall 2.5% reduction in V8 speedo reading for a given road speed, whereas perhaps one would expect it all to work out at 0.5% over-reading, but I must confess I can't be certain either way!

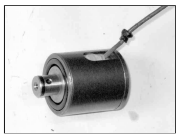
Overdrive Pulsing *Updated April 2017*

Since about 2012 Vee has exhibited a kind of 'pulsing' when switching out of OD after a long fast run, it's as if the OD is engaging and disengaging by itself. Last year someone reported the same thing on the MG Enthusiasts BB, and Stephen Strange of Virginia, USA posted the following:

> "One vexing symptom of an Overdrive problem that is not mentioned in the factory manual is a 'pumping' effect during engagement when the car is driven in direct drive, even though when driven in Overdrive all appears normal. This is caused by a problem that is very simple to fix. When the system is operating correctly, a buildup of hydraulic pressure from the pump is directed to the two operating pistons and moves the sliding annular clutch (conical clutch) unit. Its outer brake surface then comes into contact with the stationary brake ring, and then the complete sliding member and the sun gear will consequently cease to rotate. With the solenoid deactivated (i.e., Overdrive switches off), the solenoid plunger does not retract fully,

> and the springiness in the small O-ring at its tip is enough to push the piston and ball back into its seat once the pressure has bled off. This in turn causes the pressure in the actuating system to increase, which in turn causes the Overdrive to engage again. Past a certain level, there is enough pressure to force the plunger back a bit until the pressure bleeds off and the cycle is repeated again (at a frequency of about every 2 seconds). Normally, as the sliding annular clutch (conical clutch) unit of the Overdrive unit starts to move during the engagement process, the Overdrive unit temporarily loses engagement during the moment between when the inner lining of the sliding annular clutch (conical clutch) leaves its seat on the annulus and the outer lining contacts the stationary brake ring. This is event so brief that it is not noticeable, but in this case, the sliding of the annular clutch (conical clutch) never travels far enough for its outer lining to contact the stationary brake ring before it is pushed back again, so for about a second neither lining is in contact. As soon as the inner lining of the of the sliding annular clutch (conical clutch) engages the annulus, engagement returns with a jerk and stays for a second or so until the of the sliding annular clutch (conical clutch) is again pumped away, and the cycle then repeats itself. The solution to this problem is very simple: fit a thicker gasket under the solenoid cover plate. This will allow the piston to move a bit further back before hitting the solenoid cover plate, the extra movement being enough to make the O-ring slide down into its bore instead of simply compressing a bit and functioning like a spring."

I had some questions about the described cause and cure, subsequently found Paul Walbran's web page (scroll down to Overdrive "Pumping") that at the time described the same problem and solution, and left me with the same questions. As far as a thicker gasket goes, the standard gasket has a large hole which allows the base of the solenoid to sit against the cover. Adding a second or thicker gasket of the same design won't change that, so the plunger will still only move back the same amount relative the solenoid body - which contains the valve seat and ball - as before. Also allowing the solenoid body to come back further will cancel the function of the large O-ring which is to prevent oil leakage down the side of the solenoid body. Also giving more space for the solenoid body could allow the top or the base to move away slightly from the main part of the body, which will reduce the tension on the earthing spring on the end of the solenoid coil. I found even putting sealing compound on both side of the cover gasket, in an attempt (failed) to cure an oil leak, was enough to affect the earthing and hence the electrical operation. One would have to fit a non-standard gasket which held the solenoid body away from the cover - and in the original position relative to the OD body to overcome the problem of oil leakage and coil earthing, but with a smaller hole that allowed the plunger to come back to the cover, to increase the clearance at the valve. However by insulating the solenoid body from the cover you are removing one of the paths through which it can earth, and it will be dependant on a much lighter contact between the sides of the solenoid body and the OD body.



