

TEE ONE TOPICS

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Disclaimer

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Wandering Shadows

One of the more unusual things I have done in my long life has been to steer (helm?) a 100,000 tonne oil tanker out of Sydney Harbour. Unfortunately I ran aground on Pinchgut Island. Fortunately, I was conducting this exercise in self confidence in an amazing simulator in the Navy Command Centre at South Head. I felt somewhat relieved however when the Chief of Navy of another country, a veteran of many sea miles in and out of active duty, got into serious



The command department for the new Phantom. Business-like, functional with just a peppering of old Factory bits to satisfy those who said it couldn't be done.

difficulty in coming alongside an oiler. A demonstrator, a mere slip of a junior officer then proceeded to demonstrate just how easy it all was and given the inclination could probably have sailed the thing up the the now covered Tank Stream.

The secret was of course training and familiarity with the equipment. And so, (God is he going to get to the point at last) I watch in amazement as owners steer their cars of

varying ages through dense traffic and often at high speeds with a steering wheel that seems to be swinging faster than a Tatts Lotto number range! "You seem to have a bit of play in the steering" I smugly opine from the back seat. The reply is nothing, a grunt or most commonly amazement that I would make such an observation. But it happens; like everything on every car the steering wears particularly the gears that translate the turning of the steering wheel into the swinging of the Pitman Arm which in turn pushes the wheels in the direction you require.

There should be no lost motion in any steering system. Certainly some components will flex but that is by design. Recently I was peering under a beautifully kept 'R' Type coach-built Bentley which intriguingly had been retro-fitted with a cleverly designed power steering system. Rooting around underneath the very clean chassis I grabbed the right hand steering relay lever and lunged up and down, to be rewarded with a definite click and a clear indicator of wear. Later I startled the driver as he was leaving, grabbed the wheel through the window and wobbled it to prove my point. Clearly it was news to him.

The steering gear wear is fairly easily sensed by stopping the car on a hard level surface with the wheels straight ahead and lightly swinging the wheel from side to side. You may hear a click which is the easiest indicator or you may feel a strange crunch usually a rubber coupling coming apart or you may hear squeaks which mean lack of lubrication. All of these things warrant further investigation. The most common problem is wear in the steering box which mostwise can be adjusted out.

But if you want a really exciting examination, take your car to a suspension specialist that has a pneumatic pad system on which he can place the front wheels. These steel pads oscillate in a

variety of directions in a most alarming fashion and if there is wear in the mechanism it will be immediately apparent.



Typical spin pic from the press kit. Clearly these are refined ladies given the excellent manicure and diamond rings. I am wondering where the leather is coming from these days as Connollys bit the bullet some months back under the impact of an environmental direction.

Wear in the Shadow steering box is becoming apparent as these car age. Elsewhere Wayne Wardman has demonstrated fitting filters in the power steering return lines to minimise abrasive wear and valve problems. This precaution appears to have really paid off. But to compensate for wear and lost motion between the steering worm (turned by the steering wheel) and the rocking shaft (swivelled by the steering worm), there is a screwed adjuster that forces the rocking shft into the worm until not only is there no clearance between them (and hence

no lost motion) but there is a drag or resistance clearly felt at the rim of the steering wheel. This is quite common in certain bearing systems and allows for expansion of the components caused by heat without creating play or lost motion.

Most owners at this point will trot around to their friendly RR man for a second opinion and if necessary the remedial action required. But for the intrepid the following is what is required and can be performed by a well practised cautious amateur mechanic preferably with access to a few unusual tools.



I would guess this is a door lining being assembled. Pity the technician didn't have a decent haircut. I suspect that denizens of the old Factory would feel very out of place in such a modern clean environment.

