Steering and Suspension

Last updated 02-Jan-2012

NEW NEW NEW **The sectioned MGB at the Heritage Motor Centre Museum, Gaydon** NEW NEW NEW

July 2009: All you ever wanted to know about dampers, including the quote "The parallel-piston lever-arm damper was functionally very good, and the fact it has been superseded by the hydraulic telescopic, and the strut in particular at the front, is mainly due to the final assembly advantages of these, rather than any functional gain in the areas of ride and handling". In other words, simply replacing the dampers is a waste of time and money, you would have to go for a wholesale replacement of the suspension system front and rear to get anything approaching modern levels of handling. OK for serious competition maybe (then why bother racing an MGB?) but it destroys the essence of the MGB in the process - that of predictable handling and ease of control.

November 2010: Whilst British Springs seemingly went to the wall some time ago Owen Springs in Rotherham apparently took over their work in 2007. They don't mention MGB (or any application) by name but hopefully have the correct spec sheets and can supply from stock. However if this is the case one would expect them to be available from the usual suspects by now.

A-Arm Inner Bushes

That is the bushes on the pivot pin bolted to the front cross-member. Originally roadsters had a three-part bush consisting of a steel sleeve and separate rubber bush split into two parts. As the separate bushes can slide around the steel sleeve there is no need for special treatment when fitting them, just bolt up the pivot pin castellated nuts, fit the split pins, jack down, and away you go.

However V8s have a one-piece assembly where the rubber bush is bonded to the steel sleeve to give more positive handling. With these it is important not to tighten the pivot pin castellated nuts until the weight of the car is on its suspension. This is because the outer part of the rubber is a tight fit into the A-arm, the steel sleeve acts as a spacer and is clamped tight by the nut, and so the action of the suspension tends to twist the rubber rather than slide it over the spacer. If the castellated nuts are fully tightened with the suspension hanging down then when the car is on its wheels there is already a lot of twist imparted to the rubber, and when the suspension is compressed over a bump it gets twisted even more. This can tear the rubber to the detriment of handling.

The steel sleeve is quite a snug fit over the pivot pin and can rust to it. In the past I've had to drill through the rubber to part the A-arm from the pivot, then carefully

grind through the sleeve before I could chisel it off. The rubber bonds to the A-arm as well requiring more digging-out. Clean up the pivot pin and A-arm hole with a fine file or coarse emery as required to get smooth surfaces. To get the new bush into the A-arm you may well have to smear it with washing-up liquid or Swarfega Original (smooth), then use a vice to press the new bush in. For full seating you may need to use a large socket that will fit over the bush but bear on the A-arm hole on one side, and a small socket that will bear on the sleeve on the other. Smear the pivot pin with copper grease to aid future disassembly and reassemble the A-arms to pivot pin, washers and castellated nut **leaving the nuts a turn or two loose** as mentioned above. Reassemble the A-arms spring pan, spring, swivel axle as described in Front Spring Removal. Lower the car onto its wheels, and only then tighten the castellated nuts and fit the split-pins.

Anti-roll Bars

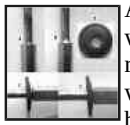
Rear anti-roll bar. These were fitted by the factory from June 1976 for the 1977 model year but they are available as an after-market product for earlier cars. The PO of my V8 fitted the Ron Hopkinson kit together with tubular dampers at the rear. The RH kit also includes an uprated front anti-roll bar as stiffening the rear without doing anything at the front bring on oversteer. For some time I couldn't really tell whether it was making much of a difference (although the PO said it did, but he would, wouldn't he?) although the back did feel 'different' to my roadster. But whether that was just because I was comparing a CB roadster with an RB V8 I couldn't really say. Then I drove a friends unmodified CB V8 and I could immediately tell it was the same as my roadster i.e. with more movement at the rear as if the rear axle were moving around or the tyres were squirming. But I still didn't know how much of the difference was down to the ARB and how much to the dampers.

Then last year I became aware of a rattle from the back of the car. When I checked I found that both of the ARB drop-links had snapped where they connect to the bar itself. When I got them off I could see there was a pin on top of the drop-link that goes through a large dished washer, rubber bush, the eye on the bar, another bush and washer and a Nylok nut holding it all together. The pin had thinned due to corrosion, eventually snapping, click on the picture at the left to enlarge. They had been on the car some eight years and 65k miles of all weathers but even so I thought it was a bit soon for suspension components to corrode and break. However the rear of the car suddenly felt like an unmodified car again, indicating that the improvement came from the ARB and not the tubular dampers.

Ron Hopkinson used to be located in Derby but Moss UK in Derby has taken over the distribution. I ordered a pair of drop links and new nuts, together with two bushes and washers which had been lost, one from each side. The rubber bushes being compressible, and with no instructions, I erred on the side of tightness and when fitting the new parts tightened down the nuts quite a bit. I also daubed the parts in Waxoyl to hopefully reduce any subsequent corrosion.

Immediately the rear handling was restored and I went merrily on my way. However about 100 miles down the road I had just done a bit of enthusiastic overtaking when I heard a bump, looked in my rear view mirror, and saw something bounding off into the undergrowth. When I checked underneath sure enough the new pin had snapped but this time I had lost both bushes and washers from that side as it had snapped right at the base of the pin and not part way up as before, see the picture on the left.

I got on the phone to Russ at Moss, who asked me to return the broken drop-link, then he sent me a new pin, bushes and washers at no charge saying he wasn't surprised it had broken given the design of the drop-link with its sharp angle. However after the failure of the new drop-link I had a close look at the ARB and realised there is a significant design weakness in the Ron Hopkinson design as a whole and not just the drop-link. If you look at the factory bars where it joins the drop-links you can see there is a joint that allows the drop-link to swivel back and fore freely, and this is important because as the axle goes up and down the angle between the drop-link and the ARB is continually changing. But with the RH arrangement the only movement that can take place is by distorting the upper rubber bushes which themselves are trying to bend the upper pins of the drop-link back and fore. So this time I made what movement there is as easy as possibly by only tightening the nuts enough to fully engage the nylon on the Nylok nuts. But even sooner this time it seemed, the drop-link on the right-hand side broke yet again, this time while travelling in a straight line but over some undulations.



Another phone call to Moss and another free drop-link, bushes and washers, but this time they sent yellow poly bushes instead of black rubber. These are **much** harder than rubber so I would imagine they would break the pins even quicker. Fortunately I had enough rubber bushes left for the top and used the yellow ones on the bottom where there is less bending movement. I decided to try and strengthen the pins by welding and grinding at the base to form a radius instead of a right-angle, you can see the before and after as A and B in the picture on the left. I also cut a chamfer into the base of the bottom washer (C in the picture) so that it sat right at the base of the pin and not up on my weld (D and E before and after). Furthermore I have tried to make the bushes more compliant by shaping the inner hole into a cone rather than the original cylinder, in the hope that this would impart less bending force to the pin. Time will tell, but if one of these breaks again then short of coming up with a completely different joint that allows free pivoting of the drop-link to the bar, I shall have to junk it all.

Update May 2005. Some 18 months and 4k miles later, and prompted by an enquiry from someone else who has had the same failure, they seem to be holding up, and that includes a reasonable amount of using the power and working the suspension. Someone else reported a while ago that they only just nipped up the nuts and have had no problem, but when I did that on the 2nd replacements they broke even sooner than the 1st replacements. An alternative to doing away with a rear ARB altogether might be to fit the factory system recovered off a scrapped car. The joints at the ends of the bar (which freely articulate) could well be worn and loose but I note they are now available again. Another possibility might be to

machine the ends of the RH bar to accept the screw-on factory end joints.

Update April 2007.

All's well with the drop-links, but I've had a request from someone who has obtained the kit but without instructions and asking for any help I can give on where and how the bar mounts. Mine were fitted by the PO so I have no instructions, but I can at least supply some photos and a brief description, click on the thumbnail.

Front anti-roll bar. I have an issue with the uprated front bar as well. One day I noticed a grinding on full lock and it turned out to be the rim of the wheel rubbing on the bar. Checked the other lock and it had plenty of clearance, so I gave an exploratory tap on the bar with a lump hammer and it moved sideways a little bit. So I tapped it some more until the clearances were about equal both sides. Now the standard bar on both the V8 and 4-cylinders cars have clamps which sit just inside the pivots and bushes which bolt up to the front apron and so prevent the bar moving from side to side, but mine doesn't have any. Either the PO never fitted them or the Ron Hopkinson kit never provided them which would be another black mark against them. However this is the first time in 9 years and 65k miles so perhaps I do them an injustice. The right-hand (where the rubbing was) front damper has also started leaking recently and although it still seems to be damping normally maybe that has had an effect too. We shall see and if it rubs again **after** I have changed the damper I will have to investigate some clamps. *Update summer 2006:* Still grinding, and by this time Colin Parkinson had emailed me to use a 1" length of hose of the appropriate diameter split up one side, and a worm clip clamped round that. Didn't have any suitable hose, but I did have an old inner tube I had already cut into, so I used a 6" (or so) length of 1" width of that, wrapped round the bar several times, and then clamped. We shall see. *Update Summer 2007:* No further grinding, so it looks like a successful mod.

NEW Centre-lock Wheel Grease Cap *Added January 2010*

Like the stud-wheel type they can be pretty tight, but unlike the stud-wheel type they are recessed inside the splined part of the hub. There is a threaded stud on the end of the cap which at a pinch can be gripped by a pair of pliers and pulled and wiggled, but that damages the threads so a more elegant solution is called for.

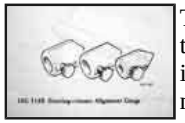
The stud thread is 1.4" UNF, so a nut welded onto the end of a tube or bar, with some means of levering it out once it is screwed in will do the trick. I thought about a couple of lengths of bar pivoted together, but I've got enough volume and weight of tools as it is. So I opted for a length of tubing about 4" long, with a nut welded to one end. A slot drilled in one side to insert the blade of a largish screwdriver, and away we go.

Screw the tube on to the stud until the slot is just about level with the end of the hub, insert screwdriver, and lever. If the slot is too

deep in the hub the angle of the screwdriver will tend to try and push the cap to one side rather than levering it off, ditto if the slot isn't in far enough, close to a right-angle will be fine. The cap is pushed in about 3/4" or more so once the cap has started to move you will probably need to remove the screwdriver, screw the tube onto the stud a few more turns, then lever again. For replacement you can either leave the tube on the stud and tap the open end of the tube, or any one of a number of other methods. There is a distinct change in sound from a dull 'thock' to a sharp 'clink' when the cap is fully on.

Column/Rack Alignment *Added July 2008*

It is vital to get this correct or you will get rapid wear of the UJ and rack pinion bearing and possible breakage of the pinion shaft. Play in either is a UK MOT failure, but note that a certain amount of rotational play in the collapsible steering columns themselves is acceptable (my Toyota Celica manual quotes 1/4" at the rim, for example, which is about what my V8 has, but I have had to replace the UJ on the roadster a couple of times even though it only had barely detectable play).



The objective is to get the centre-line of the rack shaft crossing the centre-line of the column shaft at the exact centre of the UJ. It is achieved by shims between the four rack to cross-member mounting points, together with positioning of the steering column within the movement of its mounting bolts. It is necessary because the rack and column shafts sit at different angles in both the vertical and horizontal planes, as well as manufacturing tolerances in the bodyshell and crossmember. The factory used this tool (click thumbnail), note that the different bores were probably because it was a standard tool across a range of BL vehicles, although there **are** different lengths of chrome and rubber bumper MGBs of which more later. Highly unlikely to be available now, so how do we replicate it? Personally I wrapped some stiff wire around the end of each shaft, with the tip of each wire at a point in space equal to where the centre of the UJ would be when fitted to that shaft. You can get the tip exactly on the centre line by rotating each shaft in turn, if you get any wobble of the tip it isn't aligned, so tweak it until it is stable. Then it is a matter of fitting shims and adjusting the column as required to get the two tips just touching, which could be quite a long process of trial and error. Others have said they used blobs of Blu-Tak or similar. The problem with both of these is that it is very easy to knock the tip of the wire or Blu-Tak off-centre as well as length. Some have said they loosely fit the rack, connect up the UJ, then measure the gaps between the rack casing and the crossmember and fit shims accordingly. Personally I don't think that is good enough on its own as the weight of the rack will be hanging on the UJ to some extent, although it is probably good enough to get a starting point for shims, and trial and error with pointers after that for fine adjustment. *Update January 2010:* Even worse is a method I've seen where someone turns the steering wheel back and fore while someone else tightens up each rack bolt bit by bit, till the steering wheel binds, then that bolt is slackened a bit, a section snipped out of a washer so it can be slid on the bolt, and that bolt tightened. That is so crude, the UJ will surely start binding way before you can feel any resistance at the steering wheel, hence still be binding when it is backed off a

bit and the washer tightened. Besides which the washers that were shown were way thicker than any shim I have seen. Definitely from the "If it isn't bodged it won't work" school of engineering.

Updated January 2011: Note that the early and intermediate columns (all Mk1 cars, and non-North American cars before the 72 model year) had a different mounting arrangement to the final full energy-absorbing column. The early and intermediate columns have two sets of brackets under the dash both of which can be used to alter the column position both vertically and horizontally, and small movements here will make large movements of the end of the column shaft in the engine bay. The later energy absorbing column has one bracket under the dash with three bolts, and the bottom of the outer tube has a loose plate with three bolts screwing it into the firewall. It's been said that this bottom plate and its bolts are to align the column but that is **not** the case. They simply clamp the loose plate on the bottom of the shaft, via a gasket, to the toe-board and are solely to seal the body aperture against water, noise and fumes ingress. All the alignment must be done by sliding the column on the upper three bolts for in and out adjustment, swivelling it sideways for horizontal adjustment, and by shims between the column and the body bracket, and the rack and the cross-member brackets as required, to get the correct vertical alignment. It's only when alignment is complete you tighten the toe-plate bolts. With all columns if you remove or alter the column even if you haven't altered the rack you will need to recheck the column alignment before tightening the column bolts. Note that for the earlier columns the inner shafts are free to slide up and down and will automatically take up the correct position when the UJ clamp bolts and rack mounting bolts are inserted. This is not the case for the later energy-absorbing column, where its in and out position must be carefully set with the gauges, in order to get the correct spacing of the shaft cut-outs, so that the UJ and rack bolts can be refitted.