As it has only started happening after 20 years and nearly 100k, I tend to think it is not simply lack of room for the plunger, but something else. The small O-ring Stephen mentions is **not** at the tip of the plunger, but sits in a groove further down, and prevents oil seeping down to the external cover from where it will almost certainly leak, despite the gasket and the rubber seal on the wire. It could have swelled with age, making it more difficult for the plunger to slide back down when the coil is de-energised, but it would have to be resisting close to 510psi in the V8, which seems unlikely, and normally O-rings compress

with age and lose their sealing function. As the plunger normally is able to move at least 2mm, the question has to be asked - why that is that not enough? It could be an obstruction below the plunger, or in the valve assembly at its tip, or in the relief valve assembly.

Incidentally a very similar pulsing can occur with low oil level, but only when overdrive has been selected. In that case there is insufficient oil pressure to keep the sliding clutch fully engaged with the brake ring, and it pulses between OD engaged and not engaged, in drive as well as on the overrun.

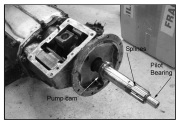
2019: Since Vee's engine and gearbox came out over 2016/17 for an engine rebuild but no work on the gearbox or OD I've not had any pulsing ... but quite possibly because it is now dropping-out electrically on the overrun, with the gear-lever moving forward slightly. I can keep it engaged by pulling the lever hard back and towards me, but it's not something I like doing. I replaced the switch and spent some time fiddling with its shims to no avail - I could reduce them to the point that it would engage pulling in 3rd but still drop out in 4th overrun. With the gearbox now whining it has to come out again, and I shall investigate the linkages that operate the switch.

Overdrive Replacement *June 2013*

A pal has a supercharged roadster and had been having various problems with it failing to engage and disengaging once engaged. Whilst some of the problems seem to have been electrical and were fixed it was still disengaging, and it seemed to be on sudden changes of direction i.e. overtaking i.e. as if 'oil surge' was causing oil starvation. Low oil level could cause that, but of course that had been eliminated as a possibility some time previously, so he decided to do an oil change and remove the sump and filter. There was a considerable amount of what looked suspiciously like friction material lying on top of the filter - which was quite probably restricting the rate at which oil could pass through the filter into the sump to be picked up again by the pump! After a bit of pondering and discussion with Overdrive Repair Services in Sheffield it was decided the best option was to send it to them and as well as any repairs they would uprate it to V8 spec to cope with the additional torque of the supercharger. He and another pal got the engine and gearbox out as one, removed the OD, parcelled it up and sent it off. He got a nice shiny one back in little more than a week, and I was co-opted to help fit it and do an opportunistic change of the clutch, slave cylinder and slave flex hose at the same time.

First task was to split the engine and gearbox, and the biggest problem was to support the engine partly on the hoist to stop it falling over, and partly on blocks to stop it swinging about, and support the gearbox such that as the two are unbolted there is no tendency for them to change angles in different directions and put a bending force on the first motion shaft. Really quite difficult, and having split them both ways now I would never ever contemplate removing both if all I were replacing was the clutch. Even if doing something with the gearbox, if I could get the car high enough I would still remove the engine i.e. while the gearbox is firmly attached to the car, then remove the gearbox separately. This was reaffirmed when it came time to put the two together, as there is a limit to the amount of weight two blokes of a certain age can manipulate in four directions while trying to get the splines re-engaged, but more of that later. The crucial thing is to keep an even gap all the way round between the bell-housing and the engine back-plate, while you are separating and joining the two.

With the gearbox off we decided to go for the interesting bit first and refit the OD. For this we had a Workmate to stand the gearbox on its bell-housing so we could lower the OD onto the other end, also recommended by the people in Sheffield. They supply a gasket for the OD/gearbox join which is proper gasket material, and not the flimsy paper effort supplied by one of the major parts houses. Although the proper gasket, being thicker, will have more ability to cater for minor imperfections in the two flanges, we decide to go for belt and braces in the shape of a smear of non-setting joint sealant on both faces of the gasket.