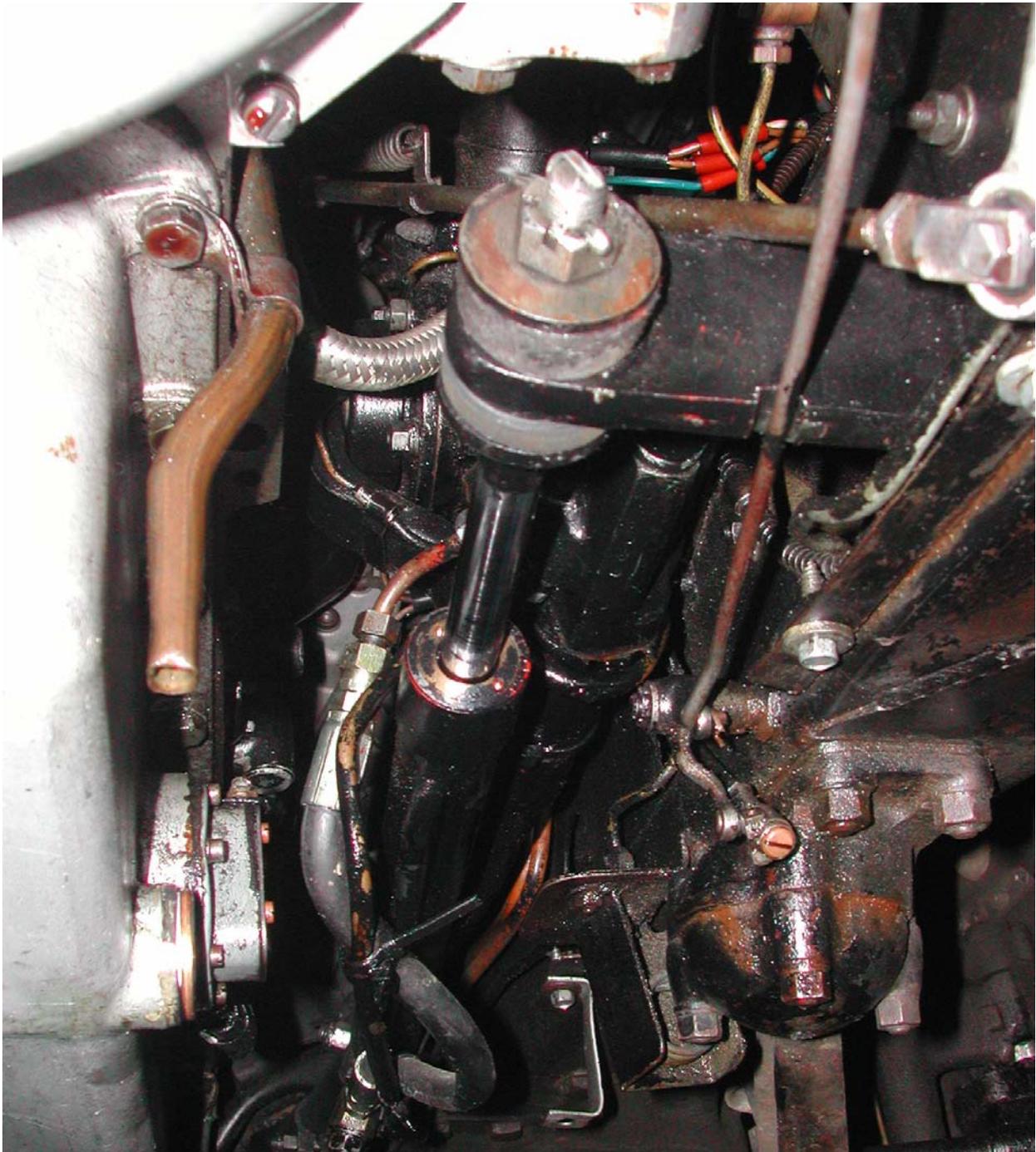
Having got the car's wheels off and the front hoisted high enough so that sitting on your favourite milk carton you can comfortably look across the top of the front sub-frame, the first step is to disconnect the steering levers from the Pitman Arm. This involves breaking one of the six ball joints in the suspension. Buy or borrow a scissors type ball joint splitter. See page 253 for a picture. Many professionals, indeed the manuals advocate bashing the adjacent components with a large hammer until they part. Not only does it permanently dent steering arms etc but you are quite likely to belt a threaded pin and ruin the hardened thread. Cost of the splitter about \$60! Most auto shops

also offer a Pitman Arm puller for about \$40 which can also be used for pushing ball joint pins out of steering arms. Of course this all presupposes that you have removed the ball joint retaining nut and its split pin.