As far as using gauges goes my Haynes is completely wrong here, saying as it does that the rack and column should be fitted before installing the alignment gauges. This simply cannot be done, the two have to be moved apart a couple of inches to get the gauges onto the shaft, and off again to refit the UJ. With the gauges on adjust the column position and the shims as above to get the correct alignment. However my Leyland Workshop Manual also has a major error in the section for the later energy absorbing columns, in that it tells you "Slacken the screw on the column point gauge and slide the gauge down until the points of both gauges are on the same plane but not overlapping". The whole point of the gauge screws with this column is that they **must** screw into the cut-outs in the shafts, and the whole column must be slid up and down to get the points to just touch. Unless you do this it is highly likely that you will **not** be able to get the second UJ clamping bolt inserted, or the rack bolts refitted, whichever you do last. This isn't the case with earlier columns, where the whole inner shaft is free to slide up and down inside the outer. With those the shaft will automatically take up the correct position. I repeat, with the later energy-absorbing column you can only adjust the up and down position of the inner, and hence get the cut-out in the correct place for the UJ, by moving the whole column on its upper bolts (which is also why the toe-plate must be able to slide up and down on the column outer). It also tells you to fit the rack after the column, and after the gauges have been fitted. Ok if you have both off, or

just the rack, but not if you have only had the column off. It makes more sense to fit the gauges before the column is reinstalled, rather than fit the column, pull the rack, fit the gauges, refit the rack, align, then have to pull and refit the rack again in order to remove the gauges and fit the UJ. Additionally towards the end of the process it tells you to replace the gauges with the UJ, then fully tighten the two upper bolts, then measure the gap at the third bolt, and fit shims accordingly. This makes no sense to me. Better to align, fitting shims as required to the third bolt and fully tightening all three to get the correct alignment while the gauges are still on the shafts. And only then pull the rack forwards to remove the gauges and fit the UJ, and refit the rack. Unlike the column, the rack (with its shims) should always go back in the same position. Whereas if you are only fitting shims to the third column bolt and fully tightening that after the UJ is installed, you could be affecting the vertical alignment. This is why it makes more sense to fit the gauges before installing the column, leaving the rack where it is until the very end of the process, only finally pulling the rack forwards to remove the gauges and refit the UJ. Note that if you raise the front wheels off the ground you only have to remove the four rack bolts, leaving the track-rod ends attached to the steering arms. As you pull the rack forwards to allow you to remove the gauges and fit the UJ, the wheels will simply go 'pigeon-toed' i.e. turn in towards each other.

Some time later I came across a web page by Simon Jansen in New Zealand who had fabricated his own alignment tool and gave the dimensions he used, see here and scroll down to January 2006. This topic comes up on mail lists and BBs from time to time and I had posted links to Simon's site. Recently someone came back querying the 29mm dimension from the centre of the notch in the shafts and the tip of the tool, saying his was more like 33mm. I passed this on to Simon, and he said it was possible as his car was a mish-mash of components as it was a conversion from rubber bumper to chrome **and** from LHD to RHD. I measured a new RB V8 UJ as carefully as I could and also came up with 33mm, with 45mm for my chrome bumper roadster (measured on car) and posted this as a warning with the link I already had on this site to Simon's page.

Some time after that Kelvin Dodd of Moss US posted this link to a replica tool available from Moss. It's curious that it seems to come with two sets of screws, as it would need two sets of **holes** to be suitable for both chrome and rubber bumper cars, which would need only one set of screws. I asked Kelvin if could confirm whether there were one or two sets of holes, and what the distances to the tips were. He came back with the information expressed slightly differently as being an overall length of 2.11", one hole 0.336" from the **open** end, and another hole 0.936" from the open end. The bore is 0.744+-0.005/0.002" or 18.9mm (slightly smaller than Simon's 19.3mm), and the hole depth is 1.70". Converting this to distance from the tip and millimetres I get 1.174" or 29.82mm for one hole and 1.764" or 44.8mm for the other, and this is where it gets curious. The Moss 29.82mm is pretty close to Simon's 29mm, and the Moss 44.8mm is very close to the 45mm I measured on my CB roadster. However my RB V8 UJ measures 33mm, which is the same measurement that the person who queried Simon's dimension in the first place, and looking in the Parts Catalogue there are only two part numbers for UJs for all models, years and markets i.e. one for CB and one for RB.

So I've re-measured my new RB V8 UJ more carefully, and still get around 1.2415" which equates to 31.5mm, so the Moss 1.174" or 29.82mm remains a mystery (Simon's original 29mm less so as his car is much modified). If making a tool for yourself you will need to check your UJ dimensions very carefully.

Update March 2010: Just been made aware of the identical alignment tool at Moss Europe. The good news is that it is only £7.65 as opposed to $24.95 when the exchange rate is 1.5 i.e. $12 or £16! The bad news is that they insist on you ordering at least £10 of parts, before they tell you the shipping costs.

Update August 2010: I get the Moss gauges with a replacement UJ and track-rod ends, so measure them myself. As I've got to change the steering column UJ, and the rack has to be pulled forward for that, it's a good opportunity to check the alignment at the same time (which is why I bought the gauges with the UJ ...).

The gauges are a nice snug fit on the shafts which is good, and one thumbscrew in each gauge going into the shaft groove holds them firm. The pointers are about 1/8" out, part horizontal and part vertical, which could have contributed to UJ wear, but there is some up and down and side to side play in each shaft so the end result would have been not much by way of sideways forces on the UJ. I'll need to adjust the sideways misalignment at the column mountings, so I opt for seeing if I can get the vertical alignment corrected there as well, rather than fiddling with shims at the rack. This style of collapsible (not energy-absorbing, that came later, the two halves of collapsible columns slide freely once the plastic peg has broken from an impact. With energy absorbing columns the outer concertinas to absorb energy, as well as the inner collapsing) column used on UK 72 and 73 models is supported by two body brackets, one up by the dash and another one further down under the shelf. Both are slotted so each mounting can move up or down independently giving quite a large change in vertical position of the UJ end of the column shaft. I find the top can go up just a little bit and the bottom down, which puts the gauge pointers in perfect vertical alignment. For horizontal alignment I put a washer between the body bracket and the column bracket on just one side, and this brings the two gauge points together. I was lucky, it really was as simple as that, the first repositioning of the brackets was right, and the first washer I tried was right. Then it's unbolt the rack again and pull it forwards as before to remove the gauges and fit the UJ, lining up the splines by eyeballing the front and rear tyres to get an equal overlap both sides, then fitting the UJ with the wheel in the straight-ahead position, and finally bolt the rack back down. The UJ only attaches to the column shaft in one position as the cut-out for the clamp bolt is cut straight across, but the rack shaft is cut all the way round. Really I should have put a paint-mark on the rack-shaft in line with the slot in the clamp before removal, but as I've got to change the track-rod ends as well and then get the alignment checked, it'll come straight in the end.

NEW Column Universal Joint *Added August 2010*

Note that chrome bumper UJ consists of separate yokes, spider and bearings (needles in a cup) and the spider and bearings can be replaced using the existing yokes. For rubber bumper cars the overall UJ is smaller which precludes component replacement and it has to be replaced as a complete assembly.

Bee had advisories on both track-rod ends this year. Having a quick look the boots had split on both, and the pin on one was loose in the body so I'm surprised it wasn't a fail. But while checking those I became aware of slop in the column UJ (again!) and that is usually a fail. This will be the fourth replacement, the first failing at the next MOT as the cups were loose in the yokes, but I got a 50% refund on those. The second replacement lasted about eight years, this one six, but only at about 2-3k miles per year for each so pretty poor. Thinking it could be column and rack alignment, my previous attempts being done with wire pointers as above, and having recently found Moss UK have the alignment gauges, I get the UJ, track-rod ends and gauges from Moss.

The UJ change was a fairly straightforward operation - remove the four rack bolts, pull it forwards about an inch or so and that with the column shaft pulled back (early collapsible column inners move in and out a couple of inches) gives enough room to get the UJ assembly off the shafts. Circlips removed and tapping the yokes knocks the cups out, but the new ones need the big vice to press them in, so no problems of them being loose next year! I then go to grease it using the supplied nipple and find it is smaller than standard, so my grease gun doesn't fit. The tapping in the UJ body is also smaller than normal so a standard nipple won't fit that either. Email to Moss, but I'm still waiting to hear what size it is or what size grease gun nozzle is required. Two local car spares places don't have any nipples or adapters, and the garage staff at one of them aren't aware of these under-sized nipples, so that problem goes on the back-burner for a while, and I get on with checking the alignment of the column and rack shafts.

That gives me time to ponder the issue of the grease nipple. The supplied nipple is an angled one, and is in two parts i.e. a straight nipple screwing into an angled base. With the steering turned to the appropriate position the nipple is pointing straight up, so easy to get a 6mm socket on to unscrew it from its base, which I had previously screwed in to the tapered threads so as to position the nipple between the two yokes. I have the idea of making an adapter by finding a bolt that screws into the nipple base, drilling a hole through that, cutting the head off, then drilling and tapping a straight standard nipple to screw on to the bolt. The first brass bolt I find in my box of bits screws into the nipple base. It's a bit loose as the threads aren't the same but should be OK as I only intend to use it for greasing, replacing it with the under-sized nipple between services. The bolt has a 3BA thread, so I drill and tap the standard-sized nipple right the way through (it doesn't need the ball and spring to keep dirt out as it isn't staying on the car) making it easier to clear out swarf

afterwards, and I pump a little grease through the assembled nipple and adapter stud just to make sure they are clean. Unscrew the under-sized nipple, screw in my adapter, pump grease gently until some issues from the cups, and none comes from where the adapter screws into the nipple base, which I reckon is a pretty good result! Finally unscrew the adapter and refit the under-sized nipple (which still has its ball and spring to keep dirt out of course). All I have to do now it put the adapter in a small poly bag and keep it somewhere I can find it at the next service ...

Dimensions

	Front Track	Rear Track	Wheelbase
Wire wheels	4' 1 1/4"	4' 1 1/4"	7' 7"
Steel wheels	4' 1"	4' 1 1/4"	7' 7"

Front Bearing End-float

The socket for the front hub nuts (on my 73 roadster and 75 factory V8) is 1 1/8" AF. If you have wire wheels you will need a method of removing the grease-caps.

Why end-float?
How do I set end-float?

Why end-float? *Updated August 2011*
The Factory Manual is quite clear on the need for a particular end-float i.e. 'free play' to be present with the type of taper roller bearings used in the MGB. Anyone who tells you to apply a pre-load of 11-15lb ft (i.e. the opposite of end-float) or whatever is wrong. That may be correct for other applications, but not for the MGB. Some say that you don't need shims in the front hubs, some even say you don't even need the spacer. Others say that the act of clamping the inner races, shims and spacer between the hub nut and the base of the axle spindle significantly increases its strength. I can certainly imagine that without shims or spacer the inner race could spin on the axle wrecking it, so personally I prefer to keep things as they came out of the factory.

As to why it's needed, consider the following: The brake disc gets very hot, that is attached to the hub, and when that gets hot it expands along the line of the stub-axle as well as radially, and this longitudinal expansion moves the outer running surfaces of the two bearings further apart. The stub axle should always be cooler than the hub, so won't expand as much, so the inner running surfaces of the two bearings aren't moved apart as much as the outers. If you look at a cross-section of the hub assembly you will see that the outer running surfaces are effectively between the inner running surfaces, and with the differential expansion each outer will be pushed closer to its inner, reducing the gap for the roller. With no running clearance when cold (let alone if there is 'pre-load'), despite the fact that tapered rooler bearings are good at taking axial load as well as radial, this will squeeze the roller between the two running surfaces pushing grease out of the bearing and generating significant heat in the bearing itself, both of which will eventually result

in premature failure of the bearing. With the correct end-float set when cold, differential expansion will be taken up by the end-float, so protecting the grease film and bearing surfaces.

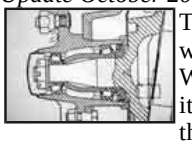
How do I set end-float?
It is advisable to have a selection of spare shims to hand before starting the job, they come in three sizes - .003, .005 and .010, and in the absence of a dial gauge will be required for estimating end-float as well as setting it. *Updated May 2008:* I've just had to reset the shims on one side of the V8 and found a .030" shim in there as well, which I seem to remember someone else mentioning in the past but I didn't notice one when I did the roadster. Whatever, it will be the three smaller sizes you will be juggling with.

- When replacing bearings assemble everything dry first (i.e. without grease) as it keeps things cleaner and is easier to set the end-float.
- The order of parts on the axle is: oil seal collar - inner race of inner bearing - spacer - shims - inner race of outer bearing - bearing retaining washer - nut.
- The first time you assemble the parts onto the hub leave out the shims and tighten the nut until the bearings bind to seat the outer races in the hub.
- Now fit the shims between the spacer and the outer bearing. The objective is to add and subtract shims until you get an end-float of .002 to .004. Using combinations and multiples of shims will give most values in .001 increments with the exception of a few of the smaller values, as follows:

Total	Qty. of .003	Qty. of .005	Qty of .010
.003	1	0	0
.005	0	1	0
.006	2	0	0
.008	1	1	0
.009	3	0	0
.010	0	0	1
.011	2	1	0
.012	4	0	0
.013	1	0	1
.014	3	1	0
.015	0	1	1
Etc.			

You will see from this that you will need up to 4 of the .003 but only one each of the other two, until you get up to 20 thou when you will need a second .005" or .010". There will almost certainly be some shims in the hub already, but if you make sure you have these as spares before you start you should be fine.

- Keep juggling shims until you get two combinations that are ideally only .001 apart where the thinner combination gives no end-float and the thicker gives perceptible end-float i.e. -0.001 to +0.001. Tighten to 40 ft lb plus the next split-pin hole with the thicker set and check you still have perceptible end-float. If not add .001 at a time until you have. Use the set that was the thickest to give no play, add another .003 shim to that, and you should have the required .002 to .004
- When you have determined the correct shims remove the races and inject or press grease **in one side only!** Keep going till the grease comes out the other side, and leave a bulge of grease on both sides. **Don't** be tempted to save time by greasing from both sides you will trap air in the middle of the bearing and possibly cause premature failure.

- Fill the groove in the oil seal that goes at the base of the axle shaft with grease, and the cavity between the oil seal and the inner bearing. Don't fill the cavity between the bearings or the grease retaining cap with grease.
Update October 2008:

There doesn't seem to be any written description of which way round the oil seal goes in the hub in either the Workshop Manual or Haynes, and whilst Porter does cover it in some editions of his 'Purchase and DIY Restoration of the MGB' or 'MGB Restoration Manual' it seems his description differs from his drawing. My 1989 edition of the former doesn't cover it at all, but Neil from the BBS writes that in his 1992 edition Porter on page 179 says the oil seal should be "fitted to the hub with the lip facing inwards or uppermost in this shot"... but 'the shot' shows the seal facing OUTWARDS, which is indeed uppermost in his picture! So he says it right but shows it wrong. The Workshop Manual does have this photo showing the flat side of the seal facing out from the hub and the grooved side i.e. the lip facing inwards. This is probably deliberate to keep water off the spring that provides the tension on the lip, so preventing it rusting, breaking, and consequently letting water and dirt in and grease out. I believe this to be the standard way to do it i.e. the flat side facing the dirt and the lip facing the oil or grease. Certainly for the rear axle half-shaft oil seals both the Workshop Manual and Haynes say "lip facing inwards".
- Reassemble everything, tighten the nut to 40 lb. ft., then tighten further until a hole in the shaft lines up with a slot in the nut. This should occur well before the maximum torque of 70 lb. ft. is reached. Some people say that this additional tightening removes the end-float and to fit additional shims on the **outside** of the outer bearing until the hole and slots line up at the minimum torque. Personally I have not found that this loss of end-float occurs. However, I have found that fitting shims between outer bearing and locating washer causes slivers of metal to be shaved off the shims when the nut is tightened, because in this position they are resting on the threads of the axle. Slivers of metal are **not** what you want in your new bearing!

NEW Front Bump/rebound rubbers *Added September 2010*


Spotted the bump rubber on the left side was missing from the bracket while working on Vee's king-pins. Got a new one but when removing the old one of course the alloy spacer crumbled quite badly, it was only then I remembered it happening the last time I changed one! It rots really badly - swelling so much it distorts the bracket and even the cross-member mounting point, and because the bolts seize in the spacer the ends around the holes tend to break away. It may also be the swelling against the face that holds the bump rubber that pushes the rubber out of the bracket. So something else to order, but in the meantime I managed to file the worst of the swelling off so it could be refitted temporarily with the new rubbers. The bolts are a bit of a fiddle, you may be able to get a slim ring-spanner on the nuts which are inside the bracket, failing that you will have to use an open-ended. And if **that** slips off and wrecks the heads they will have to be ground off.