There are two aspects to be considered when fitting an OD to a gearbox. One is the splines of which more later, and the other is the hydraulic pump cam on the gearbox and the pump plunger on the OD. There is a slight chamfer all round the edge of the cam, and I wondered if this would enable the pump roller to slide onto the cam as the two were pushed together if the output shaft was turned to present its lowest profile to the pump roller. Both the Leyland Workshop Manual and Haynes use the hallowed phrase "To refit, reverse the removal procedure" - yeah right! I took the cam off the gearbox output shaft - be aware there is a ball bearing in a depression in the shaft which engages in a slot in the cam to drive it, make sure that doesn't fall out!! - and held the cam in the position it would be inside the OD, and it was obvious the pump shaft will have to be pulled back against its return spring at least 1/8" before the two will engage, much more than the chamfer. John Twist recommends grinding a bigger chamfer on part of the cam, but I didn't think much of that idea. We used a length of braided nylon cord that happened to be handy, fed through between the pump shaft and roller, the shaft can be pulled back against its return spring pretty easily with that. The two casings are only about 1/4" apart as the roller meets the cam, so not much space for anything else. But to make things easier it helps if the output shaft is turned so that the cam presents the lowest part of its profile to the pump roller. Easily done, but you are going to have to rotate the OD output flange to align the splines, which could easily turn the gearbox output shaft as well. So as the gearbox was on the Workmate we simply put the gearbox into a gear (any gear will do), turned the cam to the correct position, and closed the workmate jaws onto the first-motion shaft to lock the cam in position.

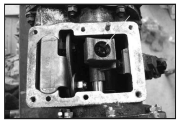
We picked up the OD and turned it open end down ... and about a cup-full of oil (presumably the residue of what was used for their testing) ran out going all over where we didn't really want it. Lowered the OD over the shaft, and it went down until the studs just started to go through the gearbox casing holes, and stopped at about a half-inch gap. We thought that might be the pump roller on the side of the cam, so pulled it back with our cord. It moved back and fore freely and made no difference to the gap between the casings, so it must be something else. Looking inside the OD there are two sets of splines, one in line with the other. One of the people at Sheffield had said something about 'moving the lower splines' which didn't make much sense at the time, especially as he qualified it with "But I only repair them, I don't fit them". At first sight they appeared to be in line, both turning as I turn the output flange, so we have another go with the same result. We then made a crude depth-gauge from a long screwdriver and a bit of masking tape to measure the distance from the edge of the OD casing to where the two splines meet, and compared that with the gearbox output shaft adding on the half-inch gap, and it came right to the end of the shaft, so the shaft must be going through the first splines, but not the second. A closer look at the two sets of splines shows that although one side appears to be in line - the side I looked first, the other side is

noticeably out of line! So a quick call to Sheffield to clarify 'moving the lower splines' and it turns out the inner set are on the one-way clutch, and if you turn the output flange one way the two sets move together, but if you turn it the other way they *do* move apart. They are set correctly at the rebuilders, but can move in transit, and of course if you turn the output flange. What you have to do is put a long screwdriver down inside the splines, hold the output flange, and turn the inner set **anti**-clockwise relative to the outer set (they won't move the other way because of the one-way clutch) until the splines are exactly in line. There are no instructions with the OD about refitting it, I don't think it would hurt them to include something to this effect.

Anyway, with the splines aligned we tried again, and this time the OD stopped about 3/4" short, with the studs clear of the gearbox casing! This must be the first set of splines not aligning this time, so pure luck that they did the first twice we tried. The only way we are going to correct this is to turn the output flange, but which way so that we don't upset the alignment of the two sets!? Now if we had to turn the inner set anti-clockwise relative to the outer set to align the two sets, because it won't move clockwise, then it stands to reason that if we turn the flange **also** anti-clockwise, then the two sets will be locked and so not move out of alignment - OK? A quick practice in the air to work out which way is anti-clockwise with the gearbox and OD standing on end, and I go for it. I turn the flange, then feel a tiny click, which is probably the splines **almost** engaging. But have I gone to far? I can't turn it back or I will misalign the two sets of splines again, to carry on turning anti-clockwise but slowly, and feel another faint click. This time we waggle the OD a little bit, and it drops, this time with about a 1/4" inch gap. So now we pull on the cord, and bingo it drops the rest of the way - barring the thickness of the cord. So very carefully easy the OD up again about 1/8", and pull the cord out. This is where cord is probably better than wire, anything strong enough might be difficult to pull out and leave scratches.