The Pitman Arm on the Shadow is a forging wondrous to behold, curved in mysterious ways to avoid collisions with other components. Having got over this sight try shaking the arm from side to side in the arc that it normally swings. The steering wheel of course is in the central position. If you can feel or hear any movement, the box needs adjusting.

A long 5/8 inch A/F spanner will undo the locknut and a 3/16" Allen Key will move the adjuster. Having released the lock nut, screw the adjuster in until all the lost motion has been eliminated and then screw it in another full turn. Feel the steering wheel. There should be a noticeable drag at the rim of the wheel, if not screw the adjuster in until there is. Judging the amount required is a knack but the simplest test is to tie a spring balance to the steering wheel rim and tighten the adjuster until the gauge shows about 1 pound effort required to move it. All this is done with the wheel at the dead centre position. If you get it too tight you will notice a tendency for the wheel to not return to straight ahead while driving. Too loose and we are back to having lost motion.

Tighten up the lock nut without the adjuster moving and feel the wheel again. Put the wheels back on lower the car check the steering pump tension and oil level and go for a drive. You will be amazed!!



An interesting addition to a coach built R Type – power steering custom made and reportedly quite effective. The unit I understand was made in England fitted here. Note the massive anchor for the power cylinder. Nowadays we are so used to power steering, the lack of it comes as a shock. The first Silver Clouds were without the system and apocrypha has it that a number of cars were retro fitted for favoured customers. As always technology has facilitated advance equipment in this case hose material and design. The pressures involved are enormous and a rupture cannot only be spectacular and expensive but downright dangerous. The lines from the Shadow hydraulic pumps to the accumulators which carry hot RR363 (hopefully) reach pressures of over 2600 psi on a nice day. The original fittings on the very early Shadows were flexible and sure enough

THE ROLLS-ROYCE PHANTOM

INTRODUCTION

“Strive for perfection in everything you do. Take the best that exists and make it better. When it doesn’t exist, design it.”

Sir Henry Royce

The founder and Chief Engineer of Rolls-Royce Motor Cars gave us these words almost a century ago, but they remain as valid today as they were then. It is this philosophy that has guided the creation of the new Rolls-Royce Phantom, manufactured at the company’s headquarters near Goodwood, West Sussex, on the south coast of England.



Nick Lang sent a picture of a factory-installed sunroof in a Shadow. This was an expensive option. Sunroofs were also available on the S series cars and Spirits.

Its unveiling marks the renaissance of what is arguably the most famous brand name in the automobile world, and a name that has become a by-word for excellence in all fields.

‘Project Rolls-Royce’ began on 28 July 1998, when BMW Group became custodians of the marque. The new Rolls-Royce Phantom is the result of an intense four year design and engineering programme that has not only produced a new motor car, but also established a manufacturing plant and a new company. Each facet of the programme has been faithful to Royce’s maxim. In creating the company, motor car and plant, perfection has been the goal.

The Phantom has authentic Rolls-Royce design proportions combined with 21st century engineering integrity. Exterior authenticity embraces a long bonnet and wheelbase, short front

and long rear overhangs, a strong C-post and discreet rear window. The new Rolls-Royce Phantom has generous interior dimensions and a prominent seating position for comfort and authority. Rear seat passengers sit alongside the C-post, well back in the motor car where they enjoy the highest levels of privacy and safety.



Shadows before the second iteration were usually a bit shy on the instrumentation. One bit of apochrypha is that they generally did not fit a temperature guage as the engine ran so hot it used to frighten the driver. As you know, fairly early in the piece they fitted a temperature sensor on the rear of the A bank head. When that sounded you stopped the engine. Actually if I heard my car make that noise I would have to be trabsferred immediately to intensive care! Anyway Nick Lang sent this pic of an early Corniche which sports a full complement of guages plus a tachometer, Wonder what happened to the haorn button – bet someone wanted the steering wheel.

reserves of torque combined with exceptional fuel economy: headline figures include the 5.7 seconds it needs to sprint from 0-60 mph and the 25.7 mpg (11.0 ltr/100kms) it returns over the EU extra urban fuel economy cycle. Maximum power is 453 bhp (338 kW) with peak torque of 720 Nm (531 lb ft) reached at 3,500 rpm. More significantly, 75 per cent of that torque is available from 1,000 rpm.