Even with a slim ring-spanner you can only undo the nuts part way, as the nuts move up the threads of the bolt they reduce the space available to remove and refit the spanner. Using a socket on the bolt head and using the ratchet on that to turn the bolt, leaving the spanner on the nut helps. It's this that is going to crack the spacer around the bolt, but you are going to have to face that at some point anyway.

When fitting the new bracket and spacer get the long bolts up through the bottom part, the spacer and the cross-member first, and fit the spring washers and nuts. Partially tighten those, and only then tap the bracket with a hammer and/or use a pointed drift to line up the top holes for the short bolts, fit them and their spring-washers and nuts, then fully tighten everything. Daub new spacer and bolts, and the inside of the rubbers bracket, in Waxoyl before fitting!

Front Damper Replacement *Updated October 2009*

Lever-arm dampers are hydraulic (being filled with light hydraulic jack fluid, not oil as such). The usual failure mode of these is for the seals on the shaft that the arms connect to start leaking. Once that happens they are shot, there is no point putting more fluid in, it will just leak out again. A leaking damper can be an MOT (UK annual inspection) failure point in the UK if the tester suspects or finds it is affecting damping. Other than that I have never found any need to check and top-up the dampers, even though it is a routine maintenance item.

When changing a damper for the first time you will almost certainly need a new link bolt and nut and bushes, as each one I have done has had the pin corroded solid with the inserts in the bushes. In both replacements I have done the link bolt was supplied with a Nylok nut instead of the original low-profile castellated nut and split-pin. In neither case was the bolt long enough - or the nut low-profile enough - to be fully tightened - with a Nylok nut there should be about three threads clear of the bolt, but the bolt barely reached the Nylok let alone go through it. Fortunately the bolts were drilled for a split-pin and I had a suitable low-profile castellated nut in each case. **Do not use a Nylok nut without there being at least three threads visible with the nut fully tightened, the bolt could come out in use.** Before paying for dampers check they move smoothly (and heavily damped through their full travel and back to the centre, then wiggle the arms up and down near the centre and make sure there is not slop as they change direction. Exchange dampers where you return the old one is much cheaper than buying new, and the rebuilt replacements are usually of reasonable quality. But as the rebuild is only as good as the original it is possible to get a duff one that fails after quite a short period, however it is still much cheaper to have to change it again fairly soon than to buy new. Out of three replacement lever-arm dampers I had to change a rear one for a second time after only a year or so, its replacement and the other two have been fine. At the time of writing I have just replaced another one so the jury is still out on that. *Update October 2009* Annoyingly that started weeping after a year or so, but lasted a further couple of years and MOTs before it got bad enough to start dripping on the floor, which was when I changed it again. Hopefully better luck this time.

Raise the front of the car by jacking under the rear edge of the cross-member (if you jack further forwards than that it will slide further forward in a series of sudden and noisy movements which is a bit disconcerting. Place axle stands under the outer edges of the spring pans, and lower the jack just enough to lift the damper arms off the rebound rubbers. **It is important to do this otherwise when you remove the top link bolt the axle assembly and hub will shoot downwards as they are under significant spring pressure.**

Next comes removal of the top link bolt connecting the damper arms to the swivel axle. Easy to say, much harder in practice. The bolt runs through the arms of the damper and steel sleeves in the rubber bushes. It is a snug fit in both and unless it has already been replaced fairly recently or was assembled using Waxoyl and copper grease it will almost certainly be well rusted to both. The rubber bushes will probably also have deteriorated and be bonded to the eye in the swivel axle. In two replacements on may cars this has been the case and I have had to hacksaw through the bolt both sides of the swivel axle eye. On a second replacement of one of them everything came apart very easily.

Remove the nut on the end of the link pin, it is usually castellated with a split-pin. Slacken right off the clamp-bolt holding the two arms of the damper together, and drive a wedge between them to lever the arms apart and give you more room to cut through the link bolt.

Use a length of cable or whatever to tie the swivel axle to the bracket of the bump and rebound rubbers to prevent the axle falling outwards and stressing the brake hose when the link pin has been cut through or removed.

You can try driving the link bolt out of the bushes and arms, but it shouldn't take much hammering to realise it isn't going to shift. If not, cut the flange off the end of each bush by chiselling and cutting at an angle into the eye of the swivel axle. This reveals a section of link bolt on each side to cut through without damaging the inner faces of the old damper (which might then be rejected as a core replacement) or the swivel axle eye. Use a hacksaw where you can turn the blade at 90 degrees to the frame and this should allow you cut inwards and upwards each side. With a decent blade it shouldn't take many minutes to cut through both sides, and the damper arms can be lifted up from the swivel axle eye. Remove (it really should be that easy) the four bolts securing the damper body to the cross-member. I use a universal joint between the ratchet and socket, it gives that extra depth for all four bolts and a bit of angle for the back ones where the inner wing curves over them. Lift the damper away - it is heavy!

Now you have to drill, cut, twist and hammer the old bushes and remains if the link bolt out of the swivel axle eye, they will probably come out as a single piece, which can only be done if you have previously removed the flange from the bushes as previously described. Remove any lumps of rubber that are stuck in the eye as this will make insertion of the new ones more difficult.

Check the fluid level in the damper now, it's easier. If you find you have to add a lot, or in any case after transportation where

they may have been at a different orientation to when fitted to the car, work the arm up and down it's full travel several times to expel any air from the valves. Remove any dirt or grit from the cross-member where the damper will sit. At this point I put a bit of copper grease into each hole in the cross-member, then put the damper in position. Coat each bolt with copper grease and insert just a few threads, don't tighten them any more than that until all four bolts are started. Again slacken the clamp-bolt holding the two arms together and wedge the arms apart to fit over the bushes. This is necessary when leaving sound bushes in the swivel axle, not just for new ones.

Coat the outside of new bushes and the inside of the swivel axle with Waxoyl and insert the bushes. They will probably be much wider than the gap between the damper arms even if they are wedged apart. You can either put one or more large nuts over the threaded end of the link bolt then tighten its nut to squeeze the bushes fully into the eye or use a small sash-cramp or something similar. Eventually you should be able to get the bushes far enough in and the damper arms far enough apart to fit the two together, but before you do so put some copper grease inside the steel sleeve of each bush, wiping off any excess from the rubber.

Place the damper arms over the bushes, put more copper grease in the holes in the arms and on the link bolt. Tap the bolt through the appropriate damper arm the bushes, and the other damper arm. Note that the bolt has a special round head with one flat which engages with a recess on one damper arm. This is the front arm on the right-hand side, the rear arm on the left, therefore the bolt can only go in one way each side. Things might need a bit of wiggling about while you are tapping to get everything lined up.

Note where the split-pin hole is in the bolt and fit and tighten the nut (40ftlb). This has to clamp the damper arms onto the ends of the bush sleeves, and the inner ends of the bush sleeves together, so it does up tight. The final position of the nut should allow insertion of the split-pin, of course. Refit and tighten the damper arms clamp bolt (28 ft lb). As the four mounting bolts allow a little wriggle-room for the damper now is the time to use it to try and correct any tendency to pull to one side or the other on a flat and level surface (note a normal drainage camber will cause the car to pull to the kerb side slightly). Pulling to one side or the other is caused by unbalanced camber, not by tracking as many think. Which ever side the car pulls there is more camber that side than the other, so pushing the damper arms **forwards** as you tighten the four bolts (43-45ftlb) will tends to reduce it, and pulling the damper arms **backwards** on the other side will do the same. It may not do much but is worth a go while you are at it. Refit the wheel and away you go. Inspect the new damper from time to time in the early days just in case you have got a duff one, and always before an MOT.

Front Spring Replacement

The first thing to say is that spring compressors are not required. Support the front of the car safely e.g. with axle stands under the chassis rails and/or front crossmember. Place a jack under the spring-pan and raise the axle until the upper

wishbone (shock-absorber arms) are clear of both the upper and lower bump and rebound rubbers.

Most seem to agree thus far, but opinions differ as to whether the four bolts that secure the spring-pan to the lower A-arms should be removed next and just the spring-pan lowered to free the spring, or whether the lower trunnion bolt should be removed disconnecting the A-arms from the swivel axle, and the A-arms and spring pan complete lowered to free the spring.

Having tried both ways I would only ever recommend the latter method. There are two reasons for this:

> Firstly, because the spring-pan is not parallel with the ground anyway, and even less so when the front of the car is raised, it is extremely difficult to support it so that the tension is taken off all four bolts at the same time. Instead the pan has to be raised and lowered slightly for each bolt to be removed. This damages the threads on the bolts. Even worse is reassembly - one has to fiddle around raising and lowering the jack little bits at a time to get the four bolts through the A-arms and spring pan one at a time, all the while with one's face just inches from an unsecured spring, don't forget the spring pan is also unsecured and could twist releasing the spring.
>
> Secondly, if there is a front anti-roll bar fitted it is my experience that the drop-link seizes in the A-arm, and the two have to be removed together for them to be parted. If this happens you have no option but to use my preferred method.

Removing the swivel-axle to A-arms bolt (lower fulcrum pivot) allows you to lower the spring pan while it is still held securely until all spring tension is released. With the jack out of the way you push the pan down a bit more with one hand and simply lift the spring out with the other. That done, you can tackle the spring-pan to A-arm bolts in complete safety.

In the time-honoured phrase - "reassembly is the reverse of removal" - that is, push down the A-arms complete with spring-pan, insert spring, jack spring-pan and pivot swivel-axle until the lower bolt can be inserted. The only thing to watch is that the grease seal, thrust washer and seal support are all present and correct on reassembly.

Another tip when buying new springs of any type is to insist on a pair with the same free height! The pair my supplier put on the counter for Vee differed by nearly 1/4". He got a matched pair without quibble, but said "it won't make any difference". At first I thought he meant that the free height made no difference to the loaded height which is obviously wrong, but once fitted although the loaded height had been the same with the old springs with the new, even after a shakedown run, there was a 1/2" difference. So maybe he meant "it doesn't matter what the free height is, the loaded heights will probably be different anyway!". Also the free heights were quite a bit higher than spec, so if you are able go for the shortest.

Update December 2005: A tip from Michael Beswick is to leave the spring pan to A-arm bolts on one side slack by a turn or two to make insertion of the assembled fulcrum, thrust washers, seals etc. into the A-arms a little easier.

Update September 2007 Another tip is that when sliding the lower fulcrum out of the A-arms, as soon as the hole reappears outside the arms, refit the bolt and nut and this will stop the grease seals etc. falling off and the bolt/nut getting dirty/lost. But I digress. Many moons ago for various reasons I fitted CB GT front springs to the roadster as they are stiffer, but with a lower free height, which gives much the same ride height. At the time they gave much the same ride height with less roll and dive under braking, but since then they have settled and for some time I haven't been able to get the hydraulic jack under the rear edge of the cross-member, and the A-arms and track-rods were both angled upwards (outer ends relative to inner) which didn't seem to me to be correct. So I decided to replace them with new originals, and in doing so found that I needed to employ a combination of the two methods above. The CB GT springs have a free height of 9.32" (and the used ones were a little less than this anyway) and pushing down on the A-arms/spring pan with the lower fulcrum pin removed was all I needed to do to get the old spring out. However the correct springs have a free height of 10.2" (and in fact the new ones were a little taller than that) and I could not push the arms down far enough to get the new spring located in the groove in the spring pan. So I removed the inner spring pan bolts altogether, and with the outer bolts slackened (actually only the bolt as I couldn't get at the anti-roll bar drop-link nut easily) the pan pivoted downwards with a bit of pressure and in went the spring. I then jacked up under the inner edge of the pan, and with a bit more levering got the holes aligned and the bolts back in. This is still a much safer method than complete removal of the four spring pan bolts as the pan and hence the spring is still securely retained by the outer two bolts (or bolt and anti-roll bar drop-link pin). So far so good, but when I jacked up under the spring pan I found I couldn't compress the new springs enough to get the holes in the fulcrum and A-arms aligned, I had to jack under the far outer edge of the pan to be able to do it. Not only that, but when on the ground a quick measurement showed that the front ride height had leapt up from 14" to 16" and looked ridiculous!

Not being a believer in springs 'settling' soon after installation, nevertheless a tour round some of the speed-hump ridden streets of Solihull and some bumpy country lanes for an hour settled them to 15.375" at the front both sides, with 14.125" at the rear also both sides. Better, but still a little high at the front, but it will probably settle more over time. I think the initial settling is due to the front springs only sitting in the spring-pan and cross-member, and so not fully seated until they have been worked up and down a bit. In contrast the rear springs are positively located by bolts and I'd expect very little initial settling. The A-arms and track rods are now angled slightly downwards (click thumbnail), and I now have 6.625" clearance under the front cross-member as opposed to about 5.5" previously.

Update October 2007

Replaced Vee's front springs today. Being shorter it was much easier than Bee's, I only had to remove the anti-roll bar and lower fulcrum

bolts, and slacken the bolts between the spring pan and the rear A-arm. Pushing the pan and A-arms down the old spring came out easy enough, although the axle assembly kept pivoting inwards getting in the way, and I didn't have enough hands to hold that out, push down the spring pan and lift out/replace the spring, so I propped the axle assembly up out of the way with a piece of wood between the hub and the ground. Didn't take much more than an hour each side. Before starting the ride height between hub centre and bottom of the trim strip was 14.5" on the right and 14.625 on the left. Immediately after replacement the right was 16.25" and the left 16.5", and after a couple of miles over the speed bumps came down to 15" and 15.5" More disparity there than originally, and the springs were the same free height, so we'll see how it goes. Clearance under the Y-pipe on the exhaust is now 4.45", up from 3.5" before, which was way below the spec ground clearance of 4.25". This thumbnail shows (from left to right) the original roadster springs (with a nice curve in them!) taken out some years ago, the newly removed CB GT springs, and new V8 springs waiting to go into Vee.

Update October 2009
Measured Bee's ride height as 14.75" right front, 14.625" left front, and 14.25" for both rears. Vee's are 14.5" right front, 14.625" left front, 15.375" right rear, and 15.6875" left rear.

Hydraulic Damper Fluid *Added November 2009*

Needless to say there are strongly-held views on what fluid should be used. The Workshop Manual states "Armstrong Super (Thin) Shock Absorber Fluid No. 624. (If this fluid is not available any good-quality mineral oil to specification SAE 20W can be used, but this alternative is not suitable for low-temperature operation)." It doesn't specify what it means by 'low temperature' but looking at the lubrication chart for the engine anything consistently below 10C/50F is considered 'cold' and anything consistently below -10C/15F is **very** cold! However the 'standard' temperature range goes down to -10C/15F, so maybe if don't go below that at any time you would be OK. But I can remember it getting as low as -27C some years ago in the UK, although that was before 'climate change'. I've always used hydraulic jack oil (Halfords £4 for 500ml) and never had a problem, although others claim that foams which destroys damping. Still others claim that claim is rubbish, foaming in jacks would be a bigger problem than in dampers! Motor-cycle fork oil is frequently mentioned as it is said to have a seal swelling agent which reduces the chances of leaks over time. Available in various viscosities from 5W to 30W, you would probably want to keep to 10W or 15W. Halfords also sell 'Halfords Central Hydraulic Fluid' at £15 per litre said to be suitable for 'certain' power hood, suspension, traction control and central locking systems, but it seems to be for modern cars and their highly sophisticated systems. Moss sell 'shock absorber oil' (for a start they are dampers, the springs are the shock absorbers, and it isn't really oil but hydraulic fluid) at £8 for 473ml. A certain authenticity in the quantity, I suppose, being 16 oz i.e. Imperial like the rest of the car.