IMPORTANT! The LH overdrive is attached to the gearbox with the solenoid and the manufactures info plate on the bottom. Unlike the D-type where they are basically on the side, which is how one MG 'specialist' used by an MGOC forum member attached an LH OD, only discovered when engine and gearbox were back in the car and he was struggling to understand how the speedo cable ran.

It's now just a case of putting the lockwashers and nuts on the OD studs ... or is it? Two of the studs don't have enough clearance to get the nuts under, so again we have to ease the OD up just enough to get the nuts under, but not enough to get the roller off the cam! The easiest way of doing this is to use a flat-bladed screwdriver under one of the studs and lever up carefully while lifting the OD until there is enough space on the other stud, and a couple of finger-tips to get the threads started. The screwdriver keeps the gap consistent, you don't want to drop the stud onto the nut and risk damaging the thread. With that nut started and on a few turns, lever under that one to lift the other stud and get the washer and nut on that. With those two on the other six are easy, then time for a well-earned bacon sarnie!



After that we change the clutch, then more struggling getting the gearbox back on the engine, keeping it square and aligned in four orientations while turning the OD output shaft (gearbox still in gear) to align the splines, reaffirming that separating and reattaching them in the car is by far the best way (short of using an engine stand). *February 2018:* However it subsequently occurred to me that by using, say, four long shafts or studding about the same diameter of

the bellhousing bolts, long enough to engage with both halves before the first-motion shaft starts to engage, that would certainly help in keeping the two halves correctly aligned whilst pushing them together. Then refit the remote tower (which has to be removed to remove and refit the OD), and most important - attach the gearbox harness to the switches, solenoid wire and gearbox and engine bracket points before putting the whole back in the car! Final job of the day is to change the clutch slave and flex hose, the latter can be really difficult on the 4-cylinder with the engine in-situ. Reinstallation of engine and gearbox to the car is a job for next day.

Overdrive Sequencer Relay

October 2016: For Graham White's version, with added features such as automatic disengagement when changing between 3rd to 4th, and 'belt and braces' ensuring OD cannot be engaged with reverse, see here.

These are the details of the MkII version. For the MkI version click here, and for an 'all-electronic' version see here.

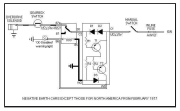
It may be my age but from time to time I find that I move from 3rd or 4th with overdrive engaged to 1st or 2nd and forget to switch overdrive off. All is well until I change up from 2nd to 3rd, then all of a sudden the overdrive engages again, usually under conditions where it is inappropriate. This means not only do I get the mild and unexpected jolt as it engages, but another one when I manually switch it off until I need it again. This has bugged me for some time and I felt sure I could knock up (i.e. build!) a circuit to prevent it.

August 2013: Following an enquiry about fitting this circuit to a car with the gear lever driver's switch I realised there are a couple of complications. For UK cars it is one of accessibility in that the circuit is inserted between the driver's switch and the gearbox switch, so you have to access those wires under the tunnel. North American cars are even more complicated, see here.

The intention of the circuit is to allow overdrive to be engaged if the manual switch is operated whilst in 3rd or 4th, but to lock it out when I change to any other gear, even when I change back to 3rd or 4th, until the manual switch is turned off and on again. On cars with OD on 3rd and 4th OD remains engaged when moving between the two, unless you move the gear lever out of the 3/4 plane into the 1/2 plane and back again, which will disengage OD and lock it out. Originally I achieved this with just one relay with a single normally-closed contact, but its disadvantage is that it requires a connection to the solenoid side of the gearbox lockout switch and there is the faint possibility that a fault could leave overdrive engaged in reverse which would destroy it. This version uses some simple electronics as well as the normally-closed relay and completely eliminates that possibility.