Drive is to the rear wheels via a 'shift-by-wire' six speed automatic transmission. The chassis has sophisticated double wishbone front and multi-link rear suspension allied to self-levelling air springing on all four wheels.

From a pure styling point of view, the Silver Cloud from the 1950s was deemed to be the quintessential post-war Rolls-Royce, combining presence with elegance and reserved lines with perfect proportions. All three exemplify the air of authority expected from a Rolls-Royce and which has been perfectly captured in the Phantom.

Adopting a fundamental rather than an incremental approach to designing a new motor car, the Rolls-Royce Phantom benefits from the application of leading edge technology, most notably in its aluminium space frame structure. As well as being far lighter than a steel shell of an equivalent size, it is significantly more rigid to the benefit of both handling and ride comfort.

Central to the design has been the concept of relaxed control over the motor car. This can be seen in the elevated driving position, the effortless operation of the controls and the refined performance from the engine.

A purpose-designed 6.75-litre V12 offers ample power and huge

The huge wheels and tyres have been specially developed for the Rolls-Royce Phantom: it is the first car in the world to feature the advanced PAX run-flat tyre system as standard.

Naturally the highest levels of craftsmanship and the best quality materials can be found in the motor car. It takes, for example, up to 16 hides to complete the interior of the car where the soft natural grain leather is complemented by exquisite cabinetry and fine veneers.

But the project has not been about achieving a single superlative – the biggest, the fastest, the most powerful – but rather about finding the optimum balance of all attributes. This is not a concept new to Rolls-Royce...

“Rolls-Royce supremacy is the reward of superlative design and meticulous care in manufacture. Its secret lies in the proved excellence of the Rolls-Royce productions in Durability, Trustworthiness, Economy, Speed, Silence and Comfort. Many cars have attempted to specialise in one or other of these points, but the Rolls-Royce is alone in that it embodies them all.”

Rolls-Royce sales brochure, 1928

With a Rolls-Royce, superlatives are found in the details. Details like the Phantom’s unique independently opening rear coach doors, designed to make entry to and exit from the motor car as easy, as comfortable and as gracefully as possible. Details like the retractable Spirit of Ecstasy, which can be lowered out of sight at the touch of a button.

And details like the purpose-designed umbrellas neatly stowed in the doors and the synchronised wheel centres, which keep the famous interlinked RR badges on all four wheels in an upright position at all times.

But perhaps the essence of the Rolls-Royce Phantom is best summed in one word, a word that can be found in no dictionary: ‘waftability’.

Its origin can be traced back to the turn of the last century. In 1907, a writer from the British motoring magazine Autocar described riding in the Rolls-Royce 40/50 hp as “... the feeling of being wafted through the countryside.” Engineers at Rolls-Royce quickly coined waftability to encapsulate that sensation.

Waftability is achieved in many ways. Effortless acceleration from low engine speeds is one. Near silence of operation is another. A cossetting ride is a given as is the refinement and comfort of the interior.

But waftability can also be found in the lines of the motor car itself: standing still the Phantom looks ready to glide off. It’s in the natural operation of the controls and in the minimum demands placed on the driver. The feeling can even be found in the masterly view from the driver’s seat, over the long bonnet and front wings to the Spirit of Ecstasy and beyond.

Ian Cameron, Chief Designer of Rolls-Royce Motor Cars, explains: “Our absolute priority was to create a motor car that is clearly a Rolls-Royce even when the radiator grille is not in view. More than this, the new car has to stand apart from all others on the road.”

Authenticity

Among the features integral to Rolls-Royce design are a long bonnet with a short front overhang and, conversely, a long overhang at the rear. A long wheelbase is essential for excellent interior

space and, when married to the proud, upright front formed around the vertical Rolls-Royce radiator and high mounted headlamps, helps create a car with genuine presence.

Another Rolls-Royce feature is the roofline which increases in depth as it nears the rear of the car where it blends into a strong C-post. The gentle downward curve of the roofline is mirrored by a subtle upward curve, running from back to front, along the bottom of the car. Others include the discreet rear window – which combines with the C-post to offer greater privacy for the rear passengers – and the ‘broad shouldered’ side profile.