There is further scope for argument over fluid level, believe it or not. The Workshop Manual simply says "fill to the bottom of the filler plug hole". But some

say it should be half an inch below it on the rears to allow an air space to absorb up fluid expansion on heating up, otherwise it could be forced past the seals. But if that is correct, why doesn't the manual say so? I then started thinking about the positions of the filler plugs, and realised that with the front damper filler plug on a vertical face of the damper body, filling to the bottom of the hole will still leave a significant air-space above it. But the rear dampers have the filler plug on top, which may not unless there is an air-space under the lid i.e. above the bottom of the filler plug hole. When I converted Vee from tubulars back to lever-arms I bought a 'kit' containing dampers, drop-links and bottom plates second-hand from some unknown MG at Stoneleigh, and it was only when I decided to recheck the fluid level some time after fitting them that I discovered the filler plug hole was also on a vertical face, and not on top as they should be! "Ah ha", I thought, that would leave an air-space in the rears as well, and maybe that part of the manual had been copied from that for another vehicle where both front and rear filler plugs **are** on a vertical face. But looking again in the manual not only does it show a top-fill rear damper, with instructions to remove the plastic plug in the chassis rail to access it, but it also shows the front damper with a top-mounted filler-plug! So from there being an obvious air-space above the fluid on both types, there could be none on both types! When Vee's rear dampers started leaking (after having lasted a few years, I was quite prepared to change them at the outset as they were an unknown quantity) I got the correct top-fill ones of course, and checking the level before fitting found that it was indeed about half an inch below the bottom of the filler plug hole. So I'm none the wiser now, but having found with leaking dampers that the fluid level can drop a long long way before it affects damping, leaving a half inch gap below the bottom of the filler plug hole on the rears is neither here nor there, and at least you are sure that there **is** then a clear air space, if that makes a difference.

NEW King-pins *Added September 2010*

I've been becoming increasingly aware of a clonk when applying and releasing the brakes, even gently, and feeling something through the pedal, although nothing came up on the MOT. Getting the spring pans up on axle stands i.e. wheels off the ground I couldn't find anything loose on the steering arms, track-rod ends, callipers, dampers, A-arms, wheel bearings, trunnions or king-pin bushes except that when I levered the tyre up and down the swivel axle was moving up and down on the king-pin, approaching a millimetre, and accompanied by a clonk. "Ah-ha", I thought, "King-pin thrust washers and shims". However I couldn't and still can't see how this would occur under braking - the weight of the car is already on the thrust washers, braking is only going to add to that, and braking is putting a rotational force on the king-pin bushes and not vertical. Nevertheless as the Workshop Manual quotes .008" to .013" (.20 to .32mm) they need attention.

The Workshop Manual shows three washers but only labels two of them - a thrust washer and a floating thrust washer (shim) .052" to .057" i.e. .055" nominal. The Parts Catalogue also shows three washers, but just as part of a king-pin repair kit and not as separately identified parts. The MGOC site shows the main thrust washer ATC4264 but not the shims, saying the shims are only available as part of a

repair kit that includes the king-pin. Googling ATC4264 displayed Quinton-Hazell, Brown & Gammons, MGOC and Moss Europe hits. B&G didn't list any other parts, QH listed shims with the main thrust washer but didn't say what axle it was for, MGOC listed the shims as separately available although only for the MGC, but Moss listed the shims indicating they are suitable for both the B and C! The shims are in three different sizes ATC4261 (.055" nominal), ATC4262 (.060" nominal) and ATC4263 (.065" nominal) which are selected to obtain the required end-float, the main phosphor bronze thrust washer being sandwiched between two of the shims. So off goes my order to Moss for two sets of washers and shims, as well as the bump/rebound stop which I had noticed had lost its bump rubber on the left-hand side. While placing the order online I noticed a checkbox by each item something to do with back-ordering. It was only afterwards I wondered if some or all of the items were out of stock, which is a possibility for things like the shims, much less so for the bump/rebound stop, I would have thought. But in the event they all arrived two days later.

So up goes the front of the car (cross-member on axle stands) and off comes the right-hand wheel. It seems to me that just undoing the big nut on the end of the king-pin will allow the trunnion to come off and reveal the thrust washers and shims, the pin through the trunnion and damper arms is obviously clear of it. However the rubber bushes around that pin fit into a notch in the king-pin, so really the damper arms need to be disconnected from the trunnion and the bushes removed before the trunnion can be removed from the king-pin. And when doing that you will probably need to slacken the clamping bolt that goes through the damper arms. Jack under the spring-pan so the damper arms just lift off the rebound rubbers to take the tension off the trunnion, damper arms and pin before trying to remove the pin. Having replaced dampers and a swivel axle at various times, if I hadn't had that pin and the bushes out beforehand they were seized solid and I had to cut through the pin both sides before I could part them, removing the damper arms clamp bolt and wedging the arms apart meand you can do this without damaging either arms or trunion. So if you haven't had yours apart before you might like to lay in a repair kit or two (bushes, pin and nut) beforehand.

Both top link repair kits I have purchased in the past have been supplied with a Nylok nut instead of the original castellated nut and split-pin, even though the pin does have the split pin hole. **These nuts have been way too deep, so much so that the threads of the pin weren't engaging with the nylon insert and so totally inadequate**. If you use a Nylok at least three threads of the pin are supposed to be exposed, but I wouldn't even trust that as this one pin is all that is holding the top of the wheel up. Fortunately I had suitable castellated nuts I could use instead, and split-pins. At the time of writing MGOC (item 73) say they are supplying Nyloks with this kit, and Leacy say (and show) they supply castellated, so guess which one gets my order.

Even then the trunnion could be stuck on the king-pin, so with the nut on the king-pin slackened clear of the top of the trunnion but short of the top of the king-pin, lower the jack from under the

spring-pan, and tap the end of the king-pin. Mine are rounded at the top so there was no chance of damaging the ends of the threads, and it came free. Before completely removing the nut jack under the spring-pan again to stop the king-pin and trunnion flying apart. Also have a length of cord available so that when it does come off you can tie up the hub e.g. to the bump/rebound bracket or anti-roll bar drop link to stop it hanging on the brake hose.

With the trunnion lifted off the end of the king-pin you can retrieve the thick phosphor bronze thrust washer sandwiched between two thinner steel shims. It's now a case of juggling shims, refitting the trunnion and retightening the king-pin nut and checking play. If you have a castellated nut it makes sense here to drop a spacer over the king-pin before fitting the nut so you only have to tighten it a few turns, instead of winding it on and off an inch or more. It's even more important with a Nylok nut, or you will have to replace that as well, with the number of times you are likely to have to fit and remove it wearing the nylon insert out. If you can't find a spacer that keeps the nylon insert clear of the threads when the nut is tightened, try and find a plain nut instead. To check end-float with each combination as well as fitting the trunnion to the king-pin I slotted the pin back through the trunnion and the damper arms and fitted the nut a few turns (the damper arms with trunnion can be lifted up far enough to clear the top of the kin-pin), lowered the jack under the spring-pan so the tension of the spring was pulling the trunnion down, then lifting and lowering the hub and swivel axle reveals the play. It's difficult to measure without a dial gauge, but 0.2 to 0.32mm is pretty easy to judge by eye, easier than 8 to 13 thou! Remember to jack under the spring pan again each time before removing the king-pin nut to try another combination.

And this is where the problems started. The Moss shims came in three bags, two to a bag, with the bags labelled with the three different sizes. The shims were all stamped with a sizing number, and I had two each of three numbers 6 (or 9), 7 and 8 - all so far so good. But when I started juggling shims I wasn't making any difference, which didn't make sense. So I started measuring everything - new washer and shims as well as the old (the old shims had no visible markings) and discovered that my six new shims which were supposed to be two each of three different sizes, were actually five thin shims and one thick! Added to that the new thrust washers were actually **thinner** than the old ones, at 0.179" as opposed to 0.184", and the old shims were 0.054" and 0.064" i.e. one thin and one thick, and apparently unworn! I suppose the thin one could originally have been a thick or middle one, worn down to exactly the thickness of a thin one, but I find that unlikely. Also I suppose it could have been the top of the swivel axle or the bottom of the trunnion, that bear on the shims, that had worn instead. I tried various combinations, including the new thinner thrust washer plus three thin shims (too thick), but the only combination that came anywhere near was my one new thick shim in place of the original thin shim, i.e. the original (thicker) thrust washer plus two thick shims. This left it with no detectable end-float at all, but the steering did turn freely, and a test-drive does show it self-centres even at the lowest speeds, so in theory is a possibility (but shouldn't be used as end-float **must** be present and the suspension unloaded to allow grease to get through the upper trunnion). But in theory if the thicker thrust washer plus two thick shims gives zero end-float but no

binding, then one thick and one medium should give .005" play i.e. less then the specified .008" to .013", and one thick and one thin should give .010" play pretty-well slap in the middle of the tolerance. However this last combination was what was in to start with, and looked to be giving a lot more than a quarter of a millimetre as judged by eye. I want to try one medium washer in place of one of the thick ones, but all I have left now is six thin washers which is unlikely to be any good for the other side. So a phone call to Moss, who say send them back. Fair enough, but simply picking others out of the same bins isn't necessarily going to be any better. They said they would measure the replacements (really!?) and make sure I got two of each, we shall see. In the event I kept two of the thin ones and the one thick one, just returning three thin ones, hoping to get two medium and a thick back. In the event about a week later I get the correct ones, plus an automatic refund of my return postage, which is pretty good. I swapped one of the thicks for a medium on this first side, but when juggling the other side found only the original combination (a thick and a medium) gave any end-float, so I ended up leaving those in.

When you have found the right combination remove the king-pin nut for the last time (and its spacer if used), lift off the trunnion and grease the thrust washer and shims by applying grease directly to them at this stage, not from the grease nipple. Refit the trunnion and king-pin nut (but don't tighten it yet), and insert the trunnion bushes into the trunnion. Lubricate the bushes with a suitable lubricant e.g. Waxoyl to make fitting easier. The bushes have to be wedged into the trunnion before you will get them in between the damper arms, even if the damper arms are wedged apart with an old screwdriver between the bosses of the cross-bolt. Use a plain nut and bolt and large washers of a suitable size through the bushes and the trunnion, to squeeze the bushes in to the trunnion. Even so they are unlikely to push straight in between the arms of the damper, I had to turn the trunnion a bit to get one bush started, then a paint-scraper as a sort of ramp to squeeze the other one in while I pushed on the trunnion. Again Waxoyl on the faces of the bushes (and inside the steel sleeves to prevent rusting to the pin in future) and the damper arms makes this easier.

Make sure you get the trunnion the right way round, the vertical king-pin is INBOARD of the horizontal trunnion pin, not the other way round as is shown in the Workshop Manual and Parts Catalogue exploded drawings!! However the assembled drawing in the Leyland manual is correct, as are both drawings in Haynes. This MGOC catalogue exploded drawing is also incorrect, but the photo of the assembled unit is correct. The Moss exploded drawing is also correct.

Peer though the damper arm, tapping it up or down and the trunnion in or out to get the holes aligned on the side the pin is inserted from, then insert the pin, again lubricating it e.g. with Waxoyl. The pin goes in from the front on the right-hand side so the cut-away on the special head engages with the raised portion on the damper arm (from the rear on the left as the dampers are not handed). Once the main body of the pin has started going through the first bush in the trunnion, peer in

from the other side and tap and align that as well, until you can tap the pin all the way through. Fit the nut tightening to 40 ft lb, and the split-pin. Tighten the damper wishbone cross-bolt (wedge removed) to 28 ft lb.

With the top link assembled you can finally tighten the king-pin nut to 60 ft lb. Leaving it loose until now allows the trunnion to take up the correct position and be twisted on the king-pin so the holes in the damper arms will line up with the holes in the bushes. Grease the king-pin as normal i.e. from all three nipples using a grease gun until clean grease oozes out of the joints, and wipe off the excess.

And the result? Just the pigging same! However when pushing the car back and fore to work it across the garage to give me more room for the second side I could hear a clonk as I started turning the tyre on the floor. Getting the Navigator to keep doing that while I looked and felt underneath showed no relative movement between track-rod end and steering arm, or up and down or back and fore movement of the track-rod, but I could definitely feel the clonk in them more than in anything else anywhere round the suspension or rack. Wheel off and there is some very slight up and down free-play in the body of the track-rod end relative to the steering arm, and with them parted the pin is flopping about all over the place, so it looks like new track-rod ends for Vee as well.

Leaf Spring Lubrication

Once I started using the V8 in mainly dry weather the rear springs started squeaking quite badly, which had the Navigator complaining. I didn't want to spray oil on them as I was concerned for the rubber bushes at each end, particularly the front bush which is a lot more difficult to change than the rear bushes, so decided to use Waxoyl which doesn't harm rubber. Waxoyl is also much less likely to get washed out from between the springs when Vee does get wet, like on organised runs!

I actually painted it on semi-congealed rather than as a liquid suitable for spraying, then used a hot air gun to melt it whereupon most of it was absorbed into the gaps between leaves and interleaving and little dripped off. At first it didn't seem to have made much difference, but then over a bit of driving it seems to have 'worked in' and they have definitely become much quieter and now I can't say that I notice them at all and neither has the Navigator commented recently. It would have been much easier to apply with the springs removed from the car and laying on their sides, but a much bigger job overall of course.

In response to a question on a Bulletin Board I mentioned this but another contributor said he didn't like Waxoyl because it dried out. In my experience whilst it does 'dry' in that the white spirit that makes it liquid evaporates it leaves behind the waxy stuff which if you rub it between your finger tips is still slippery i.e. does still lubricate, and as I say is much less likely to get washed out than oil or even grease. And being drier it will pick up less dirt and grit.

Update August 2007: Having broken a rear spring on this year's Snowdon Run before I replaced them I laid the new springs on their sides, painted on some dollops of Waxoyl, then used a heat gun to melt it into the crevices between springs

and interleaving. When they were 'dry' I could pick them up by the eyes and it was a cleaner job than I was expecting to fit them while coated. Incidentally, this is the third set of springs I have bought from three separate suppliers and fitted to two different cars - one chrome one rubber, including stiffer rubber bumper roadster springs to the chrome bumper roadster, and I have never had any trouble getting the shackles, damper drop-links or rebound rubbers attached, or in getting the shackles to point downwards. The weight of the body was more than enough to compress the springs before the body lifted off the axle stands in all cases.

Rack Gaiters

Using wedges and pickle-fork so-called ball-joint splitters I had never been able to disconnect the track rod end from the steering arm without damaging the rubber boots on them i.e. destroying them in the process so unless I was changing them anyway I didn't even try. You can either unbolt the steering arm from the swivel axle which is easily done or just unscrew the tie rod from the track rod end rather than vice-versa. You may have to remove the tie or clamp on the small end of the gaiter in order to turn the rod without twisting up the gaiter. Eventually I bought a ball joint separator but had to modify it. Now splitting track-rod end tapers is a positive joy.

*Update August 2010:*A tip when disconnecting the track-rod ends from the steering arms. The nut is usually a Nylok, and the effect of this is that once the taper is broken you can't turn the nut on the thread without locking the taper again, as the stud just turns in the ball-joint. And if using a screw-type splitter you really need to have a nut on several threads if you are to avoid damaging the end of the stud. The tip is to remove the Nylok nut, then put a plain nut on until the end of the stud is close to the face of the nut, before using the splitter. As long as the threads are good the plain nut will be much easier to remove once the taper is broken. For replacement the same problem occurs, so screw the plain nut up tight to lock the taper, then replace with the Nylok nut.