What happens is that the normally-closed contact of the relay is wired **in series** with the gearbox and manual switches. This means that if **any** of the manual switch, the gearbox switch, or the relay contact are open overdrive is disengaged, and they all have to be closed before overdrive will engage. **Thus it is fully fail-safe - any fault in the additional circuitry can only cause the OD to either operate exactly as the factory intended, or not at all, it can never cause it to operate when it shouldn't be i.e. when reverse gear is selected.** So as long as the relay remains released the overdrive operates completely normally, but when the relay operates it prevents the overdrive engaging regardless of the

state of the gearbox and manual switches. The circuit is such that if the manual switch is closed and the gearbox switch is open then the relay will operate, and will remain so until either the manual switch is opened or the ignition is switched off. Remember that whenever the relay is operated its normally closed contact is open, and this prevents the overdrive from engaging.



If you look at the diagram you will see that with the manual and gearbox switches closed and the relay released the solenoid operates in series with the two diodes, D1 and D2. Semi-conductor diodes exhibit a small volt-drop when forward-biased, and though this is not enough to affect the solenoid the voltage developed across the two in series is used to forward-bias transistor T1 via resistor R1 and so switch it on. T1 switched on ensures that transistor T2 is switched off by connecting emitter potential to its base via R2. T2 switched off means that the relay is released, so maintaining the status quo, and overdrive engaged.

If the gearbox is taken out of an overdrive gear the gearbox switch opens, the solenoid is disconnected and overdrive switches out. At the same time the current ceases to flow through diodes D1 and D2 so there is no longer any volt-drop across them. This causes transistor T1 to switch off, which allows transistor T2 to switch on via resistors R2 and R3. Transistor T2 operates the relay which puts another break in the circuit to the solenoid. D3 acts as a 'spark quench' diode to prevent high-voltage back-emfs from the relay from damaging transistor T2 when it switches off and releases the relay. Even if an overdrive gear is selected again and the gearbox switch closes, the relay contact ensures that the solenoid is not energised, so there is still no current flow through diodes D1 and D2, so again the status quo is maintained and overdrive remains switched out.

It is not until the manual switch is turned off, or the ignition is turned off, that the sequencer relay releases, because there is no longer the 12v supply via transistor T2 to keep it operated. But this also means that even when the relay releases there is no voltage supplied to the solenoid so overdrive remains switched out.

Only when the manual switch is turned on again in an overdrive gear does current flow through diodes D1 and D2, the sequencer relay contact (closed), the gearbox switch (closed) and the solenoid to switch overdrive in again.

There has been some discussion about having a warning light glowing when overdrive is engaged, but with the dash and gear lever switches there doesn't seem much point as it is easy to see and feel whether it is on or off. Less easy with the column switch, and in fact my V8 (column switch) came with a warning light courtesy of a PO. But on the roadster with the sequencer relay there have been a couple of occasions I wasn't sure if overdrive was engaged or not, even though the manual switch was on, i.e. I can't tell if the sequencer relay has operated and locked it out without turning the manual switch off and on again. So an enhancement is to have a warning light that glows only when the sequencer relay has operated i.e. overdrive is manually selected but locked out.

Electronic components: I used some 100v 1A diodes (from Lucas, believe it or not) and 50v switching PNP transistors I happened to have lying around from my Telecom days 25 years ago. The resistors used will depend on which transistors you use, but they are not critical. I think I used 1k ohms in each case selected to give minimum current but reliable operation of the circuit. I mounted the components on a small circuit board such that it

could be fitted inside an old Lucas metal can 6RA relay, utilising the spades on the insulated base plate (winding and contacts removed) for its connections to the outside world. The warning light is a red (red being significantly brighter than the green and yellow examples I had in my box of bits) LED in series with a 470 ohm resistor, the pair being connected in parallel with the relay winding, so that whenever the relay is operated the LED glows. *Updated September 2010:* The relay is a 12v automotive 'changeover', 'single-pole double-throw' or 'SPDT' type (try Googling '12v SPDT auto relay') with five spade terminals - a normally open (87), a normally closed (87a) and a common (30) as well as the two winding terminals (85 and 86), check the diagram on the relay matches up with type S4 here. Note that the circuit includes a protection diode (D3), if using relay type S6 you won't need D3 but must get the relay winding terminals 85 and 86 the right way round or you will blow the transistor. Relay type S5 includes a protection **resistor**, on its own that may not be enough to protect the transistor, and may alter the parameters of the circuit so is best avoided.