But above all, every Rolls-Royce has to have the correct proportions: the required interior package determines the overall dimensions – height, width, wheelbase and length – and even influences decisions such as wheel size. The correct proportions bring that air of authority



Seen at the recent Self Help Day organised at Neville's transmission place in Bankstown. Clearly an enthusiast ripping off the door linings to see what is going on inside, clearing out any muck neutralising any rust and lubricating the window mechanisms. Remember when replacing the panels to seal the door first with builders plastic and a non-hardening glue. This stops the moisture that gets into the door from rotting the timbers.

integral to the marque and means that, although many Rolls-Royce models of the past – and indeed, the new Phantom – are large cars, they have a sense of balance.

Undercover in London

Design work on what was originally known as ‘Project Rolls-Royce’ began in earnest in early 1999 and progressed in great secrecy, even though the initial designs were created at the heart of one of the busiest capital cities in the world: London.

In a design studio near Hyde Park and known internally as ‘The Bank’ – the offices were formerly used as a bank – three exterior and two interior teams of designers led by Ian Cameron

started work on the new car. Although the front door of ‘The Bank’ opened onto the street, security was never a problem: drawings and sketches were locked away each night in the old bank vault.

Design influences were never far away. Hyde Park is close to the affluent Mayfair and Belgravia areas of the capital. Here the design team would regularly see the Spirit of Ecstasy in its natural environment.



A view many owners would not have bothered to find. To the right is one of the oft discussed rams on which the rear of the car rides. The arrowed slots however are a later improvement allowing air flow through to the boot which helped the sealing in the later and the minimisation of dust entry. Courtesy Nick Lang.

As they started to shape the Rolls-Royce Phantom, the design team identified what they considered to be significant models from the past, quickly establishing that creating a Rolls-Royce is about finding the right balance of aesthetics and engineering.

For example, the 1930s Phantom II incorporated all the authentic Rolls-Royce design elements – large wheels, a short front overhang, long bonnet and a rising sill line. The latter gives the car a ‘take-off’ stance as if the nose of the car is rising as it accelerates away and is a visual reference to the effortless power encapsulated in the concept of waftability.

From an engineering standpoint the Silver Shadow, the first monocoque Rolls-Royce, bristled with advanced features which were combined with striking but simple styling. The result represented a bold modernism at launch in 1965, which was greatly admired by the team.

Tony Gott, chairman and chief executive of Rolls-Royce Motor Cars, says: “For nearly 100 years, Rolls-Royce has been the icon of motor engineering and design. The name has entered the language as the expression of perfection in a range of endeavours far beyond the motor industry.

“The new Rolls-Royce Phantom is, we believe, entirely in keeping with that long and illustrious heritage yet is totally contemporary in its design and technology. Its name evokes the personality of the inter-war Rolls-Royce Phantom I, II and III models, some of the best designed and finest engineered motor cars to bear the Rolls-Royce name.

“And it reflects timeless values of quality, distinction and authority, combining the best of the past with the best modern design, engineering and technology to re-interpret the role of Rolls-Royce in the 21st century.”

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To be continued

An Old Problem with a new car

Wayne Wardman



With the recent deluge of H₂O I was surprised to find a very wet front passenger seat in my Shadow II. She apologised to me but did not explain the cause though she gave a hint via a drip

from near the edge of the sun roof. After a bit of sunlight had dried her exterior I opened the sun roof and found a pool in the forward left section. In its midst a drain hole was visibly not draining. In an attempt to unblock it I passed a piece of wire into the orifice and found that the line was palpable above the headlining and was aiming toward the A pillar. No clearance resulted.

So I reached for a 20ml syringe and a length of garden dripper wire. A good squirt of water only refilled the pool in the sun roof surround. I knew my sill drains were likely to be still clear from a Tee One self help meeting last year and a check with wire confirmed this.

It was now time for Gob Power. Removing the syringe and giving a sharp blow down the dripper line gave a satisfying release. Placing the syringe on the line and discharging it resulted in water dripping from the sill but well clear of the drain. I guess that the recent dust storms had deposited enough matter in the drain to result in a thin layer of blockage. A bit of a lesson...