But I digress. Make alignment marks on the tie rod and track rod end. Slacken the lock-nut and count how many turns are needed to separate the track rod end from the tie rod. Change the gaiters then screw the tie rod and track rod end back together the same number of turns it took to part them, finishing with marks aligned, assembling with copper grease to aid future removal/adjustment. Fasten the tie or clamp on the smaller end of the gaiter, but not so tight that the tie rod can't be turned without twisting up the gaiter during future tracking adjustment. If changing both gaiters fasten the tie on one big end but leave the other off for the moment and use an oil gun to inject 1/3rd pt (0.4 US pt, 0.2 litre) into the big end - hold the bottom up to the rack housing whilst injecting in the top - periodically moving the rack slowly from lock to lock to distribute the oil.

Update Autumn 2005: If you put your hand over the top of the big end of the

gaiter with the thumb down one side and forefinger down the other you should be able to squeeze and stretch the gaiter such that the bottom half is stretched into the groove of the rack to make a reasonable seal while you are injecting oil, and stretch the top half so that you make a small loop, or at least an area of lessened tension, to allow you to insert the nozzle of the oil gun. However if the shape or size or your oil gun prevents its insertion you could try this tip sent to me by Michael Beswick: "I found a 8" piece of windscreen washer tube, cut one end at a shallow angle to make a bit of a point. The other end I put in boiling water before forcing it over the pointy end of a biro. I left it for a while and the result was a small funnel shape that the nose of my oil can fitted into neatly. I released the clip on the gaiter, put the tube in at the top of the gaiter and managed to get it all over the metal fitting. Tightened the clip to just nip the whole assembly. Inserted oil can in the funnel end of the tube (it was quite soft so the oil can spout fitted reasonably tightly) and hey presto! A little care is needed or the tube blows off the spout. Remove oil can and carefully pull out the tube (which can be kept in the right plane)." Finally, fasten the remaining big end tie or clamp.

You **should** be spot-on, but unless you know your tracking was right before there is no harm in getting it checked, and you know you will be able to slacken and adjust everything before it all seizes up again.

NEW Rear Bump Rubbers *January 2011*

Just seen a top tip on the MG Enthusiasts BBS from Fletcher Milmore on how to fit new Bump Rubbers, which really appeals to my love of lateral ideas. The hole in the rubber is quite a bit smaller than the peg they are supposed to fit over and people often complain what a chore it is. Fletcher's method is:

> "Clean up the stud, lubricate with something that doesn't eat rubber. Measure the gap between the axle and the rubber and get a block that will fill the gap. Put the rubber in position and jack the axle up so the rubber is supporting the car's weight. Might take a few minutes sitting, but it will pop on."

Rear Lever-arm Dampers *August 2009*

Replacement

The damper, drop-link, rebound rubber and bump-rubber pedestal (and for that matter spring) must be treated as a set for correct and safe operation of the rear suspension and these vary from model to model. Whilst the damper obviously controls the rate of spring compression and expansion through the normal working range, the compressed limit is controlled by a pedestal on the axle hitting a bump-rubber under the floor, and the expanded limit is controlled by the rebound strap which is fixed between a body and axle. The final component is the drop-link between damper arm and spring/axle assembly. In an ideal world the spring, in it's normal working position, will position the axle about mid-way between the fully compressed and fully expanded positions, and the drop-link length should be such that the damper is also about mid-way in its travel. The loading on the car could be a little as a single occupant, or it could be two people plus tools and luggage with

the consequent compression of the spring, so maybe a median between these two is chosen by the designer as the 'central' position. Whatever, it is vital that the drop-link, rebound strap and pedestal are installed as a set so that it is the rebound strap and bump rubber that provide the limits to axle movement and not the damper itself. Get these wrong and the damper will suffer damage. In theory it doesn't matter as much if the spring varies in set or hardness, as the other components will limit axle travel regardless and so protect the damper. But if the spring is too soft or flat you will be hitting the bump rubbers over relatively small bumps (been there, done that, extended the shackles) or at the other extreme the car will have a very tail high ("submissive monkey") stance and be hitting the straps relatively easily. Whilst hitting the bump-rubbers is merely uncomfortable, continually 'hitting' the rebound straps will eventually break them, and then you will start hitting the damper limit and damaging that.

Chrome bumper 4-cylinder cars had one set of drop-link, rebound strap and pedestal, chrome bumper V8 had a different set, and all rubber bumper cars had a third set in this case the same for 4-cylinder and V8. I know chrome bumper V8s had a higher ride height to 4-cylinder chrome bumper cars to improve the exhaust to ground clearance, utilising a different front cross-member that was later commonised to all rubber bumper cars. I don't (yet) know the detail of how the rear spring hangers differed between 4-cylinder and V8 chrome bumper cars, but again I know they were the same on all rubber bumper cars, hence the same damper and axle movement limiting parts, even though the V8 springs are harder. The combination of parts for each model from the Parts Catalogue is as follows:

Model	Armstrong catalogue	BL catalogue	Drop-link	Rebound strap	Pedestal
4-cyl chrome bumper	8178LH/RH	GSA168 LH 169 RH	97H 2031	AHH 6355	AHH 7355
V8 chrome bumper	10801LH/RH	GSA328 LH 329 RH	37H 8075	BHH 989	BHH1030
4-cyl rubber bumper to 76	12012LH/RH	GSA368 LH 367 RH	37H 8778	BHH 989	AHH 7355
V8 rubber bumper	12012LH/RH	GSA368 LH 367 RH	37H 8778	BHH 989	AHH 7335
4-cyl rubber bumper 77 on	12075LH/RH	GSA368 LH 367 RH	37H 8778	BHH 989	AHH 7355

Note the same rebound strap is used for CB V8s and all RB cars, the same pedestal for all 4-cylinder cars, and the subtle difference in part number between those and the rubber bumper V8.

Peter Caldwell of Wisconsin posted the following information on the MGCars BBS as part of a thread on this subject in December 2006:

> "Armstrong conveniently stamped their part number on every shock (except for Spridget fronts which were cast). On all rears the number is stamped on the underside of one of the mounting ears. B rear shocks will have 8178LH or RH, or 12012 or 12075 (LH, RH).
> "Per Armstrong's 1978 USA catalog... 8178 fit all B and GT (4 cyl) through

1974 (The 73 and 74 BGT V8 used 10801 which I've never seen). All models 75 through 5/76 used 12012. Then all models 6/76 to end used 12075. Again, I've seen absolutely no difference in the 8178, 12012, 12075. I suppose if matching, check that the numbers are the same."

His dates more or less tie up with what is in the BL Parts catalogue and so allows us to associate the Armstrong numbers stamped on the items with the catalogue numbers and hence models. This might seem rather pointless if the damping is all the same, but remember there were many other applications for these dampers and hence many other Armstrong numbers, many of which are bound to have different damping characteristics, and this makes the Armstrong numbers very useful when buying second-hand units where you cannot be sure of the original source.

Replacement *Added October 2009*

Ostensibly two nuts and three bolts, but it can still be a bit of a bear to remove. If you haven't changed them before the nut (11/16") will likely be corroded to the drop-link pin in the damper arm, and nut and pin will turn as one. With units that haven't been on long and correctly assembled with copper-grease the nut will probably come undone but you won't be able to break the taper between pin and damper arm. Fortunately it is easy to remove the damper complete with drop-link and spring bottom plate and deal with them on the bench.

Important - chock the front wheels. Slacken the road wheel nuts a smidgen if the handbrake isn't up to much. Support the car at the front spring eye or hanger on axle stands by jacking under the axle or spring bottom plate. Lower the axle until the car is resting on the stands, then remove the road wheel. Continue lowering the axle to give you more room to work, but observe the condition of the rebound straps before trusting the full weight of the axle to it. Remove the nuts (11/16") and spring washers from the bolts (5/8") holding the damper to the chassis rail, turn the bolts to free them up, but leave them in-situ for the moment.

Undo the U-bolt nuts (9/16" deep socket), which will allow the spring to push the bottom plate and damper drop-link fully downwards. If necessary jack under the spring one side of the bottom plate or the other to raise the spring off the bottom plate and so take any tension off the damper to chassis rail bolts. Supporting the damper remove the chassis rail bolts and lower the whole assembly down off the ends of the U-bolts and away from the car.

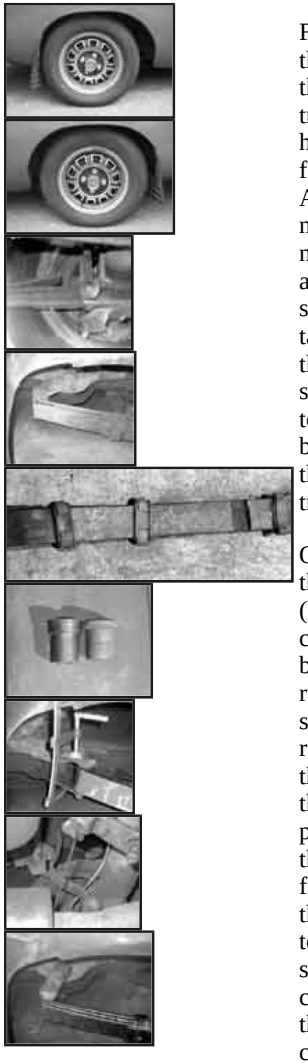
With rusted nuts I had to hacksaw at angle part-way through the nut then chisel the cut open to free the nut. Because the pin had been turning in the damper arm this came out relatively easily. Where the nut came undone I left it screwed on to the outer face was flush with the end of the pin, supported to bottom of the pin on a lump-hammer, and struck on the end of the nut and pin to free the taper.

Check the fluid level in the new dampers before fitting. If you find you have to add a lot, or in any case after transportation where they have probably been lying down, work the arm up and down it's full travel several times to expel any air from the valves. Push fit the bolts to the chassis rail, noting that later cars have the 'outer' bolt head in a recess in the wheel arch to give better clearance for the wider tyres on

GTs and particularly V8s, and this bolt is shorter than the other bolt. Offer up the damper to the bolts and fit the lock-washers and nuts. Fit the bottom plate with drop-link over the ends of the U-bolts and loosely fit the nuts, then position the damper arm so the drop-link pin can fit through it and fit its washer and nut. Tighten all nuts (55-60 ft lb for the damper to chassis rail nuts).

Rear Spring Replacement *August 2007*

See *Update July 2010*



Following the breakage of a rear spring on the V8 on the 2007 Snowdon Run I ordered replacements from the MGOC and approached fitting them with some trepidation. Would I have the same over-arched/too hard springs that so many seem to have? Would I find the bolt seized in the front eye bush that Americans frequently complain of? In the event I had neither. The front nuts came undone easily with nothing more than a spanner, and when the shackles and U-bolts had been undone and the rear of the spring lowered to the floor the bolts just tapped/twisted out. With the new springs fitted and the weight on the car there is a decent amount of slack in the rebound strap, about 3 1/2" between the top of the bump-stop pedestal and the bottom of the bump rubber, and about 15 7/8" measured between the centre of the wheel hub and the bottom of the trim strip.

On fitting the new springs one point that did differ on the rubber bumper V8 compared to the CB roadster (both CB roadster and RB roadster springs on this car) is that on the V8 I only had to lift the springs up by hand and I could insert the shackles. On the roadster I can remember the new springs being too short, and had to jack under the spring to slide the rear eye back along the chassis rail until I could get the shackle inserted. One problem I had with the V8 that I hadn't had with the roadster with either new red poly bushes at one time and new rubber another, is that the latest bushes have a significantly thicker flange than before, which meant that even without the lock-washers I couldn't get the nuts started. I had to squeeze the sides of the shackle together with a small sash cramp to compress the bushes before I could get the washers on and the nuts started. Other than that everything was straightforward, the only complication on the V8 being the Hopkinson anti-roll

bar. To get the bracket of this located on the U-bolts I had to jack under the spring until the bracket was just below the end of the U-bolts, then slowly lower it whilst locating the bracket holes over the threaded ends, until enough thread was sticking through to get the nuts started. Both the front eye bolts and the shackle nuts are done up until they suddenly come tight as the front hanger butts up against the bush sleeve, and the shackle pins have shoulders which the closing plate clamps down onto. How tight to do the U-bolt nuts is always an awkward question - I've never seen a torque figure given, so how tight do you go? Having done this job several times now it seems to me that as you start to compress the flat rubber bushes either side of the spring the nuts get stiffer quite gradually, then they seem to get quite a bit stiffer quite quickly. This is about the point I stop, but they need checking again after a short shakedown drive, and again several hundred miles later (checking the front eye bolt and the shackle nuts as well this time). During my shakedown drive I noticed some creaking coming from the right-hand side, on my return I could tighten this side quite a bit more (possibly as I did that side a couple of days prior to the left-hand side) and on a second run the creaking had disappeared. One thing that did **not** change was the rear ride-height.

One thing I did which I usually do when re-fitting MGB components, to ensure easy removal in the future, is to coat the front bolt and bush and the rear shackle pins and bushes and the rear chassis holes with Waxoyl. Before fitting I had also laid the springs down on one side, painted a decent layer of Waxoyl on, then ran my heat-gun up and down to completely melt it into the joints between springs and interleaving. When that had solidified I turned them over and treated the other side. Not even that messy when picking them up to fit to the car, and that is what latex gloves are for.

So I have now bought three different types of spring, from three different suppliers, over a period of years, and fitted them to two different cars, and never had the 'too-hard/arched' problem that so many complain about. Am I just lucky? Or is everyone that gets this problem buying from dodgy suppliers? Or are they simply not installing them correctly? I wish I knew.

July 2010: A pal's MGB fails its MOT with a broken rear spring.

Unlike the V8 it wasn't obvious as the wheel was still central in the wheel arch, as this car has the factory rear anti-roll bar which controls the fore and aft position of the axle. I suppose the ride height might have been a little lower that side but it wasn't obvious. Keith brought it round, but when the door bell went I hadn't heard the car, apparently it had conked out round the corner! This time (on the last visit it conked out two streets away, so an improvement) a fuel leak had developed and emptied the tank. A short push to a convenient slope allowed the car to roll round the corner and onto the drive, so that was going to be the first job. In the event the rubber hose between the pump and the metal pipe leading to the carbs had split, so an easy fix, and I was able to manoeuvre the car into the best place for the spring change.

For security I drove the front of the car up onto ramps, with the front of the car pointing down the slight slope on my drive. The rear was supported on axle stands just in front of the front eye, with pieces of wood inserted into the flanges of the bracket between the floor reinforcement section an the axle stand. If one end is on its wheels and you are pulling an pushing at things it's very easy to tip stands over, particularly if its the front on the ground and the rear in the air, even with chocks.

This time not so lucky as both front eye bolts are seized in the spacer tubes. I can turn the bolt with a spanner, but as I release the pressure I can feel them springing back a bit, so the spacer is turning inside the rubber bush. Pondered cutting through with a jig-saw, but they can only cope with a few mm of metal, so opt for a cutting disc for the (4 1/4") angle-grinder. Only had grinding discs before, which are thicker and have an off-set flange. Discovered that with the thinner, flat cutting disc the locking ring has to be turned over so the flat side contacts the disc, as otherwise it isn't gripped.