Installing to the car. The electronic module together with an aftermarket relay (with 87 and 87a connections) were mounted side-by-side close to the fusebox using a handy tapped hole that already existed on my 1973 roadster. Once the two units are interconnected they just need an earth/ground connection from a tag under the fixing screw, and two wires - one to the yellow from the main harness - via an in-line fuse if you haven't already fitted one by the manual switch - and one to the yellow/red in the gearbox harness. I've never liked drilling holes in the dash for extras so positioned the led at the top of the cut-out in the dash that accommodates the steering column. With my combination of height, seat and steering wheel I can just see the LED from my normal driving position, and being recessed slightly into the cut-out it is clearly visible even in bright sunlight.

Update October 2010:

After realigning the steering and rack columns I find the warning light has moved from being just visible to just invisible, unless I keep leaning forward which is a pain, so a new position has to be found. I settle on the small gap between the end of the crash rail and the door seal, as shown here, which is conveniently near the dash-switch.

Differences in other years and markets:

- The electronics are obviously polarity sensitive and so cannot be used as-is on a positive-earth car. However it should not be beyond anyone capable of building such a circuit to come up with a suitable variant, i.e. reversing the diodes and using NPN transistors.
- MkI models use the D-type overdrive and I have not tested the circuit with this unit only the later LH-type. The D-type solenoid has a 17 amp pull-in current and a 2-amp hold in, as opposed to the 1-amp pull-in and hold-in current of the LH-type. Because diodes offer a constant volt-drop when passing a current, two diodes in series will reduce the voltage to the solenoid by twice that forward volt-drop, and hence reduce the current that will flow in the circuit. It's possible this reduced current may prevent the D-type solenoid operating. As a first check before doing anything else you

can get a couple of diodes and wire them in series with the manual switch to see what happens.

- From the 1977 model year all markets had the manual switch on the gear lever. Cars other than for North America are wired as before but the yellow and yellow/red wires have to be picked up by the gearbox owing to the physical position of the manual switch.
- North America '4th gear only' cars were wired differently because the gearbox switch also controlled vacuum advance through the TCSA switch, the order of the gearbox and manual switches is reversed, and the circuit will not work as intended. See here for more information on this model.

Testing:

- With the ignition on but engine stopped and the gearlever in 1st, 2nd or reverse turn the manual switch on and off a few times. You should hear the relay click as it operates and releases with the manual switch.
- With the manual switch off, select 4th gear, then operate the manual switch. You should not hear the relay click at any time.
- Move the gear lever into 1st and you should hear the relay click once as it operates.
- Move the gear lever into and out of 4th a couple of times and you should not hear the relay clicking.
- Switch the manual switch off and you should hear the relay click once as it releases.
- On the road, get into top gear and the overdrive should engage and disengage as normal as the manual switch is turned on and off.
- With the switch on and overdrive engaged move into 2nd and note the revs (which will be higher than in 4th of course). Move the manual switch to off and there should be no change in engine revs.
- Go back into 4th and move the manual switch to off and back to on again. If the sequencer relay is doing its job there will be no increase in revs as you switch it off but there will be a decrease in revs as you turn it on again and overdrive engages.

I've used the MkII version over several hundred miles now and it works well, just a glance at the LED tells me if the sequencer relay has locked out the OD, and sometimes the LED catches my eye anyway.