(This was a very common problem with the Mk VI and Dawn which had, unlike the Shadow, a sun roof as standard. Apart from the overflow that Wayne experienced, the tubes connecting the drains being rubber, perished and destroyed the headlining and quite a bit of the wood filleting in the area. The sunroof mount and surround was made separately complete with short steel pipes welded at each corner. And I include the rear end whence the roof panel slides. These in turn were connected to fixed pipes within the body with flexible rubber tubing. Muck accumulated, drain holes blocked, the surrounds rusted and presto you had a very major repair job. So now I wonder Wayne whether the rear holes are blocked?)



Letter to the Editor,

Dear Bill

Having been a participant in the last Tee One working bee, I am very aware of how close a call you and Peter had with the dreadful fires. The gods must look on you two with some favour as you got out of it relatively unscathed. Mind you, the memory of those hours between when we all left and the crisis was over must be overpowering.

We each have a tale to tell of the day and here is mine. As you know, I left at about 4.00 pm and headed away from home to skirt the fire path. As I drove along Erindale Drive, a cyclone of hot air and embers blasted my car. The gusty winds were so ferocious that the car in front of me (an EL Falcon, not a small car!) was blown up on to two wheels. Luckily, the car did not flip over but it was such a near thing that the poor driver reduced his speed to a crawl. That gave the embers free reign with the paintwork on our cars. The sound was remarkable. It was as if we were caught in a 'sideways hail storm'! I don't blame the Falcon driver though, it was nerve wracking stuff. I doubt that two strong men with a crow bar could have placed a cigarette paper between the cheeks of my bum at the time!!!!

Anyway, that's a long winded and convoluted way of getting to the point of this letter. Here we go with some more convoluting. The paint work on SRH 34273 was damaged more than I first thought. I tried to polish out the pock marks on the side of my car to no avail and had to call my insurer to advise that I would be placing a claim for repairs. They advised me that I should obtain a quote for such repairs. I approached the repairers in Canberra whose reputation suggested that they were up to the task, and believe it or not, they refused to allow a Rolls-Royce to jump the queue! I was told that they did not have the time nor the space to carry out the job my car deserved. Yeah, Yeah.

I contacted Bentley of Sydney and arranged to take the car there for a quote. My insurance cover stated "repairer of choice" and as the local industry was otherwise occupied, I was pleased to be squeezed into this particular corner. I have closely examined some of the work that Brian's team has done and it is

fabulous. John Begg had extensive restoration carried out by Bentley of Sydney and his car is impressive. I hope the new owner is chuffed. You bloody drop-out Begg! Grumble, grumble.

I took the car down to Sydney on Tuesday. Finally, I get to the point! I spoke to the friend of all self helpers, Tom Small. Tom has been involved in the Rolls-Royce fraternity for over 23 years and as one member (whose name shall always remain Bill) said,

" When I first met Tom I thought that he was an ordinary 'parts serviceman' but over the years he has proved to be the most helpful and willing assistant any self respecting self helper could wish for.". I agree. Whole heartedly

Anyway, this is a short tribute to Tom, who in helping where he can has made the ownership of my car more enjoyable. Happy motoring.

George Shores.

Silver Cloud Number Plate Bashery

It is a very careful driver of one of these cars who has not bashed their front tag and holder on something. The usual reaction is to curse Rolls-Royce for putting the mount so low etc. It is however a warning device to avoid hitting an even more ridiculous fitting behind it. And here is the device. Power steering to the Factory was still somewhat of a novelty in the mid fifties. The first S series cars were manually steered and by today's standards needed a Sumo wrestler to park them. Power steering was introduced but instead of incorporating the power cylinder in



the steering box it was mounted ahead of the front 'axle' as a power ram which pushed and pulled the larger of the central relay levers. Of necessity the ram had to be low down and from the picture we all realise the consequences of ramming the thing into a solid curb!! The chassis on these cars, the last model to use a through frame was almost fragile compared with its predecessors. It was fabricated from heavy panel steel, immensely strong for resisting torsion and sagging

but as a lady in Sydney discovered when she threw her newish Cloud into the angled parking spot and stopped a little late, they were not too good in compression. The chassis actually shortened by 4 inches. Fortunately it was repaired by cutting and splicing lengths out of another wreck. In fairness the 'telescoping' was probably a design feature since the demise of the chassis in all passenger vehicles is to avoid the 'battering ram' effect of a through frame in a head on collision. Four wheel drive cars and trucks for reasons of required strength still require the feature. A chassis of course hikes the car up in the air – an affliction in these days of the long low and sleek clan it also adds weight and with the brilliant designs available today in body structure it really is quite unnecessary. We of course still have subframes front and rear to hold all the essentials in place. The only nostalgic bit of course is that it is nice to take a body off and tart up all the running bits.