Decide to cut the spring off the eye as close to the eye as I can, to give me as much space as possible to cut up the sides of the eye and through the bolt and spacer tube. I was gobsmacked at how quickly it made the first cut, probably less than a minute, and with that out the way the other two cuts probably less than 2 minutes each. Angle the grinder for the first cut so the sparks fly away from the car and not under it, and downwards for the other two cuts. This meant that with one of the cuts each side it didn't go through all the way in one go, so just turn the eye 180 degrees and cut through the rest. The eye just dropped out of the bracket, and a bit of wiggling got the thin ring that was the end of the spacer tube off the remains of the bolt. Less than five minutes, and no collateral damage to the bracket or anything else, it took me longer to get the spring and bottom plate off the U-bolts!

One bump-stop pedestal had completely rotted away, and the other was hanging on by a thread, so replacements needed for those as well as the front eye bolts. Good

service from MGBHive, they arrived next morning about 10:30 including something I didn't order until about 4pm. Reassembled everything with Waxoyl, turning to a clear liquid on what was a very warm day. As on the V8 with the front eyes mounted the rear shackles lined up with the chassis rail holes without compressing the spring, neither did the shackles lock under the chassis rail when I jacked up under the spring to fit the U-bolts and bottom plate. Again the U-bolts and plates were the biggest fiddle, getting them lined up, and getting the 'bump' in the top plate lined up with the hole in the bottom of the axle spring-pad. The factory anti-roll bar makes this slightly more difficult as you can't move the axle fore and aft directly, you have to rotate the whole axle to move the spring mounting pad into position over the spring. The second side is even worse as with the first side fitted you can't even do that, and a firm push from a foot on the brake drum was needed. One thing I noticed is that the new front bolts are only **just** long enough, and that is with the old nuts and lock-washers. Nyloks were supplied with the bolts but to be honest I don't think they were long enough to get the requisite minimum three threads clear, as it was the end of the bolt was just shy of the end of the nut. Other than that (well, there are only the shackles left!) it all went back together inside the hour, and that includes wheels on and tools etc, put back in the garage.

NEW Steering Column *Added January 2010*

This account relates to the later full energy-absorbing column, with (apparently) three bolts securing the lower end to the toe-board. For which columns were used when see here.

Vee's steering wheel has always had a bit of rotational play in the column. At about 6-7mm it is a good bit less than the UK MOT limit of 13mm (and a whole lot less than the 30mm specified in my Toyota Celica manual!) but I still didn't like it, for one thing it rattles over some surfaces. As well as the rotational play the steering lock has never worked in my ownership, so I was wondering if I would be able to do anything about that. The car also had a pump short before my time (as has Bee and two other cars I have worked on, all with fuses now!) so the brown and white were damaged. The white only very slightly there (much worse elsewhere) but the brown has had the bullet connector for the switch harness cut out altogether and the wires spliced together. It's had various electrical bits added before my time also connected to this splice, and when I added a horn relay I added one more to it (at least mine was brown). I'd also had an alarm installed, and the fitter soldered his wires to the 12v and indicator wires on the switch side of the multi-plugs (easier to get at) so with the repairs and additions it was all a bit of a mess round the column - another opportunity.

First job was to remove the upper UJ clamping bolt, so the column shaft can be pulled out leaving the UJ behind. It's worth mentioning here that although my roadster has just a notch on the column shaft, and a groove running all the way round the rack shaft meaning the two shafts can be reassembled in any orientation which seems to be the norm, both the V8 shafts only have notches, so the UJ can only be installed in one position on **both** shafts - strange, but true. Loosen the other

bolt right off while there is still some support from the other shaft, but leave the bolt in position so the UJ stays on the rack shaft, and the nut on the bolt a few threads so the bolt doesn't fall out!

Steering wheel comes off with the usual method. This makes it much easier to get the two halves of the cowl off, especially as the additional screws at the bottom, handily (not!) covered by the dashboard, were removed and not refitted by a PO. This is why the book says to remove the column complete with cowl and switches, which would be right pain if all you wanted to do was adjust the horn brush! In fact the book says to remove the column complete with the steering wheel as well as the cowls and switches, which is stupid if you subsequently need to remove the wheel. Unscrewed the column switches and left them dangling. At that time I couldn't see how to remove the ignition switch from the steering lock so had to cut the splice in the brown, and the alarm wire. The other ignition switch wires are on bullets, rather than a multi-plug like the column switches.

When it came to undoing the three toe-board bolts they were only finger-tight, and when I got them all out (the top one is tricky, needing two 3/8" wobble extensions) the flange wasn't attached to the column anyway, not just loose but flopping all over the place and falling right off when I finally removed the column! The hole in the flange is quite a bit bigger than the end of the outer tube it fits over, so there is no way it can align the bottom of the column to the UJ, which some say it does, but more of that later.

When I undid the upper bolts and started trying to pull the column out I could tell the lower half of the inner was staying where it was, even though I had removed the UJ bolt. I realised I would have to lever it out from inside the engine compartment so would need to support the wheel end of the column on some cord while I did so - of course no cord within reach! So I tried to put one of the upper bolts back in but even though the column bracket is slotted it was too far back to get any bolts in. Took quite a bit of pressure pushing the column down towards the toe-board against what seemed like spring pressure to get one in. When I finally got the column out of the car I found I could pull the bottom half completely out as the shear pins (actually injection moulded plastic) had done just that - hence the rotational play. There is a spring at the bottom of the lower half, pressing back against the lower bush in the outer, and forwards against a circlip on the inner shaft, which is effectively trying to push the shaft out of the bottom of the outer all the time. Ordinarily the shear pins mean it is pulling on the upper half of the shaft, and the upper bearing on that is pulled down into the upper end of the column, as well as being retained by another circlip. That's why I had trouble temporarily getting an upper bolt back in - I was having to compress that spring by pushing the column towards the toe-board far enough to get an upper bolt in, and it's quite a hefty spring! As to when and how the pins had sheared, I don't know.

With the column finally out there is a plastic sleeve wrapped round the lower half of the column, covering the collapsible mesh section. Glued or heat-bonded with five blobs down the edge I cut

through the bonds with a sharp knife, and can now see the shaft through the mesh. With the lower half of the shaft pulled out I can see the remains of the injection moulding process in two places on the upper/inner half of the shaft, and four 'nubs' of plastic sticking out of four holes (two each side) in the lower/outer part. I also find that with the lower half of the shaft out, the free end of the upper half is free to flap about inside, and in some positions the steering lock (key out) is catching, but when held centrally it is free. So I wonder if it has been attacked by thieves before my time (apparently if you don't turn the wheel to engage the lock when you have removed the key, they can wrench the wheel round and as the locking pin drops into the hole the momentum snaps it off). But later on when I have been working on the column I find the lock engaging with both parts fitted, and has to be released with the key, so maybe the locking pin is whole but just sticky. I do find the ignition switch slathered in oil, maybe squirted in to try and get the lock working. **Never** use oil or grease in a lock, only graphite powder.

With the column on the bench I spy a tiny grub-screw under the switch, which when unscrewed to flush with the lock housing allows the switch to be withdrawn. If you are going to be leave the switch out for any length of time screw this back in to prevent it falling out and getting lost. One oddity with the ignition switch is that with the various work that has been done on the wiring there is black insulation tape wrapped round it, which I have to remove to expose the alarm wire soldered to the brown, and I find a purple/pink wire. Now this is only used on North American spec cars, for the anti-runon valve. So whether the car has had an American column and/or switch at some time, or whether the manufacturers use a standard tail and just cut the unused wires off (there is no spare contact on the switch for this wire) I don't know.

I don't want to cut the lock assembly off the column (the shear bolts have sheared off), so wonder if I can remove the upper half of the shaft from the outer. This may allow me to see what is happening with the column lock, and possibly free it up if it isn't broken. I espy a circlip quite deep inside top of the outer, and manage to get that out of its slot. My angled internal circlip pliers won't go in that far, but by using one leg of a straight external set to lift up one end, I can then get one leg of my angled internal pair in that, and shift the other end of the circlip with one leg of my external pair. The shaft with it's bearing can then move up and down a couple of inches, but something is stopping it coming out altogether. There is an alloy casting at the top of the tube, held on with three large pop-rivets. I'm guessing I could have drilled those out, and the casting would have come out allowing the upper bush and shaft out, but don't have any replacements that size so stop short of drilling them out. Oh well, it's not had a steering lock for my 16 years, I doubt it matters now. Incidentally, the fact that the upper part of the shaft is retained in the outer this way, means that hammering on the end of the column to free the steering wheel, especially if your knees are braced behind the wheel, means that you are highly unlikely to break the shear pins, much less collapse the column. It's more likely to be a problem at the other end if you have to hammer or lever the UJ back on if the splines are stiff, but even then there is a strong spring pressing the lower shaft downwards, the same principle as bracing your knees behind the wheel.

And now to somehow join the two halves of the inner shaft back together. They are sort of rectangular section where they slot together (to guarantee still being able to steer even if the pins shear!), which has to have some clearance of course. There are holes in the outer, and a 'waisted' section under each hole in the inner. Plastic/nylon is injected through the hole on one side, filling the waisted sections and the gap between the two halves of the shaft, and exits from the hole on the other side. The broken ends of the shear pins came out of the lower half of the shaft easily enough, and the moulded inserts can be eased off the upper half. Whether the moulding around the waisted section always compresses over time to give some play, or whether mine only had the play because the pins had sheared I don't know. I decide to leave the remains of the injection moulding in place as removing them could introduce even more play, but need to pin the two halves of the shaft together. I can see where the pins have sheared off, so mark this position on the outer casing, then slide the lower half of the shaft over the upper until the holes in the outer line up with my marks, i.e. they are over the middle of the waisted sections. I use the holes in the outer as a guide and drill through the inner, so I can insert a pin all the way through.

I decide to slather some Araldite under and round the two halves of the nylon insert, and inside the holes in both upper and lower sections, so that when the lower half is pushed back over the upper that, and a pin through the hole, should hold the two halves together and take out the rotation play between them. I use a metal pin in each position, not being bothered about changing the collapsible characteristics after all these years, **you do this drilling and pinning at your own risk!** Note that the two halves of the shaft will fit together in two positions 180 degrees out. Oddly both my rack and column shafts have notches for the UJ bolts rather than one shaft having a notch and the other a groove all the way round, so my column and rack shafts will only connect in one position, which means if I reassemble the column shaft 180 degrees out the indicator cancelling cam will end up in the wrong position (as it would if you had a shaft with a groove, match-marked it, and reassembled to that). No big deal as it is only a friction fit on the shaft and can be slid round, but nicer to get things correct in the first plce.

Leave that to set a bit and start tidying up the wiring, which basically consists of putting bullets back on the ends of the original brown wires in the harness and ignition switch tail. However as I have no less than four additional circuits that need to connect back to this brown, rather than have a veritable daisy-chain of bullet connectors I splice three of them together with one bullet (two have in-line fuses close by and the third connects to a relay with a spade also close by, so easy enough to isolate each of them for diagnostics) and use the fourth hole for the alarm wire as that goes across the car to the alarm unit in a mini-harness. Turn the power back on and check everything electrical still works, even though the switches are still dangling, and the horn button is removed with the wheel. It's while doing this I discover a thick washer on the carpet, same size as the three that are still on the upper bolts - wonder where that came from...

I then start thinking about the pesky bottom spring and circlip. As I said it is pretty hefty, and just with hand pressure I can't get it compressed far enough to get the circlip on - nowhere near. I'm thinking I'm going to have to lever it down with something, but it will have to be pretty thin as there is going to be very little room to fit the circlip in its slot. I find some flanged plates about 8" by 2" from my BT days some 30 years ago (!) which may be strong enough. I cut a hole in this plate, which just fits over the end of the part of the shaft the circlip fits into, which is narrower than the part that the spring and a washer fits over. As I've only got two hands I stand the steering wheel end of the column on a suitable block of wood, put one end of my plate under the edge of my bench, and press down on the other end of the plate with a hand. It's compressing OK, but the problem is the washer is catching on the shoulder of the shaft, and as I'm levering rather than a straight press it is proving impossible to keep this washer aligned with the larger diameter it is supposed to go over while I'm levering. Go and gaze at my various bits again, and see an old box plug spanner which looks interesting. I'm amazed to discover this just fits over the narrower part of the shaft, and also just fits inside the washer and spring, so perfect for aligning the washer with the thicker part of the shaft! So now I put the box plug spanner through my plate, put the washer and spring on the end of the box plug spanner, and slide that lot over the end of the shaft. Now levering on the plate pushes everything over the larger diameter, and I remove the box plug spanner to reveal the circlip slot - so far so good. However it's still a bit of a fiddle picking up and manouevring the circlip one-handed while pressing down on my lever with the other, so I devise a system of string and a tommy bar (from the same plug spanner!) to pull the plate back and compress the spring while the column is clamped in the vice, and I have two hands to fit the circlip. Easy-peasy? - er no. Of course I have forgotten that the circlip is now trapping the plate! But filing the hole in the plate out to a 'keyhole' shape slightly larger than the circlip, but still smaller most of the way round than the washer, I can now fit the circlip into its slot, and lift the plate off over it. Feel thoroughly pleased with my ingenuity, and life-long policy of never throwing anything away - "If you haven't found a use for something yet, you haven't kept it long enough". In fact I have had a major clear out of the garage recently as we are planning to move house this year, but obviously kept enough of the right bits! Finally reattach the plastic cover over the mesh section of the outer, taping it up with masking tape while the adhesive dries.

And now for the refitting and alignment! There is a small ring welded to the outer tube, which the loose flange butts up against, so I wondered if it should be attached to that, although there was no sign it had been. However that puts the flange about 1/2" away from the toe-board which obviously isn't right. And with this column unlike earlier types the inner is fixed in the outer and cannot move up and down, only rotate, so the whole column has to be able to move up and down to get the right distance from the rack shaft so the UJ bolts will fit through the cut-outs in the shafts. Although some have said this bottom flange is part of the alignment, pushing the bottom of the column into the correct position, I've come to the

conclusion it is nothing more than a body seal against water, noise and fumes. Two people have confirmed that theirs is also loose and detachable (making it very odd that it is shown as part of the column), and another has said that as well as that he has a rubber bush, that slides onto the lower part of the column outer, and makes a snug fit to the hole in the flange. That makes some sort of sense, and it would make more sense if it were a flange on the existing gasket, unless it pushes **through** the gasket with the tube, which perhaps makes even more sense, except that it isn't listed as a component anywhere. The gasket and flange have to be floating with respect to the toe-board while you are doing the alignment, and the alignment is done by sliding the column up and down for length, pivoting it sideways (both using the upper bolts in slots) for horizontal alignment, and shims as required between the column and upper brackets, and between the rack and cross-member, for vertical alignment. Only when the three upper column bolts are fully tightened do you tighten the three toe-board bolts, the column flange simply sitting where the column has positioned it. In practical terms it was easier to loosely bolt the flange and gasket to the toe-board first, then push the end of the column through the hole, rather than slide the flange and gasket onto the column, put it in position with at least one upper bolt, then try and get the flange bolts in - the top one in particular is real fiddle but all are more difficult that way.