Overdrive - How many were there? *Added January 2008*

An oft discussed question, opinion being it was 'not many' in North America for some reason when the cars were new, although it is considered a very desirable addition today. Why there weren't many originally I can't imagine - it is eminently suitable for the long distances common in North America, and similar technology to automatics which were very common so that shouldn't have put people off (it didn't in the UK where automatics were rare, and are still uncommon at the time of writing). Maybe buyers just didn't understand what 'Overdrive' was'. Living quite close to Gaydon and The British Motor Museum archive I considered spending some time there counting. Thinking further, I realised I didn't need to go through all the individual build records as 18V engines from August 1971 (North American spec) and November 1973 (all other markets) had different engine types according to whether OD was fitted or not, and these represent very nearly

half of all production. So if there were documents showing how many engines of each type were ordered by Abingdon I could just look at those. It was only subsequently I realised that Clausager already contains this information, as the engine number types and quantities are listed in 'Original MGB'! So here they are:

Period	Market	No OD	OD	Total	Percent OD
Aug71-Nov73	Home and non-North American export	5201	22240	27441	81
Nov73-Sep74	Home and non-North American export	434	7123	7557	94
Sep74-Oct80 (OD standard for Home market from June 1975)	Home and non-North American export	813	40087	40900	98
Total Home and non-North American export		**6408**	**69450**	**75898**	**92**
Aug71-Aug72	North America	19390	2650	22040	12
Aug72-Sep74	North America	37993	6449	44442	15
Sep74-Dec74	North America	5300	1403	6703	21
Dec74-Aug75	North America	9260	1593	10853	15
Aug75-Jun76	Canada	996	313	1309	24
Jun75-Jun76	USA	14700	3408	18108	19
Jun76-Oct80	USA (not California)	50883	10324	61207	17
Jun76-Dec79	California	11958	4483	16441	27
Jun80-Oct80	Japan	0	805	805	100
Aug76-Oct80	Canada	3458	1176	4634	25
Total North American spec		**153938**	**32604**	**186542**	**17**

Note: Whilst the Home and non-North American total engine numbers tally very closely with Clausager's production figures (just 17 different) the North American total is some 5200 different, at the moment I can't see why. The year-on-year disparity ranges from there being 1139 fewer cars than engines for the 75 model year, to there being 3072 more cars than engines for the 77 to 80 model years (which includes Japan up to Dec 79). However this does represent a disparity of less than 3%.

At 92% with overdrive for the Home and non-North American export market and only 17% for North American spec there is indeed a huge disparity. And why should Japan get 100% with OD (admittedly on a very small number) when they got the North American spec towards the end of production? Even California and Canada got a significantly higher proportion than the rest of the USA.

Update April 2008: I've just come across the following passage in 'MG by McComb' (p197): "Another special problem on the US market concerned the MGB overdrive, which

had been available from early 1963 but for some time was withheld from America - where it was most needed - because it might adversely affect the already dwindling sales of the big Austin-Healey. Eventually commonsense prevailed ...". There is no indication of how long this withholding lasted or when overdrives started to be supplied, but with the Healey 3000 finishing in 1967 the very low take-up in North America still continued to the end of production in 1980. Subsequently a USA pal said generally people there didn't know what overdrive was, so couldn't see the point of paying extra for it. It is certainly highly desirable now, with rarity resulting in very high prices so much so that it is worth shipping cheap units from the UK.

Rear Seal

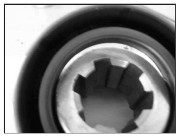
Checking: *September 2016* For a very long time I've suspected Bee's rear oil seal might be leaking slightly, bought a replacement seal, but because drips from the engine were significantly worse there didn't seem much point. After changing Bee's clutch in August and seemingly (so far!) got the engine leak-free I decided to tackle the rear seal. Got underneath to take the prop-shaft off and then remembered that many months ago I decided to see if the seal was actually leaking, by tying a strip of white cloth around the flange shaft adjacent to the seal, and cleaning the bottom of the casing where it angles down and forwards towards the drain plug. The trouble is that not only does oil run downwards, it can also run backwards from air-flow when driving, making it tricky to determine where it is actually coming from. The cloth was perfectly clean, and so was that part of the bottom of the casing, so I'm pretty sure that seal isn't leaking, which means it must be coming from somewhere else. There were drips hanging off the OD filter plate screws, and the drain plug, and I think a little further forwards as well. In the past I've been fairly sure the oil under the gearbox has been clean, i.e. gearbox oil, but moving the car immediately before getting under it did look more like engine oil. As the engine still looks clean - above the sump flange at least - it's a bit of a mystery unless it is the sump gasket, which I didn't touch, but maybe should have replaced when the engine was out. The problem is, where do you stop? Maybe I can tie some longer strips of cloth around the gearbox in an effort to find which section - or sections - it is coming from.