They were not always the bastion of strength we were led to believe. If you consider their task of keeping the body mounted on them as near rigid as possible while the car went over all manner of obstacles. I have an Armstrong Siddeley which has cracks in the roof since the body is fastened securely to the chassis and when that twists so does the body. Rolls Royce got over this problem by insulating the body structure from the chassis with rubber mounts. Most other lesser cars of that vintage posed some interesting problems including on I think a Humber which could not be driven over a curb diagonally lest you crushed the windscreen!!



On the Level with Shadows



Barrie Gillings has a T series Bentley that ranks with the veterans – chassis number SBH1288. The earliest car in the current Club Register is 1045 (the first made was 1001) and I seem to remember 1010 being in the possession of the late Bruce Ross many years ago. Anyway one of the first big mods inflicted on the new car was to cut out front levelling

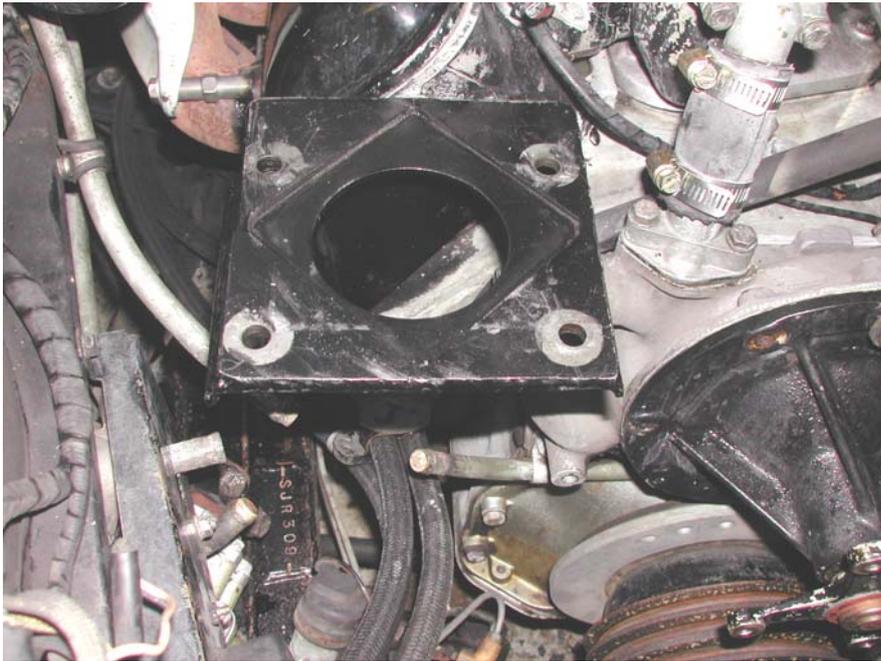
which involved blanking off various ports and pipes around the engine. For some reason Barrie's car was not modified and apparently the whole system works perfectly. Apart from levelling, the system corrected for body roll on cornering and nose diving during heavy braking. Overall it was allegedly not successful hence the modification.



HELLO, HELLO, HELLO!!!

Well I am disappointed that there was not a chorus of excitement from my readers when they saw this picture. Look carefully at about 7.00 o'clock and you will see the stamping of the chassis number on a welded extra plate on the top of the right hand chassis member. Just below it in the picture is a black rubber cap just to the left of the two power steering hoses. Guess? It is the cover to the ride control solenoid on the right hand front shock damper. The original specification for the S series cars included a similar solenoid on the two rear dampers. A simple application involving a solenoid operated pin that added load to the rebound valve on the damper. The effect was quite noticeable on new units when the switch that operated the solenoids on the side of the steering column was operated. The main effect is to stop the rear

end bounding up and down at high speed on an undulating road. Why it was not installed on the front units has not been revealed but I have seen a letter from the Factory to York Motors that



future deliveries of cars to Australia would include solenoids to the front units. The above Cloud III much loved and owned by Martyn Stafford-Bell is the first fitting I have seen. And it works well!