Another thing concerns the alignment gauges. The book says to remove the **rack**, even when it is the column that is being refitted. You **do** have to remove the rack later on, but there is no point doing it now only to have to refit it, then remove and refit it a second time later on. If using the Moss gauges these have two tapped holes depending on which rack and column they are used for. Compare the gauge to the UJ, position the tip in line with the centre of the UJ, and see which hole in the gauge lines up with the clamp bolt hole in the UJ, and put the clamp screws in those holes. Note that each part of the Moss gauge seems to be a couple of milli-metres shorter than the rubber bumper UJ (not so the chrome bumper), so bear this in mind when doing the alignment i.e. leave a couple of mil between the points or you may not be able to get both UJ clamp bolts in right at the end (alternatively, fit the UJ first, nip up the column bolts to get the correct in and out adjustment, then pull the rack forwards to replace the UJ with the gauges and note the gap between the tips, if any. When you have corrected the column and rack shimming for horizontal and vertical alignment make sure you end up with that same in and out gap). Apart from that when refitting a column it's easier to fit the alignment gauges first, minus the screw in the column piece. Then fit the column loosely, the alignment gauge easily goes through the toe-board flange and gasket, and then fit the screw to the column half of the gauge. This is a bit fiddly being recessed into the toe-board 'cup' as it is but can be done. It would be easier with a knurled bolt, or even a hex bolt, or if the screw could be pushed in to the hole a little way before the threads started. Note that the screws must screw into the bottom of the cut-out in the shafts, not onto the splined portion. My Haynes is completely wrong here, by saying the rack and column should be fitted **before** installing the alignment gauges. This simply cannot be done, the two have to be moved apart a couple of inches to get the gauges onto the shaft, and off again to refit the UJ. With the gauges on adjust the column position and the shims as above

to get the correct alignment. However my Leyland Workshop Manual also has a major error, in that it tells you "Slacken the screw on the column point gauge and slide the gauge down until the points of both gauges are on the same plane but not overlapping". The whole point of the gauge screws with this column is that they **must** screw into the cut-outs in the shafts, and the whole column must be slid up and down to get the correct in and out position. Unless you do this it is highly likely that you will **not** be able to get the second UJ clamping bolt inserted, the cut-out in the shaft not lining up with the hole in the UJ. This isn't the case with earlier columns, where the whole inner shaft is free to slide up and down inside the outer, with those the shaft will automatically take up the correct position. I repeat, with this later energy-absorbing column you can only adjust the in and out position of the inner, and hence get the cut-out in the correct place for the UJ, by moving the whole column on its upper bolts (which is also why the toe-plate must be able to slide up and down on the column outer).

Additionally at the end of the process i.e. with the gauges replaced by the UJ, it tells you tighten the two upper bolts, then measure the gap at the third bolt, and fit shims accordingly. This makes no sense to me, as the gauge of the correct size would have to be gripped by almost the same tension as the final shims which is 12-17 ft lb as you were sliding it in and out. Better to align, fitting shims as required to the third bolt and tightening all three to get the correct alignment while the gauges are still on the shafts. More long-winded certainly, but it seems more accurate to me. The two upper column bolts do not allow the column to 'rock' on them when tightened, so unless the shimming required on the third bolt is negligible to nothing then there must be some sideways pressure on the UJ and hence the rack pinion bearing. If you shim the column to that final position, then the two shafts will **not** be accurately aligned. When the column and rack shafts are correctly aligned with the gauges, only then pull the rack forwards to remove the gauges, fit the UJ, and refit the rack. Unlike the column, the rack (with any shims) should **always** go back in the same position. Whereas if you are only fitting shims to the third column bolt and fully tightening that after the UJ is installed, you could be affecting the vertical alignment, and indeed would have to lever the bottom of the column downwards in order to get the shims inserted. This is why it makes more sense to fit the gauges before installing the column, leaving the rack where it is until the very end of the process, only then pulling the rack forwards to remove the gauges and refit the UJ. Note that if you raise the front wheels off the ground you only have to remove the four rack bolts, leaving the track-rod ends attached to the steering arms. As you pull the rack forwards a few inches to allow you to remove the gauges and fit the UJ, the wheels will simply go 'pigeon-toed' i.e. turn in towards each other.

Refit rack bolts, tighten UJ clamp bolts, refit switches. Check all the electrics again, which involves putting the key in the ignition, and immediately sense that it is now closer to the bottom of the dashboard than it was before. I now realise what that odd thick washer was - it must have been between the column and body brackets on the right-hand bolt which would space that side down a bit - buggah! To fit it now would involve realigning the column. Consult the workshop manual to find something I missed before, that there should be such a spacer on **all three** upper column bolts! Indeed six shown in the Leyland Parts Catalogue, but only three in online parts lists. However the manual talks in terms of "if the packing washers are

mislaid" so it is probably no big deal, and I can live with it until I next have to remove rack or column. Refit the column cowls **before** the steering wheel as it is easier, and if the lower cowl screws (covered by the edge of the dashboard) were fitted before don't bother refitting them, they just aren't needed. If you haven't upset the positioning of the indicator cancelling cam, and it was correct to begin with (cam pointing at the switch when straight-ahead), then loosely refit the steering wheel to turn the shaft to the straight-ahead position, then refit the wheel fully. Otherwise fit it with the nut not fully tightened, take it to a quiet straight road close by (not 10 miles away!), and adjust as required. Take your socket etc. with you so as to fully tighten it before driving back, so you can take the scenic route and enjoy getting your car back on the road again. The rattle-free steering really is an improvement.

Column changes: Not an optional gearchange in a different location, but which cars had what column when. Originally the column did not have a steering lock and ignition switch, although various European countries got them at different times between 1962 and late 69, and hence a different column. LHD and RHD had different shafts and tubes, solid shafts - otherwise known as "the spear pointing at your chest". USA got a collapsible column for the Mk2, Canada a year later in 1968, these had what Clausager describes as "an easily defeatable", side entry steering lock. For the 1970 year non-North American inners and outers changed, and North America got a column assembly with an improved side-entry steering lock. From 1st January 1971 the UK required a steering lock, so a column with a front-entry lock was fitted to cars for all markets except North America. For the 1972 model year in non-North American markets the column changed to an assembly rather than separate tubes and shafts, now collapsible. V8s had the side-entry lock on a different column. From the start of rubber bumper production all cars including the V8, regardless of market, got the same full energy-absorbing column (crushable outer as well as collapsing shaft) with side entry lock. For the 77 model year the column changed again to one with different wheel splines although not much else changed. The splines changed at two earlier points as well, giving four different columns, each with different splines, and the wheels are not interchangeable.

Interestingly the 'collapsible' columns before the full energy-absorbing allow the shaft to move freely up and down within the inner. So in any frontal impact an unbelted occupant could push the wheel forwards, crushing the switchgear. If the collision is so severe as to move the rack rearwards the steering wheel and inner shaft would actually move towards the occupant, possibly allowing even a belted driver to hit it, an unbelted driver possibly deforming the wheel such that the boss did indeed spear him, the forces involved being the weight of the occupant plus the energy from whatever the front of the car has hit. The later full energy-absorbing columns are different in that the inner cannot move in and out of the outer. If an unbelted driver hits the wheel with enough force the rim could deform and the boss spear them as before, but it would need a lot more energy from the occupant. If the rack moves backwards then the inner will shear with very little force, and no energy absorption. It's only if the toe-board comes back far enough to hit the bottom of the column outer that the mesh construction of the outer will do its energy-absorbing stuff, and it's difficult to see how that could happen, expect possibly in a V8 where

the engine moves backwards. If the impact is severe enough to reach the toe-board, even with a V8, it's difficult to see how the energy absorbing column is going to make much difference to the injuries of the driver, given that this 130kph/75G impact of an MGB with a solid concrete wall resulted in no intrusion into the cabin.

Steering Wheels

According to Clausager four different types of column and wheel splines were used over the years, and are not interchangeable. Originally wire spokes in three groups, for 1970 it changed to three flat alloy spokes with five holes each. In 1973 the five holes (said to have trapped fingers!) were replaced by a tapered slot, but only until June 73 when the slot became simply a depression in each solid spoke. For 1977 to the end a wheel with four plastic spokes was used, except for the North American LE of 79-80 which oddly went back to spokes with holes in again, albeit only three in a smaller diameter wheel. It seems likely that wire, original alloy with holes, alloy with slots, and finally plastic have the four different splines, the 'depressed' slot being the same as the short-lived slot, and the American LE being the same as the plastic-spoked wheel.

The wheel is fitted to the shaft with a splined and tapered joint and a nut (about 1 1/16" or 3/4" Whitworth on my 73 roadster and 75 V8), which together means that even if the nut comes loose the wheel should not be loose on the column, the taper must be 'broken' as well. The best way of doing this to avoid damage to both wheel rim and column is as follows:

- Remove the horn push or centre cover (varies with model)
- Slacken the nut by just a turn or two - make absolutely sure that plenty of turns remain engaged and the nut does not protrude too far above the end of the column.
- Sitting in the drivers seat, draw your knees up behind the wheel and use them to apply pressure to the back of the wheel rim.
- Wearing appropriate eye protection, place a medium hammer on the end of the column shaft. If you have a hammer with a ball-end then use this end against the column. Whatever hammer you use make sure the hammer is in contact with the end of the column and not the nut or you will damage the threads.
- Strike the first hammer firmly with a second hammer.
- After a couple of blows the wheel should pop free, but be safely retained by the nut which prevents it from flying towards your face.

I've seen it claimed that this method can cause the collapsible shaft to collapse, and recommending an alternative method which involves slackening the nut as before, then alternately pulling and pushing each side of the wheel, as if you were attempting to bend the end of the shaft from side to side. This method didn't work for me when the wheel hadn't been off for a long time, but it did on subsequent occasions. The upper shaft of the rubber bumper fully collapsible column has the upper bearing retained in the outer against a stop which prevents it going any

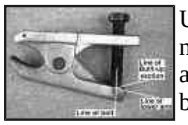
further into the column, and in any case bracing the knees behind the wheel is going to counteract any downward movement, the shock of the blow releasing the taper.

Update August 2011:

After living with the Moto-Lita on Vee for 17 years and wondering about getting an original, I suddenly decide to do something about it. Contact Andy Jennings and he does have one available at £20 plus p&p. The condition as described and in a photo looks good enough so I go for it, it arrives next day, and if anything is better then expected. First thing is to make sure it fits, which it does. The hub needs repainting which is no bother, the horn-push is perfect, and the rim which is the most important thing as it would be a pain to do anything about is near perfect. The hardest job concerned the spokes, which had obviously been wire-brushed with a drill in the past, but across the spokes as well as longitudinally leaving score-marks in both directions, whereas the original brushed surface would have been longitudinal only. I try model-makes wire wool, and various grades of wet and dry up to the coarsest I have which is 400 grit. I manage to greatly reduce the scoring but not totally eliminate it, and even 400 grit leaves the remainder of the surface polished instead of brushed. I even try a hand wire brush on the back (which I'd also done with the 400) in an attempt to recreate the brushed look but it made no impression. I could have tried my grinding stone, but wouldn't have been able to get into the depressions in the spokes, so settle for a wire wool polished finish. Vee is a 75-built car eligible for the gold 50th anniversary badging, so I paint the MG logo on the horn push as shown in Clausager, albeit with Humbrol gold instead of the yellow he describes. Andy couldn't supply a sprung pencil for the horn connection, I could have got a new one but a wire soldered from the back of the slip-ring to a tag on the centre screw of the horn push does exactly the same thing and saves £10. Fitted, it makes the steering even lighter than I was expecting, and at least now I can see the supplementary gauges without peering round the rim.

1977 (and later) model-year cars have a special wheel boss which engages with a cancellation collar on the indicator/turn switch, see here. A non-standard wheel is likely to fail to cancel the indicators without a modification as indicated.

NEW Track-rod Ends and Tracking Adjustment *Added August 2010*



Using wedges and pickle-fork so-called ball-joint splitters I had never been able to disconnect the track rod end from the steering arm to either replace them or gaiters without damaging the rubber boots on them i.e. destroying them in the process so unless I was changing them anyway I didn't even try. But to change track-rod ends you will have to disconnect them from the steering arms of course. Eventually I bought a ball joint separator but had to modify it, now splitting track-rod end tapers is a positive joy. Make alignment marks on the tie rod and track rod end, slacken the lock-nut and count how many turns are needed to separate the track rod end from the tie rod. If refitting the same track-rod ends you **should** be spot-on, but

unless you know your tracking was right before there is no harm in getting it checked, and you know you will be able to slacken and adjust everything before it all seizes up again (and if you reassemble with copper grease it is much less likely to seize-up anyway).

A tip when disconnecting the track-rod ends from the steering arms. The nut is usually a Nylok, and the effect of this is that once the taper is broken turning the nut just turns the pin with it unless you lock the taper again, as otherwise the stud just turns the ball in its joint. And if using a screw-type splitter you really need to have a nut on several threads to avoid damaging the end of the stud. The tip is before cracking the taper remove the Nylok nut, then put a plain nut on until the end of the stud is close to the face of the nut, then use the splitter. As long as the threads are good the plain nut will be much easier to remove once the taper is broken. For replacement the same problem occurs, so screw the plain nut up tight to lock the taper, then replace with the Nylok nut.

If changing track rod ends and they are basically the same length alignment marks and counting turns will probably get you close enough to drive straight (hopefully!) to an alignment centre, which should be done as there are bound to be dimensional differences between old and new track rod ends. However changing Bee's track-rod ends I found the new ones were quite a bit longer than the old, so no point. I measured the difference as best I could at 6mm, then screwed the lock-nuts back towards the gaiters until there was a 6mm gap to the ends of the old track-rod ends, and removed them.

The old ones were surprisingly bad given they were only advisories, the worst had lost a large part of its rubber boot, the ball was sloppy in its joint and rusty. The other one had a split boot and was rusty inside, but the ball wasn't as loose. I then screwed the new ones on right up to the lock-nuts. Not happy that I had got the tracking close enough for driving to the alignment place I decided to make an alignment gauge. Having (hopefully) got the tracking close enough for a test drive it was immediately noticeable how smooth the steering was, I had recently been aware of some vibration through the wheel, which wasn't consistent so I didn't think it was wheel balance. Also quieter, as if I had subconcsiously noted some rattling, both must have been coming from the worn UJ as well as track-rod ends. I suppose it is a case of not noticing gradual changes in sound and feel over a long time, whereas we should all be aware of sudden changes and either know what they are (as in this case) or investigate them - Nory's "Listen to your car, it is talking to you".

Just after replacing Bee's I find that Vee's need doing as well, as a result of investigating a clonk when applying and releasing the brakes, which led me to discover a clonk as I turned the steering wheel back and fore with the road wheels on the ground, which felt like it was the track-rod end but could be the rack! But this time the offside at least looks heavily corroded. I buy two more track-rod ends plus lock-nuts as it looks I might have to use an angle-grinder on both. I don't have a

spanner that fits, and my mini-Stillsons isn't giving me enough leverage as well as chewing up the nut, so a trip to Halfords with a new nut gets me a 22mm which is a pretty close fit. That gets the nut turning on the track-rod, but the track-rod is stuck fast in the track-rod end. My Stillsons grip the track-rod to some extent, and a large ring-spanner over the end of the handle gives me more leverage, but being round bar eventually it just slips, even having applied Halfords 'shock and oh' releasing fluid ('shock' from the freezing spray as well as the penetrating fluid, 'oh' from the 'oh bugger' when it doesn't make any difference). So nothing for it but to run the angle-grinder along the length of the track-rod end until the tips of the threads just start to appear. Get the Stillsons on the track-rod again, hoping the heat from the angle-grinding might have done the trick, with more freezer spray on the exposed threads, but still no go. So this time I put the Stillsons on the end of the track-rod end, pin still in the steering arm, in such a way that it is trying to peel it open, and finally hear a 'crack'. After that it comes off relatively easily, only took a couple of hours... New and old look to be the same lengths, so count the turns to remove (21) and fit the new one (with copper-grease!). I decide to leave the old nut on, screwed back a bit, plus a new one, thinking that in future the two nuts locked together will give me more purchase to turn the track-rod.