Replacement: *by Michael Beswick, August 2013*

Having just had my overdrive unit rebuilt, I was rather disappointed to discover it was leaking from the rear oil seal. Rather than pull the entire engine, gearbox and overdrive out again, it was decided in conjunction with the rebuilders that I would replace the rear oil seal in-situ. The most likely cause of a leak is a very slight groove in the drive flange where it runs through the oil seal.

The first photograph shows the new oil seal plus new flange and also a wooden disc I made to help seat the oil seal (in the event I did not use this).

The next shot shows how the oil seal fits the flange.



Third shot shows a piece of 2 ½" angle iron, with a curved section cut out and 2 holes. This is used to prevent the flange rotating thus allowing you to undo the big nut the centre of the shaft (which is 1 1/8 AF, same as the front hub nuts).

First job is to drain the oil. Also be aware that when the oil seal is removed a certain amount of oil will escape. As it took me a while to remove the prop shaft and the central nut on the overdrive there was very little oil left in the gearbox.

Undoing the nuts on the prop shaft to the overdrive flange requires a ½" AF open-ended spanner, everything else jams. The bolts are a special type with a flat on them that allows them to fit down the flange and prevents them rotating. Once this is undone you can turn your attention to the flange on the differential. Again it is a half inch open ended and a ring spanner to remove them. I marked the position of the rear flange on the prop shaft and the corresponding position on the flange on the differential. This is probably not necessary as prop shafts are dynamically balanced off-car and should run true with the flanges in any orientation. (As I was removing and replacing the flange in the overdrive there was little point in making similar marks for the front of the prop shaft). The prop shaft can then be fed forwards and downwards and removed.

The central nut of the overdrive was pretty tight so I needed to use the piece of angle iron which jammed against the transmission tunnel. Using a 2 foot breaker bar and pulling the angle iron towards me I managed to loosen the nut. The splined flange then simply pulls forwards and off. (See also this 'universal' tool made from B&Q flat steel strip).

I had been told that the seal could be removed using a screwdriver, but I found that I needed the correct tool. I borrowed one from my local garage but Machine Mart do them for about £6. It resembles a small ice pick. It is obvious how to use the pick - set it so there is leverage then a sharp pull will remove the seal. It seems that the tool pulls out the spring that forces the lips of the seal against their respective faces. Thus deformed the seal comes out easily. Care needs to be taken to ensure the tip of the "pick" rests on the seal and does not score the face of the housing-thus producing another oil leak....

Replacing the new oil seal is simply a matter of oiling it all round and then using a large socket (or equivalent drift), and tapping it home ensure it is square. I then used a soft-faced mallet to ensure the seal was flush all the way round.

The special prop-shaft bolts have to be fitted to the drive flange before the flange is fitted to the gearbox or OD. It is worth cleaning up the threads on the bolts with a die. Trying to get the nut on a semi-captive bolt is a fiddle, as the yokes of the U/J get in the way.

Oil the lip of the seal and the flange, replace the splined flange, and fit the washer and nut. The large central nut needs to be tightened to 55 foot pounds and I discovered by putting the car in second gear that I was able to achieve this. It may well be that using bottom gear would be sufficient to enable this nut to be undone and therefore the piece of angle iron would not be necessary.

Slide the prop in from the gearbox end and reconnect the diff flange and the o/d flange. The diff is relatively easy, but the o/d one is a fiddle (again!).

Replace the drain plug and refill with oil.

I could have refilled with oil before attaching the prop-shaft, then started the engine, engaged 3rd or 4th and overdrive which would have served two purposes - firstly it would have allowed me to top-up and correct the oil level there and then as it always drops a significant amount the first time the gearbox is run and OD engaged, and also to see if the new seal leaked. However I only thought this after I finished reconnecting the prop.