It is probably pertinent to mention here the active or adaptive suspension system adopted by the Factory in 1990. The new ingredient here is variable controllable valving in the shock dampers at the front and

struts at the rear. Controlling them however is another matter; that requires micro processors and very sophisticated sensors. The end result however is very impressive, all we have to do is work out how to maintain them.



TIE ROD END JOINTS



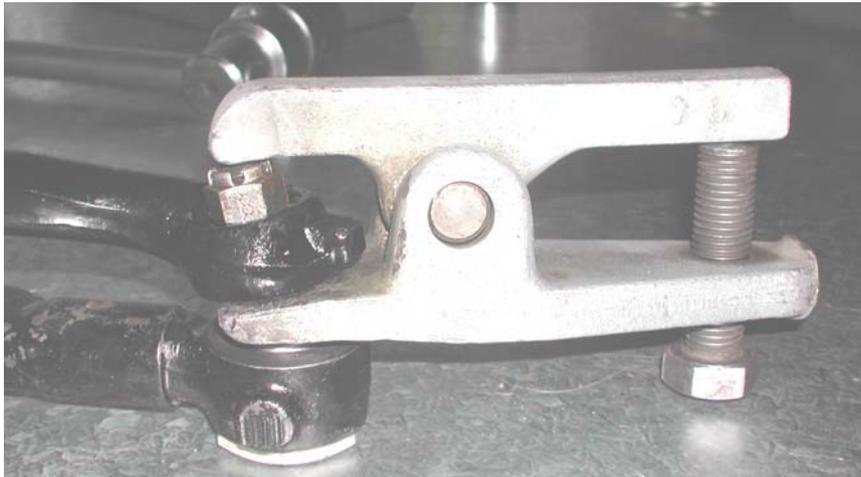
The outer ball joint on a Shadow with its rubber cover off. Note the dented lip on the top side from someone using the bashing method of tie rod end joint extraction.

These little gadgets which are generally ignored and/or abused are simply so vital to our survival in any car. If cars were built like Billy Carts we could simply yank the axle around to go where we wanted to but the resultant car would be so high, since the wheels would have to be able to go under the car; all but the fittest would require a step ladder to get into the cabin. By fixing the axle and swivelling the wheels for direction changes, the car is much lower and the risk of it falling over because the wheels are under the car is avoided.

To swivel the wheels we use steering arms, bits of steel bolted horizontally

across the back of the hubs with which we can get some leverage to turn the wheels. Very loosely speaking the wheels should both turn in the same direction to go round a corner and that is achieved by tying the two steering arms together with a tie rod. All you have to do then is

reach through a hole in the floor, grab this rod and push it in the appropriate direction. It is probably easier to use a steering gear box to do this job but that can be discussed later.



The preferred method. These scissor type removers are readily available and utterly reliable.

Already you need a joint at the end of the tie rod to cope with the wheel and steering lever swivelling but then there is the bother of the wheel going up and down. The tie rod you are hanging onto has to stay in your hand so the end of the rod has to allow for that swivelling. Hence the genesis of the tie rod end. Most cars other than Rolls-Royce make sealed units filled with grease or else a grease nipple is provided.

When the things wear out they are replaced. The Factory made up their tie rod ends which can be completely overhauled and worn bits replaced but this is seldom necessary because of the stuff with which they are made. There is an exception to the above observation. The dear old Mark VI Bentley and derivatives used bronze seats on which the swivel pins swivelled! The late Bert Ward recounts how in the early days he was servicing a car on a property outback and grabbed the tie rods to heave himself under the car. One of the tie rod ends parted and came off in his hand. Seems the legendary bulldust that these vehicles had to pass through in those day worked with the chassis oil as a very nice grinding compound!

Apart from keeping the greased tie rod ends well filled and the oiled ones well oiled there is little to do with them other than check from time to time that they are not showing their age. The pin of all these joints is carefully tapered and fits into a complimentary hole. The nut on top draws the combination very tight. When it is necessary to split them, do use either a scissor splitter or a puller. The alternative is to hammer the joints and inevitably damage them!

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