When I come to do the second one I don't have much time but put the spanner on the locknut just to see what happens and it moves straight-away. Not only that it is screwing the track-rod out of the track-rod end. So crack the taper to the steering arm, unscrew (18 turns), and screw the new one on. This one already has copper-grease on it, I'd forgotten I had already dealt with that one some years ago when replacing a gaiter. Shows just how effective the grease is, and second nut on the other side obviously not required. This one takes me 10 minutes start to finish! All I have to do now is check and adjust the tracking with my gauge. Well, I say 'all', but having gone from king-pins to track-rod ends and noticing a broken bump-rubber on the way, this time I noticed the A-arms on the left side weren't being held centrally on the bushes on the wishbone pivot, but were both as far back as they could go, the front one up against the face of the pivot and the rear one against the retaining washer. Annoying as I replaced A-arms and bushes a few years ago and they are the correct V8 ones. In theory this might have altered the suspension geometry, which could account for a very slight drift to the left on a flat surface, which implies a difference in castor angle between sides. But the direction the A-arms have moved is rearwards, which would have **reduced** the castor angle that side, which in theory should cause a drift to the **right**. So something else to investigate further. Used the alignment gauge again, the kit at my local tyre place should fit the V8 wheels OK as a double-check. But just like Bee it was immediately noticeable how much quieter and smoother the steering had become. After finally getting the wheels balanced correctly I was left with an occasional tremor over some surfaces, which I put down to the slight wear that I know exists in the rack, and the free-play in the column. On a 70 miles run there was absolutely nothing - excellent result.

Alignment gauge, first some points about tracking and alignment:

- The alignment of the front wheels, or tracking, is adjusted by screwing the track-rods into or out of the track-rod ends.
- If the rack is in front of the axle (as on the MGB), and the track rods are

screwed into the track-rod ends, the front of the wheels are moved closer together and the back of the wheels moved further apart. If the rack is behind the line of the axle the opposite is true i.e. screwing the track rods into the track-rod ends moves the back of the wheels closer together and the fronts further apart.

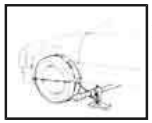
- If the fronts are closer than the rears the wheels are said to be toeing in, and this is the normal arrangement for most cars, but by no means universal, and the amount different cars toe in or out also varies. The MGB (including V8) is adjusted to toe-in 1/16" to 3/32" (1.5 to 2.3mm), unladen. This is total toe, i.e. between the two wheels, half of that between each wheel and a notional centre-line.
- The purpose of toe, either in or out, is to reduce the amount the tyre scrubs against the road surface, the more the tyre scrubs the faster it will wear. If a tyre is toeing-in too much, the outer edges of the tyres will wear more rapidly, in a sort of stepped fashion. And if they are toeing-out too much the inner edges will wear more rapidly. If one tyre wears different to the other, then that is an indication that other aspects of steering and suspension alignment are unbalanced between sides, and this can include problems at the rear. It can be caused by accident damage and chassis misalignment as well as damage to or wear in suspension and steering components. It is the various suspension angles - camber, castor and king-pin inclination that determine how much toe is required to produce zero scrub, and in which direction.
- It is incorrect to say that if the car is pulling to one side or the other on a flat and level road then the tracking is out (although it may be). The front suspension is designed so that when travelling forwards the steering self-centres, so you don't have to pull on the wheel to straighten up after a bend, and there is no tendency to wander from side to side needing continual corrections when travelling in a straight line. This is achieved by the castor ('caster' is a type of sugar, or a container for sprinkling it) angle of the king-pins, which is the amount a line through the centre of the king-pin is off vertical, in a fore and aft direction, the bottom of the king-pin being further forward than the top. Clearly seen on a bicycle or motorbike where the line of the forks up through the frame is angled (bicycles and motorbikes also have the rotational centre of the wheel set forward of the line of the forks, which is called 'trail', from having curved forks on a bicycle and the axle bracket attached to the front of the forks on a motorbike). Forward motion with turned steering puts the contact patch to one side or the other of a notional centre-line, and it tries to pull back to that centre-line, just like a shopping trolley wheel. If the castor (and all the other) angle is the same on both sides then the centralisation forces will be the same both sides, and regardless of how much the toe in or out is both tyres will be at the same angle and the car will travel in a straight line. If it doesn't, on a flat and level surface (the usual camber for rain-water drainage will always tend to pull the car towards the side of the road), then it means the castor angles are different between sides, and the car will pull towards the side with the greatest castor angle.
- On the MGB the castor angle is between 5 and 7.25 degrees, and not adjustable, except possibly using clearances between bolts and holes by slackening the damper mounting bolts, and the A-arm inner pivot to

crossmember bolts, and applying appropriate leverage while you retighten. In theory, if the car is pulling to the left, the left king-pin is more inclined than the right, so pulling its damper backwards or its A-arms forwards, and doing the opposite on the other side, might have an effect.

- When checking or adjusting tracking the car must be on a flat and level surface, with the suspension at its working level i.e. bounce it up and down to settle it if the front of the car has been raised and roll it back and fore a few times, with the tyres at correct and equal pressures, and the wheels in the straight-ahead position. This last is to remove the effects of the Ackerman Angle, which is where when cornering the inside wheel turns more than the outside wheel, to reduce scrub, steering effort and loss of traction, as the inside wheel takes a shorter line than the outer. Similar to why a driven axle has a differential, although in that case it is to prevent drag, wheel skid and loss of traction. If you measure the physical toe with the wheels off-centre you reduce the toe-in, maybe to the point of making them toe out. If you adjusted them to the book figure like this they will be toeing in more than they should be when straight ahead. On the MGB when the inner wheel is at 20 degrees the outer wheel is at 19 degrees (+- 1 degree).
- When adjusting the tracking, if the steering wheel was previously straight when travelling in a straight line, then **both** sides must be adjusted by an equal amount. If you only adjust one side then the steering wheel will end up at an angle when travelling in a straight line.
- The other aspect to steering is the lock each side, or how far the wheel can be turned in each direction. Ideally there should be **exactly** the same number of turns from straight ahead to the right lock and the left lock. Compare the angle of the wheel spokes at one lock to the other, and it should be a mirror image. If the wheel turns more to one lock than the other then that will give different turning circles one side to the other. No big deal with small amounts, but if it goes too far the wheel could rub on something, as well as making manoeuvring awkward. To correct this, move the steering wheel on the splines until, from the centre position of the **wheel**, the spokes are a mirror image at each lock (or as close as can be obtained between two adjacent splines). This will put the wheel off-centre when travelling straight ahead, so then turn the track-rods in each track-rod end by **exactly** the same amount in the appropriate direction, which should leave the tracking alignment unchanged. For example if the wheel is turned to the right when travelling straight ahead (or the car turns to the left when the wheel is held centred), unscrew the left-hand track rod from its track-rod end (for a front-mounted rack), and screw the right-hand one further in.

Tracking can be measured in one of two ways - physical measurement of the tyres and wheels, or the amount of scrub. I've never used it but Gunson's Trakrite measures the scrub, or side-slip, by pushing the car forwards with one wheel over the device which consists of two plates, one on top of the other, with ball-bearings between them. Any scrub will tend to push the top plate sideways relative to the bottom plate, and this relative movement is displayed on a scale. You adjust the tracking (both track-rod ends equally remember) to give zero scrub or as close as you can get, my Celica manual for example quotes a maximum of 3mm per meter, or 0.118" in 3.3 feet(!) in either direction. You only have to measure one side, as

the grip between the tyre and the ground on the other side will push or pull the tested tyre the whole amount of the scrub for both tyres. Therefore get the tested tyre to zero, and the other should be at zero also. Out of interest the toe on the Celica is +-1mm, i.e. neutral or zero toe, which is quite common for front-wheel drive cars.



As well as describing measuring side-slip or scrub the Celica manual has a detailed description of how to measure the physical amount of toe. Basically you mark the middle of tread, in line with the centre of the axle, on the front or the back of the tyre, and measure the distance between the two marks, which is most easily done with two pointers on a connecting bar resting on the ground. Then roll the car half a revolution, so the marks on the tyres are now on the other side but back in line with the axle centre-line again, and again measure the distance between the two marks. If you carefully move your pointers from the first (reference) position to the second (comparison) position, and line up one pointer with its mark, you can directly measure the total toe between the other mark and its pointer. If you take the reference measurement at the back then roll the car forward to make the comparison, or vice-versa, so the marks aren't scrubbed off on the ground. If adjustment is required this method obviously needs you to move the gauge between the back and the front of the tyres several times, making small adjustments to the pointers each time, and being careful not to knock the pointers when moving from the reference side to the comparison side, in addition to rolling the car back and fore several times (which applies to both methods). The side-slip method will certainly be easier, but at a cost of typically £75 as opposed to perhaps nothing if you have a long enough broom-handle and some thin rod, considerably more expensive for something that may only be used once per year at most.

Having recently had a major clear-out of garage and shed I didn't really have the makings without butchering a garden tool or two, so for a few quid I bought some square tubing, threaded rod and nuts from B&Q. I measured the distance between the centre of the treads on each wheel, and this gave me the nominal spacing of the pointers. I also measured the ZS, which is quite a bit wider, and made the bar just long enough to take the pointers at this spacing, in case I ever needed to do that car as well. I drilled hole through the tubing (at the MGB spacing) to take the threaded rod, then overdrilled the bottom hole to allow a cap-nut to pass through which would be on the bottom of each rod. A butterfly nut further up the thread, above the tubing, clamps the rod in position. The rod rises vertically from the tubing and is then bent forwards to meet the mark on the tyre, it's overall length being such that the pointer touches the centre-line of the axle. I subsequently noticed that Moss have a similar gauge at about £50 so quite a bit cheaper than a Trakrite, but not as cheap as mine! However the instructions on the ordering page simply to measure between the outer sidewalls at the front of the tyre, then compare that with the backs. That would require the tyres to be perfectly mounted on the wheels, with no run-out. At the very least the car should be rolled back and fore half a turn so you are comparing the **same point** on the sidewalls, as I am doing with the centre of the tread.

Subsequently took the car to my local tyre place for a tracking check to find their stuff would not fit over/round the spinners, also my next local place. The fronts could be turned so that with the ears at an angle the laser unit fitted round them, but at the back it is a single central vertical bar and even the body of the spinner sticks out too far for that. Good job I got them (hopefully) close with my home-made gauge, looks like I have a 20 mile drive to the next nearest place with kit that should cope with them. **One week later...** Some nice weather at long last so a trip through the countryside to a place with screw-in adapters that hold the gizmos further out from the wheel hence clearing the spinner. Tracking is a shade under 2mm toe in, so given that the spec calls for 1.5 to 2.3mm I call that a result! Even more of a result is that checking is free, only adjustment costs!!

Tubular Dampers - or "Nix to Spax" *April 2006*

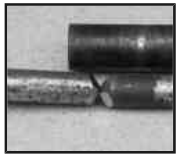
The V8 came with tubular Spax dampers at the rear fitted by the PO. After only a few thousand miles one started leaking, and as I couldn't get a direct replacement I had to buy the pair. And at about £60 as opposed to about a tenner for a single reconditioned lever-arm unit I was not best pleased. It also took Moss three attempts to get the right ones to me, there are two different bottom pin sizes and they kept sending me the wrong one, but that is a bit by-the-by. Having driven roadsters and V8s both with and without tubulars and the rear anti-roll bar and uprated front bar, I can say that whilst the anti-roll bars **do** have an effect on handling and axle location I could detect no real difference between the two types of damper. Click on the thumbnails below for full-sized images.

The replacements lasted for many tens of thousands of miles (no more than one should expect) but I had been aware for a while that the ride was getting quite bouncy, especially over humps and dips. The USP of the Spax is their adjustability, but unless you have them on the softest setting they give a bone-jarring ride, and many testify to this. Thinking that they may have 'softened up' over the 70k or so miles they have been on the car (which itself is a poor 'feature') I tried turning the adjusters, but needless to say they had seized, and I decided that I would not replace them when the need next arose but go back to lever-arms. However I was concerned that if one should fail, unless I splashed out again for a replacement (or possibly a pair), I might have to take the V8 off the road for a time while I sourced a pair of lever-arms together with the drop-links and bottom plates. So at the 2006 Stoneleigh MG Spares Show I was on the lookout and managed to pick up the whole lot minus one bottom plate for a tenner, and got a used bottom plate from elsewhere for another fiver. They were already assembled but I wanted to part them for cleaning and painting, but as usual (IME) the nuts had seized. **TIP:** Careful hacksawing as far as I could through the nut without cutting into the studs (OK, I just nicked the threads, but that won't affect its strength) then using a cold-chisel to open up the cut cracked the rust and it came

undone. Using heat is inadvisable is it is bound to damage the rubber bush the stud is mounted in, which is not a replaceable item. That left me needing a couple of nuts, which being Imperial are not that easy to come by. Popped down to my local Halfords where the chap who usually MOT's all my cars had a root through his toolbox and came up with exactly what I needed (That's *another* pint I owe you ...).

I then discovered that despite measuring two lengths of drop-link at the show, and thinking I had got the longer V8/rubber bumper items (10 5/16" pivot pin centre to pivot pin centre, thanks Graham), I actually ended up with the shorter CB items (8 3/4"). Only discovered this as part of an email thread with someone else, who had the longer ones and needed the shorter! Sadly he was in America so a swap was out of the question. Rather than buy another pair I decided to try 'cutting and shutting' them to extend them (as I had with the rear shackles on the roadster) by the required 1 1/2" or so. Looking round the garage I found a couple of front suspension bottom trunnion bolts that were the correct (0.5") diameter and did the necessary cutting and welding. Two coats of Hammerite smooth on them and the bottom plates and they were ready to go on.

I was quite surprised to find the U-bolts and the nuts and bolts holding the top brackets to the chassis all came undone quite easily as they had not been touched in my ownership, likewise the replacements went on straight-forwardly, the whole job only taking a couple of hours. **TIP:** The only thing to be aware of is that the two bolts holding each dampers to the chassis rail are different in length by about 1/4", which could cause you some head-scratching if you get them mixed up and the two shorter ones on the same side. At some point the forward bolt was recessed into the chassis rail to give more clearance for tyres, possibly for the wider tyres on GT and V8, the shorter bolt goes in this position.



Took the car for a test drive and immediately noticed that on 'normal' surfaces the ride seemed exactly the same but over humps and dips there was no bounce, just a more appropriate firmness without harshness. The standard lever-arms have a two-stage valve that gives relatively mild damping with short movements and harder damping with larger movements, something I have never seen attributed to tubulars of any type. I was deliberately taking the car over as many speed humps as I could find, and going at them progressively harder, when I actually broke one of the welds. It was my fault, when doing the first one I became aware that I was feeding the wire too quickly, which tends to form bobbles of weld on the surfaces of the two pieces being joined rather than fusing them together. No matter, 1/2 hour to take the broken drop-link off, clean up the joint and re-weld, but this time I slipped the spacer tube

from the aforementioned bottom bolt (exactly the right internal diameter) over the shaft first, then welded the shaft, then positioned the spacer tube so it covered both welds, and applied more weld between spacer and shaft. Repainted, refitted a couple of days later, and so far so good.

http://www.mgb-stuff.org.uk/